National Sports Academy "Vassil Levski"
Sofia, Bulgaria

International Scientific Congress "Applied Sports Sciences"

2–3 December 2022

PROCEEDING BOOK

Volume 2

WWW.ICASS2022.COM

International Scientific Congress "Applied Sports Sciences"

PROCEEDING BOOK

Volume 2

2-3 December 2022

Sofia, Bulgaria

INTERNATIONAL SCIENTIFIC CONGRESS
"APPLIED SPORTS SCIENCES"

2 - 3 December 2022
Sofia, Bulgaria

PROCEEDING BOOK

VOLUME 2

EDITORS OF THE PROCEEDING BOOK:

Prof. Tatiana Iancheva, DSc

Assoc. Prof. Stefka Djobova, PhD

Assist. Prof. Milena Kuleva, PhD

SCIENTIFIC COMMITTEE

Members of the Editorial board from National Sports Academy „Vassil Levski"	International members of the Scientific committee
Prof. Nikolay Izov	Prof. Alexander Garcia Mas, PhD
Prof. Ivan Maznev	Prof. Juris Grants, PhD
Prof. Apostol Slavchev	Prof. Branislav Antala, PhD
Prof. Krasimir Petkov	Prof. Marta Bobo-Arce, PhD
Prof. Ognyan Miladinov	Prof. Milovan Bratic, PhD
Prof. Daniela Lyubenova	Prof. Lence Aleksovska Velickovska, PhD
Prof. Daniela Dasheva	Prof. Monica Stanescu, PhD
Prof. Kiril Andonov	Assoc. Prof. Jan Konarski, PhD
Prof. Evgenia Dimitrova	Dr Uri Schaefer
Prof. Diana Dimitrova	
Prof. Svilen Neykov	
Prof. Albena Alexandrova	
Prof. Lubomir Petrov	
Assoc. prof. Zdravko Stefanov	
Assoc. prof. Michail Michailov	

Design: Stanislav Hristov, Svetla Kostova, Radostina Angelova
Printed and bounded by: ZONA ArtPRINT Ltd.
Publisher: Scientific Publishing House NSA Press
ISBN (Online): 978-954-718-702-3
ISBN (Print): 978-954-718-701-6

CONTENTS

	SPORTS AND BIOMEDICAL	9
B. Ilinova	BODY COMPOSITION AND SOMATOTYPE OF ERASMUS STUDENTS	11
S. Tzvetkov	APPLICABILITY OF RELATIVE OXYGEN CONSUMPTION FOR EVALUATION OF FUNCTIONAL WORK CAPACITY IN ADOLESCENT ATHLETES	17
D. Zaykova, M. Konchev, I. Yanev, L. Dimitrova	EPIDEMIOLOGY PROFILE OF INJURIES OF ELITE AND SUB-ELITE MALE ARTISTIC GYMNASTS IN SOFIA, BULGARIA	23
E. Miloshova	SPORTS INJURIES – A SURVEY AMONG YOUNG BULGARIAN ATHLETES	31
D. Dimitrova, E. Miloshova	RISK FACTORS FOR STRESS FRACTURES IN MALE ATHLETES	38
T. Pedev, L. Mladenov, A. Gochkov, S. Shandurkova	OXYGEN SATURATION AND HEART RATE VARIABILITY DURING ORIENTEERING RACES	45
R. Iossifov, M. Kachaunov	OXYGEN CONSUMPTION IN SHORT-, MIDDLE- AND LONG-DISTANCE YOUNG SWIMMERS	51
M. Zaharinova, N. Zaekov, K. Rankov, M. Nikolova	ASSOCIATION BETWEEN CHRONOTYPE, STRESS, AND GENDER IN BULGARIAN SPORTS STUDENTS	58
M. Gateva	PROTOCOL OF HEART RATE AND BLOOD LACTATE MONITORING IN RHYTHMIC GYMNASTICS	63
H. Hristov	BIOMECHANICAL ANALYSIS OF THE FIGHT BY FRONTAL HEAD PRESSURE ON THE CHEST OF THE OPPONENT IN SUMO	68
N. Dimitrova, A. Nikolova, H. Pavlov	BIOMECHANICAL EVALUATION OF MOTOR ACTIONS AT THE GRIP "SHOULDER THROW" IN THE SPORT OF WRESTLING	73
N. Gospodarski	BIOMECHANICAL CHARACTERISTICS OF THE BULGARIAN ELITE ROWERS' TECHNIQUE	78
D. Zagorsky	IMPORTANCE OF THE KINEMATIC CHARACTERISTICS OF MAE GERI FIGHTING TECHNIQUE FOR SPORT-RELATED INJURIES IN BULGARIAN KARATE SHOTOKAN ATHLETES	84
I. Yanev, E. Stoimenov	KINEMATIC ANALYSIS OF BACKWARD UPRISE AND 5/4 SALTO FWD STRADDLED TO HANG ON PARALLEL BARS	92
I. Ivanov, L. Trenev, Z. Stefanov, G. Rusimova, D. Zagorski, I. Janakiev, O.Tishinov, D. Trenev, A. Antonov	BIOMECHANICAL JUMP CHARACTERISTICS OF CHILDREN (9 - 12 YEARS) BASEBALL PLAYERS AFTER STRETCHING PROGRAM	97
V. Georgieva	INFLUENCE OF A BALANCED DIET ON MUSCLE MASS IN MEN	106
P. Milanova	STUDY ON THE EFFECT OF SWAMI DEV MURTI'S YOGA PRACTICE "CROCODILE EXERCISES"	110
B. Dimitrova, G. Dincheva	NATURAL HERITAGE AND HEALING PRACTICES FOR WELLNESS LIFESTYLE	115
P. Yankov, D. Todorov, S. Simeonov	CHARACTERISTICS OF INCIDENTS AND INJURIES IN SKI AREA BOROVETS DURING THE 2019/2020 SEASON	122
V. Kotev, B. Yankov	ANALYSIS OF THE DIFFERENCES IN THE SPEED, ACCELERATION, AND POWER OF VOLLEYBALL PLAYERS ON DIFFERENT PLAYING SURFACES	128

K. Petkov, B. Tahboub	METHODOLOGY OF BACK PAIN RELIEF USING ISOMETRIC-TENSION POST-COVID-19 DISEASE	133
L. Chervencova, Z. Zsheliaskova-Koynova	BENEFICIAL INFLUENCE OF PANEURHYTHMY ON THE AFFECTIVE BALANCE AND HAPPINESS	140
M. Angelcheva, D. Pachova	A BULGARIAN STUDY ON PATIENTS' AND DOCTORS' SATISFACTION WITH THE HOMEOPATHIC METHOD OF TREATMENT	146
A. Lyuga, D. Tomov, D. Tomova	AMATEUR TENNIS PLAYER PROFILE FROM SOUTH-WEST BULGARIA AND NORTHERN GREECE	154
V. Aleksandrova	ADAPTED FOOTBALL PROGRAM TO DEVELOP THE MOTOR SKILLS OF CHILDREN WITH INTELLECTUAL DISABILITIES	161
S. Djobova, I. Kirilova	EMPOWERMENT OF PERSONS WITH INTELLECTUAL DISABILITIES THROUGH INVOLVEMENT IN SPECIAL OLYMPICS BULGARIA	168
I. Kirilova, S. Djobova, Y. Dochevska, V. Aleksandrova, I. Zdravkov	EXTENT OF INCLUSION IN ERASMUS+ SPORT PROJECTS	174
	PHYSICAL EDUCATION	181
Y. Rumenov	STUDENTS' ASSESSMENT CRITERIA FOR THE COMPONENT EVALUATION FROM OTHER PARTICIPATIONS	183
D. Nancheva, K. Naydenova	CHANGES IN THE MANIFESTATION OF THE MOTOR ABILITY SPEED IN BOYS AT THE LOWER SECONDARY STAGE OF PRIMARY EDUCATION	189
B. Tzolov, A. Haralampieva, A. Gencheva-Vasileva	POSTGRADUATE EDUCATION AT NATIONAL SPORTS ACADEMY "VASSIL LEVSKI"– RETROSPECTIVE ANALYSIS	195
M. Boncheva	CHANGES IN THE LEVEL AND TYPE OF STUDENTS' PHYSICAL ACTIVITY BEFORE AND DURING THE COVID-19 PANDEMIC	201
S. Masurska, I. Vladova	TEACHERS' BEHAVIOR AND STUDENTS' DISCIPLINE	207
E. Bellova, E. Mileva	PHYSICAL EDUCATION ONLINE TEACHING MODEL IN SCHOOL EDUCATION SETTINGS	214
F. Muca	A GLANCE OF PHYSICAL EDUCATION TEACHER'S SATISFACTION WITH THEIR PROFESSION IN ALBANIA	219
D. Todorov, S. Simeonov, P. Iankov	THE BENEFITS OF THE COURSES IN SNOW SPORTS FOR THE STUDENTS OF THE NATIONAL SPORTS ACADEMY „VASSIL LEVSKI"	224
N. Kostova	SOME ASPECTS OF IN-PERSON AND ONLINE PHYSICAL EDUCATION AND SPORT	229
G. Brestnichki, M. Borukova	SUCCESS RATE OF NSA STUDENTS IN THE ATTENDANCE AND ONLINE BASKETBALL EXAMS	236
T. Hristakieva	TRANSLATION COMPETENCE IN THE SPECIALIZED LANGUAGE COURSES FOR SPORTS STUDENTS	244
E. Mileva, V. Chernev	ATTITUDE OF YOUNG PEOPLE IN BULGARIA TO ACADEMIC DISHONESTY BEHAVIOR	249
Z. Zsheliaskova-Koynova, T. Hristakieva	KINESITHERAPY STUDENTS' SATISFACTION WITH ENGLISH LANGUAGE CLASSES DURING COVID-19 PANDEMIC	255
D. Zheleva-Terzieva	THE FORMATIVE ROLE OF ACTIVE SPORTS ACTIVITY FOR THE MORAL STATUS OF ADOLESCENTS	260
I. Bonova, E. Mileva1, S. Kolimechkov	MORPHOLOGICAL CHARACTERISTICS AND HEALTH STATUS OF 8-19-YEAR OLD GIRLS	265

P. Petkova, O. Hristov, P. Peev, B. Petrova, M. Zdravcheva, H. Andonov, V. Aleksandrova	PHYSICAL ACTIVITY AND DEVELOPMENT OF BULGARIAN STUDENTS	272
Ts. Traykova	STUDY OF THE RELATIONSHIP BETWEEN THE MOTOR ABILITIES OF PRESCHOOL BOYS	279
K. Naydenova, D. Nancheva	DYNAMICS OF THE DEVELOPMENT OF MOTOR QUALITY SPEED IN 12 – 15-YEAR-OLD GIRLS	286
D. Simeonova, A. Shalev	IMPACT OF DISTANCE LEARNING IN AN ONLINE ENVIRONMENT ON PHYSICAL PERFORMANCE IN HIGH SCHOOL BOYS	292
L. Borisov	INTERDISCIPLINARY TRAINING METHODOLOGY IMPACT ON MOTOR QUALITIES OF SCHOOL BOYS	298
B. Zlatev, H. Andonov, S. Andonov	TRENDS IN THE DEVELOPMENT OF GENERAL PHYSICAL TRAINING IN 14-16 YEARS OLD STUDENTS	303
P. Mavrudiev	MOBILE GAMES AS A MEANS OF DEVELOPING MOTOR QUALITIES IN TENNIS TRAINING	310
T. Marinov	STRUCTURAL SPECIFICS OF THE PHYSICAL ABILITY OF SECONDARY SCHOOL STUDENTS	318
S. Gruev	EFFICIENCY OF SPORTS GAMES TRAINING FOR 12 AND 13-YEAR OLD STUDENTS	324
I. Radkova, K. Naydenova	LONGITUDINALLY RESEARCH ON THE PHYSICAL FITNESS OF 10-14 YEARS OLD FEMALE PUPILS	330
	SPORTS MANAGEMENT	337
D. Dasheva, H. Andonov, M. Konchev, A. Boeva, H. Hristov	FINANCING OF ELITE BULGARIAN SPORT	339
R. Solinas	KNOWLEDGE AND SKILLS OF MIGRANT SPORTS PROFESSIONALS IN BULGARIA	346
N. Stoyanova	NEW MANAGEMENT APPROACHES TO IMPROVE THE QUALITY OF SWIMMING RESULTS AND SPORT	352
I. Zdravkov, Y. Dochevska	THE MAIN RISKS AND THREATS RELATED TO THE ORGANIZATION AND CONDUCT OF SPORTING EVENTS	359
I. Slavchev	REQUIREMENTS FOR PERSONAL QUALITIES AND PROFESSIONAL SKILLS OF SPORTS OFFICIALS IN BULGARIA AND EUROPE	366
D. Ilieva	IMPLEMENTATION OF NATIONAL YOUTH POLICIES BY MEANS OF A PROGRAM-PROJECT APPROACH	373
M. Pirina	NEW TREND IN COMPETENCE FRAMEWORK FOR SPORTS MANAGERS	378
V. Dimitrov	AUTONOMY AND RESPONSIBILITY OF MODERN SPORT: BETWEEN NATIONAL STANDARDS, THE APPLICABILITY OF EUROPEAN UNION LAW AND MARKET MECHANISMS	382
I. Sandanski	PARENTS AS VALUE CO-CREATORS AND DESTROYERS I N YOUTH FOOTBALL IN BULGARIA	388
N. Atanasova, G. Draganov	VOLUNTARY WORK IN THE MANAGEMENT OF SPORTS EVENTS	395
A. Dimitrova	CURRENT SOCIOLOGICAL PROBLEMS RELATED TO TENNIS IN THE SYSTEM OF BULGARIAN SCHOOL EDUCATION	402
G. Draganov, I. Sandanski, I. Slavchev	STUDY OF VIOLENCE AMONG BASKETBALL FANS IN BULGARIA	409
D. Dimov, E. Atanasov	THE ROLE OF SET PIECES IN MODERN SOCCER	417

S. Ilieva-Sinigerova	DIDACTIC TEST FOR ASSESSMENT OF THEORETICAL KNOWLEDGE IN TAEKWON-DO	423
A. Shopov, T. Todorov	EXPERIMENTAL METHODOLOGY FOR EVALUATION OF THE PRELIMINARY TRAINING OF MOUNTAIN GUIDES	429
E.Vitanova	THE OLYMPIC FLAME THROUGH BULGARIA – 1936	436
	PHYSIOTHERAPY	443
N. Popov	ASSESSMENT OF THE EFFECTIVENESS OF LUMBAR SPINAL MANIPULATION IN PATIENTS WITH MECHANICAL LOW BACK PAIN	445
T. Grueva-Pancheva	PREDISPOSING FACTORS AND PREVENTION FOR OVERUSE INJURIES IN ANKLE AND FOOT COMPLEX IN RHYTHMIC GYMNASTS	450
S. Naydenova, E. Dimitrova	COMBINED METHODS OF PHYSIOTHERAPY IN CASE OF CARPAL TUNNEL SYNDROME	456
N. Gencheva	PHYSIOTHERAPY FOR COLON CANCER IN THE EARLY POSTOPERATIVE PERIOD – A CASE REPORT	463
N. Popova	COMPLEX RECOVERY OF THE UPPER LIMB AFTER NERVE TRANSFERS IN PATIENTS WITH ADULT BRACHIAL PLEXUS INJURIES	469
L. Sazdova	ASPECTS OF PHYSIOTHERAPY AFTER NONOPERATIVE TREATMENT OF LATERAL ANKLE SPRAIN	474
D. Popova, M. Filipova, D. Kantchev	SCAPULOTHORACIC DYSKINESIA - ETIOLOGY, FUNCTIONAL STUDY AND GUIDELINES FOR PHYSIOTHERAPY	480
E. Dimitrova, F. Daci	COMPARISON OF TWO PHYSIOTHERAPY METHODS IN PATIENTS WITH SHOULDER IMPINGEMENT	485
F. Daci, E. Dimitrova	FUNCTIONAL ASSESSMENT ON THE PATIENTS WITH SHOULDER IMPINGEMENT	490
P. Mincheva-Bolgurova	FITBALL EXERCISES AS A MEANS OF TRAINING AND PREVENTION OF POSTURAL CONTROL	494
S. Shandurkova, M. Stoychevski, S. Belomazheva-Dimitrova	IMPROVING AEROBIC CAPACITY AND SPINE FLEXIBILITY THROUGH ADAPTED SWIMMING EXERCISES FOR PUPILS IN PRIMARY SCHOOL	499
D. Marinova	TRADITIONAL CHINESE MASSAGE (TUINA) FOR CHRONIC NECK PAIN	506
D. Sadikova	ASSESSMENT OF BODY POSTURE OF 6-7 YEARS OLD CHILDREN IN RELATION TO THE BMI	511
D. Stefanova, M. Angelcheva, S. Bogdanova	A COMPARATIVE STUDY ON THE EFFECT OF EXTRACORPOREAL SHOCK WAVE THERAPY AND INTERFERENTIAL ELECTROTHERAPY IN PERIARTHRITIS HUMEROSCAPULARIS	515
R. Tasheva	APPLICATION OF AN INCLINOMETER IN THE FUNCTIONAL DIAGNOSIS OF CHILDREN SPORTING FOOTBALL	522
M. Filipova, D. Popova, Ch. Stoychev	THE USE OF SPECIALIZED KINESITHERAPY IN PATIENTS WITH ISCHEMIC STROKE WHO ARE TREATED WITH TISSUE PLASMINOGEN ACTIVATOR	528
V. Dimitrova, L. Sazdova	ALTERED MOBILITY IN THE SPINE AS A PREREQUISITE FOR CHRONIC NON-SPECIFIC LOW BACK PAIN	532
M. Simonska, M. Filipova, A. Andreeva	COMPLEX SPEECH THERAPY AND KINESITHERAPEUTIC ASSESSMENT IN PERSONS WITH ACQUIRED NEUROLOGICAL DISEASES	538

S. Ivanova, F. Alexiev	POSSIBILITIES OF EEG DIAGNOSTICS FOR EVALUATION OF THE MASSAGE EFFECTS	543
Y. Georgiev, N. Gencheva, T. Marinov	RESEARCH OF HAMSTRINGS MUSCLES IN CHILDREN SPORTS KARATE	549
M. Ilcheva	THE EFFECT OF A SPECIALIZED PHYSIOTHERAPY PROGRAM IN AN INFANT WITH A RARE GENETIC DISEASE	555
B. Jorgić, S. Kostić, S. Đorđević, M. Hadžović, V. Antić	EFFECTS OF EXERCISE PROGRAMS ON THE CERVICAL SYNDROME: A SYSTEMATIC REVIEW	560
D. Popova-Dobreva	PHYSICAL ACTIVITY AND PREVALENCE OF DYSMENORRHEA AMONG UNIVERSITY STUDENTS IN BULGARIA	567

SPORTS AND BIOMEDICAL

 DOI: 10.37393/ICASS2022/75 11 - 16

BODY COMPOSITION AND SOMATOTYPE OF ERASMUS STUDENTS

Bogdana Ilinova
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
The present study aims to investigate the body composition and somatotype of students from several European countries, who study Sports Sciences or Physical Education in their countries and were in Bulgaria, in the National Sports Academy like incoming participants in the Educational Program Erasmus. They all practice different sports at an amateur level. Material and Methodology: An anthropometric investigation of 30 male and 20 female students was done. It included the following parameters height (cm), weight (kg), body circumferences of arms and legs (cm), skinfolds (mm), and bone diameters (cm) with corresponding certified devices. Over the measured features composed parameters, characterizing body composition were calculated- a percentage of body fat (%), absolute quantity of fat tissue (kg), lean body mass (kg), an absolute quantity of muscle mass (kg), muscular circumferences of arm and tight (cm) and Body Mass Index (BMI). The somatotype of the students was defined by the Heath-Carter method. The data were compared with those of Bulgarian and Greek students studying similar disciplines- Sports Sciences and Physical Education. Conclusion: The results in concern of the % of body fat tissue seem to be similar between those of Erasmus and Bulgarian students in males (about 12%) and a little bit different in females (15-20%). Somatotypologic characteristics mark higher value in the mesomorphic component in both Erasmus and Bulgarian students.

Keywords: *Anthropometry, Heath–Carter Method*

INTRODUCTION

The investigation of the body structure of students from Sports Universities allows us to make an analysis and give some recommendations connected with the educational and training process and also with the whole living regimen of the students. The comparison of the physical development of the population groups from different countries gives an opportunity to study the influence of concrete influences – social and economic, the specifics of the nutrition in the country, the climate, the physical and some other circumstances that influence the morpho-functional peculiarities of the person's body. So our interest was pointed to investigate the body structure of foreign students from several European countries and to compare them with those of Bulgarian and Greek students (Toteva et al., 2004).

Some scientists from different countries appear to have similar interests because university students constitute one of the most important social groups in every country (Lopez – Sanchez et al., 2019; Poplawska et al., 2020) students who study Physical Education or Sports Sciences are a special group of young people, with different body structure and somatotype in comparison with students from other Universities, that is connected with their physical activity, the special field of study and also with their future professional engagement (Lopez – Sanchez et al., 2019)

Some authors investigated the changes in the physical development and physical fitness among students of Physical Education in the long-term observations there still exists secular changes in the anthropometric features and body composition (Yagi et al., 1989)

One study carried out in Spain has shown that university students of Physical Education and Sports Sciences tend to have a healthier lifestyle, a better cardiovascular profile, and less body fat than students of other university disciplines. Maybe it is due to the curricula of Physical Education and Sport Sciences, which promote an active and healthy lifestyle and also participating in practical lessons, in which students learn and practice different physical activities and kinds of sports (Lopez – Sanchez et al., 2020; Almagia et al., 2009).

It will be useful to find if there are any differences in body composition and somatotypes in university students from different countries to develop country-specific recommendations on health promotion

to provide to students when a transition to another European University (Lopez – Sanchez et al., 2020).

Another investigator (Pavlovic, 2022) found in his study that the students of Physical Education and sports have the most appropriate body composition and somatotype which is a consequence of their adequate physical activity and well-designed curricula in their faculty.

Aim

Our work aims to study the body composition and somatotype of foreign Bulgaria students, who study Physical Education or Sports Sciences in their countries, by anthropometric investigation and Heath – Carter somatotype method.

Anthropometry is the study of human body measurements to assist in understanding human physical variations and aid in anthropometrical classification (Nalh, 1995) Body composition analysis is usually portioned into fat and lean body mass. It is well known that body composition is an indicator of general health and important fractures affecting athletic performance in different sports (Barut et al., 2021).

Somatotyping is a system of classifying body types in terms of three categories - endomorphy mesomorphy and ectomorphy. So somatotype is most commonly evaluated using the Heath–Carter measurement system, in which ratings for endomorphy, mesomorphy, and ectomorphy are calculated using various anthropometrical measurements. Endomorphy is the relative fatness, mesomorphy is the relative musculoskeletal robustness and ectomorphy is the relative linearity or slenderness of a physique (Carter & Heath, 1990; Carter, 2002).

MATERIAL AND METHODS

Anthropometric investigation of thirty males at an average age of 21.9 years old and twenty female foreign students at an average age of 21.7 years old, who are in Bulgaria like incoming participants of the Educational program Erasmus in NSA. Informed consent of the participants in the anthropometric investigation was obtained. Most of the students are from Spain and Portugal, and several of them are from France and Italy. They all study Sports Sciences or Physical Education and practice different sports at an amateur level.

Anthropometry included the following parameters.. body height (cm) body weight (kg), body circumferences of arms and legs (cm), skin folds (mm), and bone diameters (cm) the following equipment was used in the study: anthropometer of Martin, flexible centimeter type, Lange skin fold caliper, bone caliper, digital weighing scale. All measuring devices are responding to international standards. On the basics of the measured anthropometric features composed parameters, characterizing the body composition were calculated. % body fat, an absolute quantity of fat tissue (kg), lean body mass (kg), an absolute quantity of muscle mass (kg), muscular circumferences of arm and tight (cm), Body Mass Index (BMI)

The somatotype of the students was defined by the Heath- Carter method (Heath & Carter, 1992; Carter, 2002).

The obtained results were worked out by the computer program SPSS 19 by the method of variance analysis.

Table 1. *Variance Analysis - Male Students*

	Age	Height	Weight	BMI	% F T	AQFT	L M	AQMM	MCA	MCT
X	21.9	177.5	74.7	23.6	13.8	10.4	64.3	38.6	22.61	48.2
S	1.8	13.6	8.9	2.3	2.5	2.6	7.2	7.7	13.84	5.5
Var	8%	9%	12%	10%	18%	25%	11%	20%	16%	11%
Max	26.0	190.0	89.0	29.1	20.3	16.2	77.5	55.6	34.76	62.0
Min	20.0	164	54.5	19.1	9.9	5.6	47.1	22.7	20.92	36.9
Ex	-0.3	-0.7	-0.1	-0.4	0.7	-0.3	0.2	-0.1	-0.3	0.5
As	0.9	-0.9	-0.5	0.1	0.8	0.5	-0.4	0.3	0.9	0.3

Composed Parameters: BMI – Body Mass Index, % F T – Percentage Fat Tissue, AQFT – Absolute Quantity Fat Tissue, LBM – Lean Body Mass, AQMM – Absolute Quantity Muscle Mass, MCA – Muscular Circumference of Arm, MCT – Muscular Circumference of Tight

RESULTS AND DISCUSSION

The average values of the investigated anthropometric parameters are displayed in table 1 for male participants.

The body height as the main feature for the physic of a person, from which the rest of anthropometric parameters depend is with an average value of 177.5 cm for male Erasmus students in comparison with Bulgarian students who are178 cm tall and Greek students – 176.62. The average value for body weight is 74.7 kg for foreign males and 75.51 for Bulgarians and 74.70 for Greeks. The body mass index is similar for the three groups: 23.6 for Erasmus students, 23.78 for Bulgarians, and 23.93 for Greeks (Toteva et al., 2004).

Concerning the parameters, characterizing the body composition, the values do not differ much – the average value for % fat issue of Erasmus students is 13.8%, of Bulgarian students 12.56%, and of Greeks – 13.92%. The lean body mass of Erasmus students is 64.3kg, towards 65.76kg for Bulgarians and 64.13kg for Greeks (Toteva et al., 2004).

Table 2. *Somatotype components*

	Age	ENDO	MESO	ECTO
X	21.9	3.0	5.2	2.4
S	1.8	0.9	1.4	1.0
Var	8%	29%	26%	42%
Max	26.0	5.4	7.4	4.1
Min	20.0	1.4	2.8	0.3
Ex	-0.3	1.3	-1.1	-1.0
As	0.9	0.8	0.0	-0.1

The somatotype components are expressed in three numbers, where the endomorphy score first, then the mesomorphy, and the last ectomorphy. The scores may also be plotted in a shield diagram or somatograph, representing the somatotype on a two-dimensional scale (Carter, 2002).

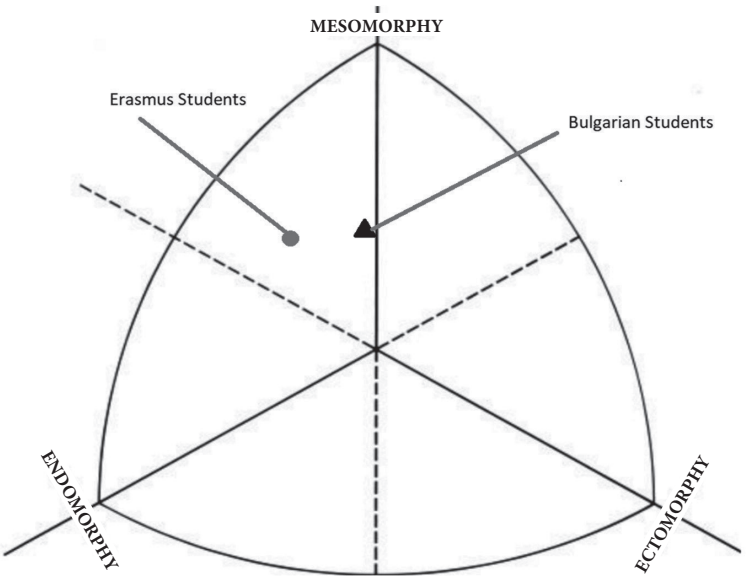


Figure 1. *Somatochart – Male Students*

The average values (presented in Table 2) of somatotype components of Erasmus students are 3.0 – 5.2 – 2.4, which means balanced mesomorph or persons with well-developed muscle and skeletal systems. The average somatotype of Bulgarian students is similar, with values 2,2 – 5,35 – 2,3, the structure of the body appropriate for young men, who do enough physical activity and practice

sports (Toteva, 1992). The data are presented in a somatograph. (Figure 1).

The average value of body height of Erasmus girls is 164.1 cm, while Bulgarian students are a little bit taller – 166,62cm and Greek females are similar to Erasmus girls – 164,62cm. The average value of the body weight of Erasmus students is 61,4kg while the Bulgarians are lighter – 56,16kg and the Greek girls are 59kg. Body Mass Index again differs between the groups – for Erasmus girls is 22,8, for Bulgarians 20,16, and Greek females is 21.66. In concern with the parameters characterizing the body composition the % of fat tissue of Erasmus girls is 19,2%, of Bulgarian students is lower 15,2% and the Greek students have 16,52%.Maybe it is due to some difference in the sports, the girls' practice or the level of physical activity and training of the students. The lean body mass of Erasmus girls is with an average value of 49.5kg, of Bulgarians is 47.66kg and of Greeks is 48.97kg. Again the values of Erasmus and Greek female students are similar (Toteva et al., 2004). The anthropometric parameters of female Erasmus students are displayed in Table 3.

Table 3. *Variance Analysis – Female Students*

	Age	Height	Weight	BMI	% BF	AQBF	LBM	AQMM	MCA	MCT
X	21.7	164.1	61.4	22.8	19.2	11.8	49.5	31.9	20.4	48.4
S	1.3	6.7	6.1	1.9	3.3	2.7	4.6	5.2	2.3	4.1
Var	6%	4%	10%	8%	17%	23%	9%	16%	11%	8%
Max	25.0	179.0	75.0	27.2	24.4	17.3	58.3	42.7	25.3	57.7
Min	20.0	153.0	51.0	19.4	13.0	7.8	42.6	22.1	16.5	39.6
Ex	2.5	-0.1	0.2	0.1	-0.6	-0.4	-1.1	0.3	-0.1	0.5
As	1.4	0.4	0.7	0.4	-0.5	0.2	0.1	0.3	0.6	0.2

Composed Parameters: BMI – Body Mass Index, % F T – Percentage Fat Tissue, AQFT – Absolute Quantity Fat Tissue, LBM – Lean Body Mass, AQMM – Absolute Quantity Muscle Mass, MCA – Muscular Circumference of Arm, MCT – Muscular Circumference of Tight

Table 4. *Somatotype Components – Female Students*

	Age	ENDO	MESO	ECTO
X	21.7	3.8	4.6	2.0
S	1.3	0.6	1.0	1.0
Var	6%	16%	22%	48%
Max	25.0	5.1	6.5	4.5
Min	20.0	2.6	2.6	0.6
Ex	2.5	0.2	-0.7	0.9
As	1.4	-0.2	-0.1	0.7

The average values of somatotype components of Erasmus female students (Table 4) are 3,8 – 4,6 – 2, which means well-developed muscular and skeletal body structure with moderate subcutaneous fat tissue or endo-mesomorph. The average somatotype of Bulgarian students is similar to this of foreign girls – 3,70 – 4,45 – 2,80 and is qualified as endo-mesomorph (Toteva, 1992). The structure of the body is suitable for female students, who study Physical Education or Sports Sciences and have adequate physical activity for both Erasmus and Bulgarian female students. The data are presented in a Somatograph (Figure 2).

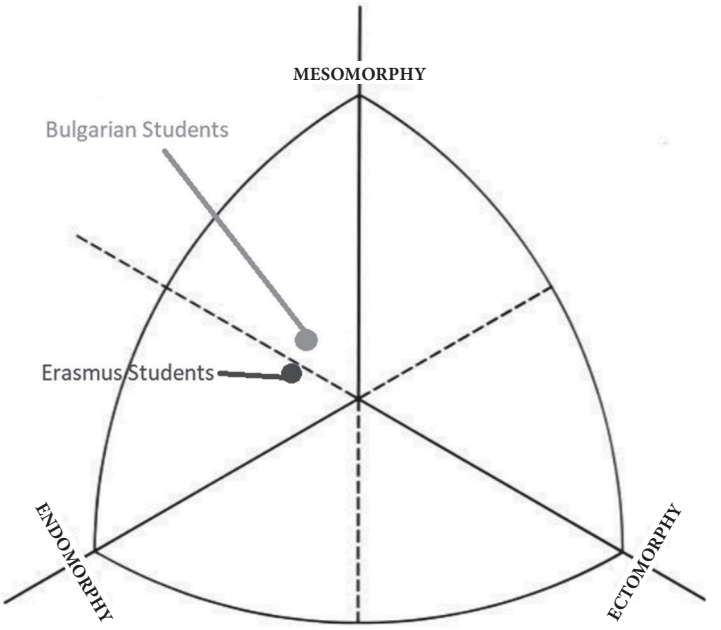


Figure 2. *Somatochart - Females*

Some of our results can be compared with the results of other studies, that analyzed the same parameters of students, who study Physical Education and Sports Sciences. The body height of Spanish male students from Murcia and Madrid is with an average value of 178 cm and of Polish male students from Gdansk is 180 cm, so the Spanish students are with similar values like our investigated persons – 175 cm. The body weight of males from Murcia is with an average value of 75,31kg, from Madrid – 74,6k g and from Gdansk – 78,8 kg, and of our investigated group is similar to that of Spanish males – 74,7 kg. The body mass Index of Spanish males from Murcia is 23,64, again similar to our investigation – 23,6, and in Polish males is 24,17. The % of fat tissue of males from Murcia is 14,7% and in our study is 13,8%, while Polish students have 14,28% fat tissue. The lean body mass of Spanish students from Murcia is 63,92 kg and is similar to this of our investigation – 64,3 kg, while Polish students from Gdansk have an average 67,11 kg lean body mass. The slight differences may be explained by genetic factors (Lopez-Sanchez et al., 2019).

CONCLUSION

The results of our investigation allow us to conclude that the body composition and the somatotype of Erasmus students, although from different, but European nations have similar body structures compared with Bulgarian and Greek students, who study Physical Education and Sports Sciences. Maybe it is due to the similar Physical activities and the demands of the Educational Curricula of the European Universities of Physical Education and Sports Sciences.

REFERENCES

Toteva, M. (1992). *Somatotypologia v sporta*, NSA – IPB, Sofia,

Toteva, M., Petkov, S., Maznev, I., Ilinova, B., Dimitrova, D., & Miloshova, E. (2004). Sravnitelna antropometrichna harakteristika na Bulgarski i Grutski studenti ot NSA ‘’*Sport, Obshtestvo, Obrazovanie*” (6): 507-513, NSA – Press, Sofia,

Almagia, F., Arce, L., Rodriguez, F., Marinovich, D., Gutierez, O. (2009). Anthropometric Measures and Physical Performance in University Students of Physical Education, *Int. Journal of Morphology* 27(4)., 971-975

Barut, A., Tek, T., Kocak, M.S., & Senel, O. (2021). Methods used to Evaluate Body Composition in Sports Sciences *Rol.Spor.Blimimberi Dergasi* 2(3): 80-89

Carter, L., & Heath, B. (1990). *Somatotyping – Development and Applications*, Cambridge: Cambridge University Press

Carter, L. (2002). *The Heath - Carter Anthropometric Somatotyping – Instruction Manual,* San Diego University CA the USA

Catikas, F., Kurt, C. (2018). Anthropometric Profiles of Physical Education and Sports Students, *Canakkale On-*

sekiz Mart University Spor Bilimberi Dorgisi, 1(1): 35-45

Yagi, T., Takabe, Y., & Itoh, M. (1989). Secular Trends in Physique and Physical Fitness in Japanese Students during the latest 20 years, *American Journal of Human Biology* 1(5): 581-587

Lopez-Sanchez, G., Radziminski, L., Skalska, M., Yostrebska, Y., Smith, L., Wakuluk, D. & Yastrebinska, Z. (2019). Body Composition, Physical Fitness, Physical Activity, and Nutrition in Polish and Spanish male students of Sports Sciences: differences and correlations, *International Journal of Research and Public Health* 16(7): 1148

Lopez-Sanchez, G., Radziminski, L., Skalska, M., Yostrebska, Y., Smith, L., Wakuluk, D. & Yastrebinska, Z. (2020). Body Composition, Physical Fitness, Physical Activity and Nutrition in Polish and Spanish female students of Sports Sciences, *Science & Sports* 31(1)., 21-28

Nath, N. (1995). *Handbook of Anthropometry Nizam`s Institute of Medical Sciences*, Hyderabad, India

Pavlovich, R. (2022). Body Composition in students Physical Activity and Sports.. Cross-Sectional Pilot Study, *J. Health Sport, Rehabilitation* vol.8 № 2

Poplawska, H., Dmitruk, A. & Halub, W. (2020). Body Composition, Physical Fitness, and Physical Activity among students from Universities of Biala Podlaska, *Polish Journal of Sport and Tourism* 27(1)., 21-27

Smolarczyk, M., Wisnievski, A., Chaikowska, A., Keska, A., Tkaczyk, J., Milde, K., Norkawski, H., Gajewski, J., Trajdos, A. & Majchrzak, A. (2012). The Physique and Body Composition of Students studying Physical Education: a preliminary report, *Journal Pediatric, Endocrinology, Diabetes and Metabolism* 18(1), 27-32

Vehrs, P., Hager, R. (2006). Assessment and Interpretation of Body Composition in Physical Education, *Journal of Physical Education, Recreation & Dance*, 77(7) 46-51

Zaccagni, L., Barbieri, D. & Gualdi – Russo, E. (2014). Body Composition and Physical Activity in Italian University Students *J. Transl. Med*. 12:120

Corresponding author:
Bogdana Ilinova, MD, PhD
Department of Sports Medicine
National Sports Academy "Vassil Levski",
21, Acad. Stefan Mladenov, str.
Sofia, Bulgaria
E-mail: bogyilinova@abv.bg

 DOI: 10.37393/ICASS2022/76 17 - 22

APPLICABILITY OF RELATIVE OXYGEN CONSUMPTION FOR EVALUATION OF FUNCTIONAL WORK CAPACITY IN ADOLESCENT ATHLETES

Stanislav Tzvetkov
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
The evaluation of the absolute (VO_{2peak}) and relative (VO_{2peak}/kg) values of the peak oxygen consumption is an essential component of exercise testing in athletes. However, according to many researchers, VO_{2peak}/kg values in adolescent athletes do not provide sufficiently reliable information to assess their functional work capacity. The present research aims to investigate the applicability of relative values of oxygen consumption for accurate estimation of functional work capacity in adolescent athletes. The research subjects were twelve basketball players from a junior club team participating in the state championship of Bulgaria. They carried out two maximum bicycle exercise tests with a twelve-month period between the two tests. We analyzed the registered absolute and relative peak power output ($Watt_{peak}$, $Watt_{peak}$/kg) and peak oxygen consumption. It was established that there was a significant increase in average $Watt_{peak}$ (8.5%), $Watt_{peak}$/kg (6.2%), and VO_{2peak} (3.7%) during the second test as compared to the first one. At the same time, in all subjects, no significant increase in VO_{2peak}/kg (average of 0.9%) was registered. This result is associated with the athletes' increased body weight (average of 2.7%) during the second test. Based on the lack of VO_{2peak}/kg dynamics compared to the significant increase of $Watt_{peak}$, $Watt_{peak}$/kg, VO_{2peak}, it can be concluded that the isolated use of VO_{2peak}/kg for functional capacity analysis may result in significant errors in estimating the functional work capacity of adolescent athletes.

Keywords: *relative oxygen consumption, work capacity, adolescent athletes*

INTRODUCTION

The assessment of body aerobic capacity is a primary prerequisite for a scientific analysis of athletes' working capacity and is an essential component of their functional testing. This is due to the fact that aerobic capacity characterizes the individual capabilities of the body for sustained motor activity in which multiple muscle groups are involved (Kenney et al., 2011). According to recognized scientific guidelines, maximal oxygen consumption is the main indicator directly dependent on the intensity of aerobic cellular metabolism that, when tested, can be sufficiently accurately quantified (Kenney et al., 2011; McArdle et al., 2009; Wasserman et al., 2011). Consequently, it is accepted that the body aerobic capacity is evaluated by examining the absolute (VO_{2max}) and relative (VO_{2max}/kg) values of the maximal oxygen consumption (Wasserman et al., 2011). Despite the fact that the energy supply of motor activity carried out during a basketball game is mainly anaerobic, some specialists stress that the registration of optimal VO_{2max} and VO_{2max}/kg values is an important prerequisite for high sports performance of basketball players (Gocentas et al., 2004; Narazaki et al., 2009). According to them, the ever-increasing dynamism of modern basketball creates a real need for a parallel increase in basketball players' anaerobic and aerobic functional capabilities and optimization of their complex work capacity. Nowadays, the game of basketball is extremely popular among teenagers, which determines its mass practicing as an amateur or organized sports activity. Therefore, in sports practice, it is often necessary to analyze in details the absolute and relative values of the maximal oxygen consumption recorded in adolescent basketball players.

In a methodological aspect, the determination and assessment of maximal oxygen consumption in children and adolescents are characterized by certain specifics. Armstrong et al. (1996) and Rowland (1993) believe that when analyzing the functional work capacity of children and adolescents, it is recommended to use the peak value of oxygen consumption (VO_{2peak}) instead of the VO_{2max} value. According to these authors, VO_{2peak} is a sufficiently informative indicator and can be successfully used to assess this age group's aerobic capacity. The significant difference in age-related dynamics of absolute and relative values of maximal oxygen

consumption (peak oxygen consumption) is the other essential feature in children and adolescents. It has been established that during puberty, the age-related longitudinal change in VO_{2max} (VO_{2peak}) is not accompanied by a proportionate increase in VO_{2max}/kg (VO_{2peak}/kg) (Tanner, 1949). On this basis, experts comment that the use of VO_{2max}/kg (VO_{2peak}/kg) values for assessing dynamics of the main functional indicators in children and adolescents may be the cause of misinterpretation of the obtained data and leading to incorrect conclusions (Baxter-Jones et al., 1993).

The present research aims to investigate the applicability of relative values of oxygen consumption for accurate estimation of functional work capacity in adolescent basketball players.

METHODS

The research subjects were twelve boys (average age of 13.1 ±0.64 years), players from a junior basketball club team participating in the state championship of Bulgaria (group A). Before participating in the research, the subjects and their parents were familiarized with the experimental procedure, and the subjects' parents gave their written informed consent.

The standard stepwise protocol for maximal exercise testing on a treadmill applied in Bulgaria is characterized by an initial speed of 6 km/h, increased by 1.2 km/h every 90 seconds (Iliev, 1974). A specific feature of this protocol is that the stepwise increase of speed frequently causes high psycho-emotional stress in adolescents resulting in premature termination of the test. Due to this peculiarity of the protocol, we considered it appropriate to conduct the maximal test using a cycle ergometer. All subjects carried out two maximal incremental tests on a bicycle ergometer (Ergoline 900, Erich Jaeger GmBH & Co Wuerzburg, Germany) with a twelve-month period between the two tests. An exercise stepwise model was applied, with initial power of 60 Watt and an incremental power increase with 30 Watt every 90 seconds at a constant pedaling tempo of 60 rpm until objective voluntary exhaustion was achieved (Iliev, 1974). Gas exchange was measured throughout the test using a metabolic system Oxycon Pro (Erich Jaeger GmBH & Co Wuerzburg, Germany). Before each test, the gas analyzers were calibrated using ambient air and calibration gas. During the twelve-month period between the two maximal exercise tests, the subjects of the research conducted regular weekly training sessions (one sixty-minute training session per week) with low and medium exercise intensity.

Some researchers emphasize that when studying the VO_{2max} of adolescents, the dynamics of oxygen consumption often does not form a VO_2 plateau, and the real VO_{2max} value is not always attained (Karila et al., 2001). Thus, when conducting exercise testing, one of the most essential methodological criteria (the presence of a VO_2 plateau) confirming the achievement of an objective functional maximum by the examined person was found to be missing. The lack of this evidence of an objectively achieved maximum exertion motivates leading specialists to suggest that when interpreting maximum aerobic capacity of adolescents, in addition to VO_{2max}, VO_{2peak} can also be used (Wasserman et al., 2011). In accordance with this opinion, when evaluating the results of the two tests, we analyzed the following parameters: peak oxygen consumption (VO_{2peak}), peak power output ($Watt_{peak}$), peak heart rate (HR_{peak}), peak oxygen pulse (VO_{2peak}/HR_{peak}). Relative values for peak oxygen consumption (VO_{2peak}/kg) and peak power output ($Watt_{peak}$/kg) were also calculated. They were expressed as a ratio of absolute values to body weight of the respective basketball player. A Student's *t*-test was performed to analyze the values of $Watt_{peak}$, $Watt_{peak}$/kg, VO_{2peak}, VO_{2peak}/kg, and VO_{2peak}/HR_{peak} registered during the conduct of the two exercise tests. It was preceded by a distribution normality check of the respective samples with standard statistical tests (Stehlik-Barry, Babinec, 2017). The cutoff for statistical significance was set at the standard level ($p^{*}<.05$).

RESULTS

The conducted Paired Student's *t*-test for dependent variables found a significant increase in the registered average values of height, body weight, $Watt_{peak}$, $Watt_{peak}$/kg, $VO_{2peak,}$ and VO_{2peak}/HR_{peak} during the second test as compared to the first one (Table 1).

Table 1. *Average values of main anthropometric and functional parameters during the two conducted exercise tests (n=12).*

Parameters	First exercise test ($\overline{X}1$)	Second exercise test ($\overline{X}2$)	$\overline{X}1$ - $\overline{X}2$
Height (cm)	176.9 (±5.69)	178.4 (±5.87)	1.5 (p*) (8.5%)
Weight (kg)	67.04 (±10.36)	68.85 (±10.51)	1.81(p*) (2.7%)
$Watt_{peak}$ (W)	244.1 (±14.43)	266.8 (±14.97)	22.7(p*) (8.5%)
$Watt_{peak}$/kg (W/kg)	3.64 (±0.51)	3.88 (±0.57)	0.24(p*) (6.2%)
VO_{2peak} (ml/min)	3313.2 (±547)	3434.2 (±583)	121(p*) (3.7%)
VO_{2peak}/kg(ml/min/kg)	49.42 (±6.37)	49.88 (±6.45)	0.46 (0.9%)
VO_{2peak}/HR_{peak}	17.43 (±1.2)	17.79 (±1.31)	0.36 (p*) (2.1%)

It should be pointed out that from a statistical point of view, the increase in peak oxygen pulse presented in Table 1 is not strictly informative because a borderline level of statistical significance was established in the statistical analysis (VO_{2peak}/HR_{peak}(-first test) - VO_{2peak}/HR_{peak}(second test) = 0.36 (p = .047)). Although borderline, this level of statistical significance is in sync with the positive dynamics of $Watt_{peak}$, $Watt_{peak}$/kg, and VO_{2peak} and is an additional confirmation that during the second test, the subjects had a significantly higher functional work capacity. The significant increase in the absolute and relative values of peak power output during the second functional testing ($Watt_{peak}$(first test) - $Watt_{peak}$(second test) = 22.7 (p*); $Watt_{peak}$/kg(first test) - $Watt_{peak}$/kg(second test) = 0.24 (p*)) demonstrated in the chart presented in Figure 1 is a convincing proof for the plausibility of this statement.

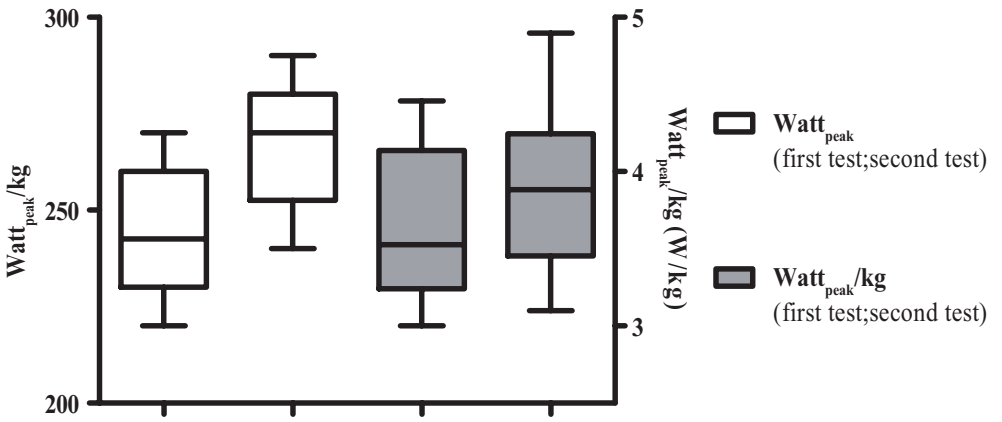


Figure 1. *Registered average values of $Watt_{peak}$ and $Watt_{peak}$/kg during the conducted two exercise tests.*

Despite the observed increase in the functional work capacity of the basketball players studied (a significant increase in average $Watt_{peak}$, $Watt_{peak}$/kg, and VO_{2peak} values in the second test), there was no statistically significant difference between the average VO_{2peak}/kg values registered in the two tests (Table 1). In fact, the conducted statistical analysis found a discrepancy in the dynamics of the absolute and relative values of oxygen consumption (Figure 2).

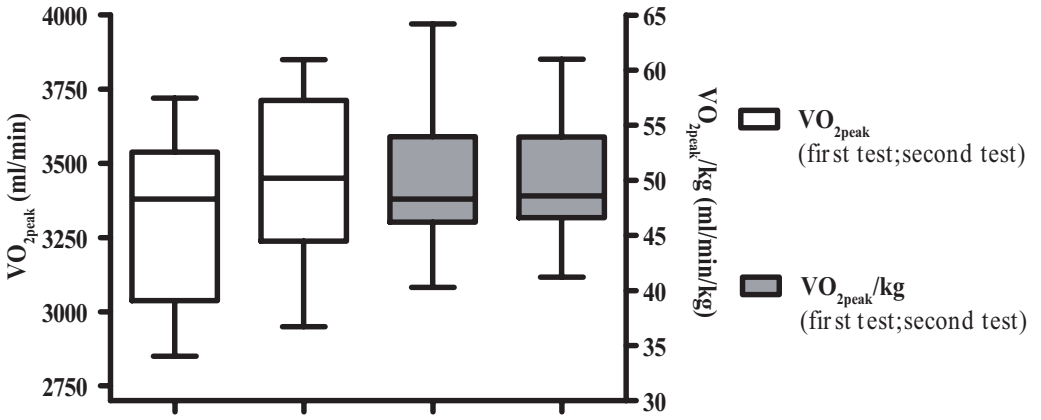


Figure 2. *Registered average values of VO_{2peak} and VO_{2peak}/kg during the conducted two exercise tests.*

The graphic analysis presented in Figure 2 clearly visualizes the discrepancy between the significant increase in the VO_{2peak} values recorded in the first and second test, while the differences between VO_{2peak}/kg(first test) and VO_{2peak}/kg(second test) values are insignificant (p>0.05).

DISCUSSION

The comparative analysis of VO_{2peak}/kg values (VO_{2peak}/kg(first test)=49.42 ±6.37 ml/min/kg, VO_{2peak}/kg(second test)=49.88 ±6.45 ml/min/kg) demonstrates that the tested basketball players have higher relative values of maximal oxygen consumption compared to the data recorded in tennis players (VO_{2max}/kg=48.2 ±4.3 ml/min/kg) and gymnasts (VO_{2max}/kg=48.6 ±5.3 ml/min/kg) of comparable age (respectively 12.7 ±1.5 years and 12.0 ±1.0 years) (Baxter-Jones et al., 1993). In addition, it can be pointed out that Welsman, Armstrong (2000), who studied boys (aged 13.1 ±0.04) from the general population, found significantly lower average VO_{2peak} values (VO_{2peak}=2400 ±460 ml/min) than those registered in the present study (VO_{2peak}(first test)=3313 ±547 ml/min, VO_{2peak}(second test)=3434 ±583 ml/min). Based on the presented data, it can be stated that, in accordance with the high specific dynamic of the modern basketball game, the subjects studied by us are characterized by an adequate aerobic capacity, which is significantly higher than that recorded in adolescents from the general population. At the same time, the average VO_{2peak}/kg values obtained in the present study are lower than those recorded in adolescent swimmers (VO_{2max}/kg=51.7 ±4.3 ml/min/kg, 12.8 ±1.6 years) (Baxter-Jones et al., 1993). This is explainable because the energy supply of motor activity in basketball is mostly anaerobic, therefore, it is expected that the swimmers' data would be higher than those found in the basketball players we studied.

An interesting result from the statistical processing of the research data is the absence of a statistically significant difference between the registered VO_{2peak}/kg(first test) and VO_{2peak}/kg(second test) values (Table 1, Figure 2). This finding may lead to the assumption that there is no positive dynamics of the functional work capacity of the examined subjects. Considering that significantly higher $Watt_{peak}$, $Watt_{peak}$/kg, $VO_{2peak,}$ and VO_{2peak}/HR_{peak} values (Table 1) were found during the second exercise test, this hypothesis would be incorrect. Modern scientific guidelines recommend to regard power output registered during functional testing as a main analytical indicator when interpreting the functional work capacity of athletes (Kenney et al., 2011; McArdle et al., 2009). McArdle et al. (2009) emphasize that the optimal exercise performance of athletes is not determined solely by the increase in maximal oxygen consumption, but also by the economy and efficiency of functional processes in the body, as well as the full synchrony between aerobic and anaerobic cellular energy-providing mechanisms. In this context, the registered significant increase in the absolute and relative peak power output values is an objective confirmation of a real increase in the functional work capacity of the subjects. Moreover, the positive dynamics of $Watt_{peak}$ and $Watt_{peak}$/kg is also accompanied by a significant increase in the average VO_{2peak}(second test) value.

A reasonable explanation of the established discrepancy in the dynamics of the absolute and rel-

ative values of oxygen consumption (significant increase in average VO_{2peak} value and lack of a significant increase in average VO_{2peak}/kg value) is the registered significant increase in body weight (average of 2.7%) of the young athletes during the second test. In fact, despite the increase in the average VO_{2peak}(second test) value, due to the significantly higher body weight registered in the second exercise test, the average VO_{2peak}/kg (second test) value changes minimally (VO_{2peak}/kg (first test) - VO_{2peak}/kg(second test)=0.46 ml/min/kg ($p>0.05$)). The significant change in the body weight of the studied persons is determined by the generally known fact that the intense increase in body mass is a characteristic physiological feature of the adolescent organism (Kenney et al., 2011). This feature gives reason to experts to point out that when analyzing the longitudinal dynamics of maximal oxygen consumption in adolescents, disproportionate changes in VO_{2max} and VO_{2max}/kg values are often found (Tanner, 1949). The stated scientific position and the data we received are in agreement with the results of the study by Rowland, Boyajian (1995), in which active athletes (boys and girls aged 10.9÷12.8 years) were tested. As a result of a twelve-week intensive training process, characterized by regular sessions of aerobic activity (three times a week with a duration of 30 minutes), a significantly greater increase in the average VO_{2max} value (10.9%) of the subjects was registered, compared to the increase in average VO_{2max}/kg value (6.5%). Further evidence for the existence of disproportionate changes in absolute and relative values of oxygen consumption in children is available in published data from the study by Mandigout et al. (2001). The authors studied 10÷11-year-old students, divided into two groups (experimental and control). The students included in the experimental group had a thirteen-week training program with three times per week training. The training was predominantly aerobic and consisted of one interval and one continuous long-distance running session, and one session with other aerobic activities (swimming, soccer, basketball). At the same time, participants in the control group were instructed to simply carry on their daily regimen as normal during these thirteen weeks. Before and after the thirteen-week period, exercise tests were conducted and it was found that the children from the experimental group had a significantly larger increase in the average VO_{2max} value (8.2% for boys, 20.7% for girls), compared to the average VO_{2max}/kg value (4.2% for boys, 8.5% for girls). The fact that the boys included in the control group had a decrease in average VO_{2max}/kg value (-1.3%), despite the increased average VO_{2max} value (6.3%) is particularly telling.

Based on the data presented in this paper, it can be summarized that because of disparate changes in the absolute and relative values of the maximal oxygen consumption in adolescents, the isolated use of VO_{2max}/kg values for analysis of the results of the conducted maximal functional testing creates prerequisites for formulating wrong conclusions. For this reason, it is recommended to not use the relative values of maximal oxygen consumption as the main analytical indicator when assessing the functional work capacity of adolescents. The optimum methodological approach in evaluating data obtained from functional testing requires conducting a detailed analysis, including a complex evaluation of the registered absolute and relative maximal values of power output, oxygen consumption, heart rate, oxygen pulse and other functional parameters.

REFERENCES

Armstrong, N., Welsman, J., Winsley, R. (1996). Is peak VO2 a maximal index of children's aerobic fitness? *International Journal of Sports Medicine,* Vol. 17, pp. 356-59.

Baxter-Jones, A., Goldstein, H., Helms, P. (1993). The development of aerobic power in young athletes. *Journal of Applied Physiology*, Vol. 75, №3, pp. 1160-1167.

Gocentas, A., Landor, A., Andziulis, A. (2004). Dependence of intensity of specific basketball exercise from aerobic capacity. *Papers on Anthropology,* Vol. 13, pp. 9-17.

Iliev, I. (1974). Metodika za kompleksno izsledvane na sportisti ot visoka klasa. Balgarski sayuz za fizicheska kultura i sport, Sofiya.//Илиев, И. (1974). Методика за комплексно изследване на спортисти от висока класа. Български съюз за физическа култура и спорт, София.

Karila, C., Blic, J., Waerbessyckle, S. et al. (2001). Cardiopulmonary exercise testing in children: an individualized protocol for workload increase. *Chest*, Vol. 120, pp. 81-87.

Kenney, L., Wilmore, J., Costill, D. (2011). *Physiology of sport and exercise*. 5th ed., Human Kinetics Press, Champaign.

Mandigout, S., Lecoq, A., Courteix, D. et al. (2001). Effect of gender in response to an aerobic training programme in prepubertal children. *Acta Paediatrica*, Vol. 90, pp. 9-15.

McArdle, W., Katch, F., Katch, V. (2009). *Exercise Physiology: Energy, Nutrition and Human Performance.* 7th ed., Williams & Wilkins, Philadelphia.

Narazaki, K., Berg, K., Stergiou, N., Chen, B. (2009). Physiological demands of competitive basketball. *Scandinavian Journal of Medicine and Science*, Vol. 19, №3, pp. 425-432.

Rowland, T. (1993) Does peak VO2 reflect VO2-max in children – evidence from supramaximal testing. *Medicine and Science in Sports and Exercise*, Vol. 25, pp. 689-693.

Rowland, T. & Boyajian, A. (1995) Aerobic response to endurance exercise training in children. *Pediatrics*, Vol. 96, pp. 654-658.

Stehlik-Barry, K. & Babinec, A. (2017). *Data Analysis with IBM SPSS Statistics*. Packt, Birmingham.

Tanner, J. M. (1949). Fallacy of per-weight and per-surface area standards, and their relation to spurious correlation. *Journal of Applied Physiology*, Vol. 2, pp.1-15.

Wasserman, K., Hansen, J., Sue, D. et al. (2011). *Principles of exercise testing and interpretation.* 5th ed. Williams & Wilkins, Philadelphia.

Welsman, J. & Armstrong, N. (2000). Longitudinal changes in submaximal oxygen uptake in 11 - to 13-year-olds. *Journal of Sports Sciences*, Vol. 18, pp. 183-189.

Corresponding author:
Tzvetkov Stanislav, MD, PhD
Department of "Sports medicine"
National Sports Academy "Vassil Levski",
Studentski grad, 21, Acad. Stefan Mladenov str.,
Sofia 1700, Bulgaria
E-mail: stanislav.tsvetkov@nsa.bg

EPIDEMIOLOGY PROFILE OF INJURIES OF ELITE AND SUB-ELITE MALE ARTISTIC GYMNASTS IN SOFIA, BULGARIA

Dilyana Zaykova, Mihail Konchev, Iliya Yanev, Leyla Dimitrova
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT

Introduction: Artistic gymnastics is an Olympic sport in which male artistic gymnasts perform on six apparatuses. The number of weekly training sessions can reach to 12, with 36 hours overall load.

Methodology: The research was conducted among 15 elite and 16 sub-elite gymnasts on international and national level from Sofia, Bulgaria. The participants filled in a questionnaire about the type, severity, location, and reasons for the appearance of injuries.

Results: We calculated injury incidence at 93.33% for elite and 87.50% for sub-elite male artistic gymnasts. The injury rate for elite gymnasts was 2.19/1000 gymnastic exposures and 2.87 injuries per gymnast for the year. The injury rate for sub-elite gymnasts was 3.78/1000 gymnastic exposures and 2.13 injuries per gymnast for the year. The acute injuries dominated in all participants. Shoulder is the most often injured anatomical location as a result of the exercises performed on rings and horizontal bar. Ankle is the next often traumatized location because of the exercises done on floor and vault (landing phase).

Conclusions: Literature describing injuries in male artistic gymnasts is scarce, which makes it relatively difficult to compare gender data. Injury rates in the male artistic gymnasts we studied fall within the range described in the sports literature.

Keywords: *male artistic gymnasts, injury rate, injury incidence, injury location, type of injury*

INTRODUCTION

Artistic gymnastics is an Olympic sport in which male artistic gymnasts perform on six apparatuses (floor, pommel horse, rings, vault, parallel bars, and horizontal bar). Gymnasts start training from an early age (at the age of 5-6). The number of training sessions per week can reach 10-12 sessions with duration of the load of up to 36 hours. This significantly increases the risk of traumatism (Caine, Harringe, 2013), as a result of which the risk of lasting muscle-skeletal injuries, reduction in the number of the training sessions, and participation in competitions is also increased (Bradshaw, Hume, 2012).

Artistic gymnastics is characterized with a high percentage and rate of traumatic injuries (Campbell et al, 2019). The incidence of acute injuries was reported at 73% and overuse injuries at 27% (Bak et al., 1994). Traumatism in the area of upper limbs in male gymnasts is observed quite frequently (Bak et al, 1996; Westermann et al, 2015) – about 36% to 56% (Caine, Nassar, 2005), and traumatism in the shoulder area may reach 19% of overall injuries compared to other anatomic areas (Caine, Nassar, 2005). Other frequently injured areas are elbow (Dexel et al., 2014), ankle (Ghasempour et al., 2013; Westermann et al., 2015; Paxinos et al., 2019), knee (Westermann et al., 2015; Paxinos et al., 2019) and lumbar spine (Paxinos et al., 2019).

Aim and objectives of the study

The aim of this research was to design an epidemiology profile of elite and sub-elite male gymnasts in Sofia, Bulgaria.

STUDY DESIGN: Prospective Face-to-face questionnaire.

RESEARCH METHODS

In order to assess the level of injuries in the previous year (12 months), we had the participants to fill out a questionnaire which included open and close questions about type, severity, location, and the reasons for the appearance of injuries in the following anatomical locations: head, neck, shoulder (joint apparatus, muscle), upper arm, elbow, forearm, wrist and hand, chest, abdomen, thoracic spine, lumbar spine, pelvis and buttock (bones), hip

and groin (muscles), thigh, knee, lower leg, ankle, foot. Participants could mark out more than one injured location. All gymnasts signed the informed consent form to participate in the study.

For the purposes of the analysis, we used Student T-test and Mann–Whitney test for two independent samples. We also used Chi-square to determine the differences in the distribution of injuries, their incidence, location, and severity. We used frequency analysis as well. The statistical processing of the data was done with the software package SPSS V.25. The accepted statistical significance level was α = .05.

Classification of injuries:
According to the severity of injuries and the time needed for recovery, the injuries were divided into slight (1/2 days), minimal (1-3 days), mild (4-7 days), moderate (8-28 days), and severe (over 28 days) (Clarsen et al, 2013). The questions were divided into two groups depending on the type of the injury: whether it appeared during a training session (Acute injuries) or because of chronic overload (Overuse injuries). The definition of the two types of injuries included in the questionnaire is the following: „Acute injuries – strain, tear, sprain, luxation, fracture, etc. similar ones obtained during the workout; and overuse injuries - pain in the area without a clear cause that occurred during the training process“ (Clarsen et al., 2013).

On the basis of the answers provided, we determined and calculated the following indexes: *Location of injuries* – the participants were able to indicate more than one location and more than one injury for a particular area; *Types of injuries* – acute and overuse; *Severity of injuries* – slight, minimal, mild, moderate, severe; Injury incidence – describes the number of the injuries in the researched group over the previous year (12 months) in %; *Injury rate* – provides information about the level of injuries in the researched sample.

Index for calculation of Injury rate:
The overall number of injuries, reported by the participants for the previous year, is used as a numerator for % of injuries. The denominator is training with a duration of 60 min. These values are multiplied by the total number of training sessions per week, indicated by the researched individuals. The result is multiplied by the number of weeks in the year (maximal number of weeks–52). The obtained value is a very small number. Therefore, to calculate the level of injuries over a year, we multiply it by 1000 hours (Feito et al., 2018).

We introduce the formula below for the calculation of the level of injuries among elite and sub-elite male artistic gymnasts. It shows the correlation between the number of overall injuries equalized to 1000 hours and the total number of training hours for the two researched groups.

$$Injury\ Rate = \frac{N_t}{N.\overline{T}_w.N_w.\overline{H}_t}.1000 \quad (1)$$

Where: N – number of the researched individuals; N_t – number of overall injuries; $\overline{T}_w$ – average number of trainings per week; N_w – number of weeks; $\overline{H}_t$ – hours of training (mean).

RESULTS
The research was conducted among 31 people (15 elite and 16 sub-elite gymnasts) on an international and national level from Sofia, Bulgaria. The sub-elite gymnasts were selected on the basis of their prize ranking in national championships. The baseline characteristics of the researched groups are presented in Table 1.

We did not find any statistically significant differences regarding the indicators age, height, weight, and training experience. However, we found some significant differences between average training sessions per week in elite and sub-elite gymnasts (Sig = .000 < 0.05) and between the average duration of training in elite and sub-elite gymnasts (Sig = .000 < 0.05).

Table 1. *Basic characteristics of the elite and sub-elite gymnasts*

	Elite gymnasts (n = 15)	Sub-elite gymnasts (n = 16)
Age	19 ± 2.66	21 ± 3.24
High	168 ± 6.44	168 ± 3.44
Weight	61 ± 7.47	61 ± 3.76
Average training experience (years)	13 ± 2.26	14 ± 3.27
Average training sessions per week (n)	9 ± 1.85	6 ± 0.81
Average duration of training (min)	161 ± 31.27	107 ± 15.37
Average training hours per week	24.187.96±	10.441.95±

There were 77 injuries recorded by elite and sub-elite gymnasts during the period of 12 months (previous year). The total number of injuries among the elite gymnasts was 43 and among the sub-elite ones – 34. The location of the shoulder was the most often traumatized anatomic area in both groups, followed by ankle and lumbar spine. As regards the locations of the head, neck, upper arm, forearm, chest, abdomen, thoracic spine, pelvis and buttock (bones), hip and groin (muscles), thigh, lower leg, and foot the researched individuals did not report having any injuries over the previous year (12 months). We did not find any statistically significant differences between the different anatomical locations in the elite and sub-elite gymnasts (Table 2).

Table 2. *Overall injury locations for elite and sub-elite gymnasts*

Number of injuries			
	Overall injuries (n = 77)	Elite gymnasts (n = 43)	Sub-elite gymnasts (n = 34)
Anatomical locations	n (%)	n (%)	n (%)
Shoulder	24 (31%)	13 (30%)	11 (32%)
Elbow	9 (12%)	6 (14%)	3 (9%)
Wrist and hand	6 (8%)	3 (7%)	3 (9%)
Lumbar spine	13 (17%)	8 (19%)	5 (15%)
Knee	8 (10%)	3 (7%)	5 (15%)
Ankle	17 (22%)	10 (23%)	7 (21%)

% - percent of overall injuries

Strain was the type of injury which was indicated most often by both researched groups, followed by contusion, torsion, and inflamed ligaments. Fracture, protrusion, scapular effusion, disc herniation, and necrotic thinning of bone tissue in the growth zone in the previous year (12 months) were indicated by one of the elite gymnasts. These injuries led to seeking orthopaedist's assistance and termination of the training and competitive process for a longer period. We did not find any statistically significant differences between types of injuries in elite and sub-elite gymnasts (Table 3).

Table 3. *Type of overall injuries for elite and sub-elite gymnasts*

	Overall injuries (n = 77)	**Elite gymnasts (n = 43)**	**Sub-elite gymnasts (n = 34)**
Type of Injuries	**n (%)**	**n (%)**	**n (%)**
Strain	25 (32%)	14 (33%)	11 (32%)
Contusion	13 (17%)	6 (14%)	7 (21%)
Torsion	12 (16%)	5 (12%)	7 (21%)
Inflamed ligaments	11 (14%)	6 (14%)	5 (15%)
Subluxation	5 (6%)	2 (5%)	3 (9%)
Sprain	3 (4%)	3 (7%)	
Tendinitis	3 (4%)	2 (5%)	1 (3%)
Protrusion	1 (1%)	1 (2%)	
Scapular effusion	1 (1%)	1 (2%)	
Disc herniation	1 (1%)	1 (2%)	
Necrotic thinning of bone tissue in the growth zone	1 (1%)	1 (2%)	
Fracture	1 (1%)	1 (2%)	

% - percent of overall injuries

The total number of acute injuries for all participants (n=55) was significantly higher than that of the overuse injuries for all participants (n=22) (Sig = .000 < 0.05). There was no significant difference between acute injuries of the elite gymnasts (n=29) and the acute injuries among sub-elite gymnasts (n=26) (Sig = .820 > 0.05), as well as between overuse injuries for the elite (n=14) and the sub-elite gymnasts (n=8) (Sig = .269 > 0.05) (Table 4).

We did not find any significant differences as regards the severity of injuries in different anatomical location between total number of acute and overuse injuries for the whole researched group and when we made a comparison between the elite and sub-elite gymnasts.

Table 4.*Overall number, severity, and location of the injuries in elite and sub-elite artistic gymnasts*

Gymnasts with injuries	Shoulder	Elbow	Wrist & hand	Lumbar spine	Knee	Ankle
Elite gymnasts (n =14)						
Number of acute injuries 29 (37.7%)	1^{a}, 2^{b}, 3^{c}, 1^{d}, 1^{e}	1^{a}, 2^{b}, 1^{c},1^{d}	2^{c}, 1^{d}	2^{d}, 2^{e}	1^{c}, 1^{d}	2^{b}, 2^{c}, 2^{d}, 1^{e}
Number of overuse injuries 14 (18.1%)	2^{b}, 3^{c}	1^{c}		1^{c}, 3^{d}	1^{c}	3^{c}
Sub-elite gymnasts (n = 14)						
Number of acute injuries 26 (33.8%)	1b, 4c, 1d	1^{b}, 1^{c}, 1^{d}	1^{b}, 2^{c}	1^{c}, 2^{e}, 1^{e}	2^{c}, 2^{d}, 1^{e}	5^{c}
Number of overuse injuries 8 (10.3%)	2b, 2c, 1d			1^{b}		2^{b}

*Legend: % - percent of overall injuries; slight ½ days symptoms – **a**; minimal 1-3 days symptoms – **b**; mild 4-7 days symptoms – **c**; moderate 8-28 days symptoms – **d**; severe over 28 days symptoms – **e***

The participants reported for traumatism related to all compulsory apparatuses in male artistic gymnastics. They had more than one injury in more than one anatomical location due to some of the exercises (Table 5). The table shows the reasons and severity for injuries. The researched individuals were told they could indicate more than one answer.

Table 5. *Summary of type of apparatus, type of exercises, reasons and severity for injuries in all participants*

Apparatus, type of exercise n (%)	Reasons n (%)	Severity of injuries n (%)
Rings – 20 (26%) Giant swing to handstand - 6 (8%) Giant swing – 4 (5%) Swing - 4 (5%) Strength - 3 (4%) Landing - 3 (4%)	Excessive overload 20 (44%)	Slight: ½ days 2 (3%)
Horizontal bar – 6 (8%) Adler 2 (3%) Fall 4 (5%)	Fatigue 11 (24%)	Minimal: 1-3 days 16 (21%)
Floor – 11 (14%) Routine exercises 5 (6%) Double salto bwd.tucked 3 (4%) Stepping crooked 3 (4%)	Insufficient Warm-up 10 (22%)	Mild: 4-7 days 35 (45%)
Vault – 11 (14%) Landing 6 (8%) Handspring fwd. and salto fwd. tucked 4 (5%)	Technical Error 4 (9%)	Moderate: 8-28 days 16 (21%)
Pommel Horse – 8 (10%) Circles 5 (6%) Dismounts 3 (4%)		Severe: over 28 days 7 (9%)
Parallel bars - 3 (4%) Basket with 1/1 turn to handstand 3 (4%)		

% - percent of overall injuries

DISCUSSION

The exercises in artistic gymnastics are characterized with high intensity and difficulty of execution. The multiple repetitive movements and the significant number of training hours – up to 36 hours per week (Caine, Harringe, 2013), in combination with the participation in important competitions throughout the year, reduce the efficient recovery processes and significantly increase the risk of traumatism in sport. Artistic gymnastics is associated with a high percentage of traumatism – up to 94%, as well as with a high injury rate – up to 9.2 injuries per 1000 gymnastic exposures (Campbell et al., 2019).

We calculated injury incidence at 90.3% for the whole researched group - 93.33% for the elite gymnasts and 87.50% for the sub-elite male gymnasts. In order to assess the injury rate in the researched sample, we applied the introduced formula (Formula 1). The injury rate for the elite gymnasts was 2.19/1000 gymnastic exposures and 2.87 injuries per gymnast for year. The injury rate for the sub-elite gymnasts was 3.78/1000 gymnastic exposures, and 2.13 injuries per gymnast for year. The calculated values of injury rate for both researched groups that were within the range of the ones described in literature for artistic gymnastics on national and international level – 1.5 to 9.2 injuries per 1000 gymnastic exposures (Campbell et al., 2019), 1.4 to 8.5 injuries per 1000 gymnastic exposures (Paxinos et al., 2019).

Of the researched 15 elite male gymnasts, 14 reported 43 injuries over the previous year (56% of overall injuries). Again 14 of the researched 16 sub-elite male gymnasts reported 34 (44% of overall injuries) injuries over the researched period (Table 2). Acute injuries were dominant for both groups (29 for the elite gymnasts and 26 for the sub-elite gymnasts) (Table 4). This high level of acute traumatism (total of 71%) could be explained with the

relatively great number of training sessions per week and with the high duration of the training sessions. The two indicators are a premise for a regular overtraining and insufficient recovery which significantly increases the risk of traumatism in sport (Bergeron et al, 2011). According to the researched individuals, the reasons for the appearance of acute injuries were mainly excessive overload with 44% and fatigue with 24% (Table 5). Overuse injuries among the researched male gymnasts were 29% of overall injuries – in the range of 27.0% to 39.7%, calculated for male artistic gymnasts (Campbell et al., 2019). According to the researched individuals, the main reason for overuse injuries was recurrent injuries - (22%) of the reasons for traumatic injuries (Table 5).

Male gymnasts' injuries in the upper limbs are more frequent (Bak et al., 1994), most often in the exercises performed on rings and horizontal bar (Cuk et al., 2012; e.g., Caine, Nassar, 2013). These significant injuries appear more often before a competition as a result of the increased volume and intensity of the training sessions which often lead to overtraining and inefficient recovery (Grapton et al., 2012). The analysis of the results from this research showed a dominating traumatism in the area of upper limbs – 22 (51%) for the elite gymnasts and 17 (50%) for the sub-elite male gymnasts (Table 2). The most frequently injured anatomical location was shoulder with a total of 24 (31%) injuries - 13 (30%) for the elite gymnasts and 11 (32%) for the sub-elite gymnasts, followed by elbow with 9 (12%) injuries and wrist and hand with 6 (8%) (Table 4). When executing gymnastics exercises, gymnasts move their shoulders over the physiological range of motion, which combined with the repetitive execution of complex technical movements leads to excessive load and significantly increases the risk of acute trauma during violent movements or intense muscle contractions (eMeeusen, Borms, 1992; De Carli et al., 2012; Gendre, Boileau, 2021).

The second most frequently injured area in the researched group was the anatomic location ankle with total of 17 (22%) injuries - 10 (23%) for the elite gymnasts and 7 (22%) for the sub-elite gymnasts, followed by locations knee with total 14 (18%) and lumbar spine with total 13 (17%) (Table 4). The researched gymnasts reported that the exercises leading to these injuries were mostly on floor and vault, mainly during the landing phase. Floor is the most complex apparatus in artistic gymnastics and it is composed of acrobatic elements combined with gymnastic strength and balance exercises. Floor exercises require strength and power both in lower and upper limbs, joint flexibility, and anaerobic endurance (e.g., Caine et al., 2013). The landing phase upon execution of gymnastic exercises is as important as the routine itself and significantly influences the final score (Mcnitt-Gray, 2001). In the last years there has been an increase in the difficulty of execution of gymnastic exercises related mainly to landing from great heights, usually on unstable surfaces, often with rotation (e.g., Ghasempour et al., 2013). These changes are a premise for increased traumatism in the area of the lower limbs (Elliott, 1999; Caine, Nassar, 2005; Gones, Wolf, 2008; Cuk et al., 2012), mostly in the landing phase (76%) (Hrazdira, Binder, 2010).

Strain was the dominating injury in both elite and sub-elite gymnasts - n=25 (32%). The distribution of the number of the injuries was relatively similar for both researched groups (Table 3). The severity of injuries was most often mild n=35, both regarding the acute and chronic injuries in both researched groups. Next were minimal n=16 and moderate n=16 injuries. There were no significant differences as regards severity of injuries (Table 4) but the elite gymnasts reported for severe injuries such as fracture, protrusion, etc. over the researched period (Table 3) which required a longer recovery period. These more acute injuries among the elite gymnasts could be explained with the significantly greater training load, combined with shorter recovery periods. All of these lead to an increased level of traumatism, repetitive injuries, and turning micro injuries into macro traumatism.

The weekly training hours for the elite male gymnasts are more (24.18±7.96), which explains the greater number of acute and chronic injuries (n=43) reported by them. The calculated injury rate for them, however, was lower - 2.19/1000 gymnastic exposures. This could be explained with the higher professional qualification of the coaches in the national team; optimal distribution of the training load in the training sessions twice a day; additional biostimulation and the applied physiotherapy procedures. On the other hand, the greater number of training hours for the elite male gymnasts provide them with the opportunity for a longer warm-up and additional skill work aimed at optimization

of the leading motor qualities. These factors are a premise for prevention and a decrease in the risk of traumatism in the researched group.

The number of weekly training hours for the sub-elite male gymnasts is smaller (10.44±1.95). The training load is also smaller, but their overall work intensity is higher which explains the higher injury rate we found (3.78/1000 gymnastic exposures).

CONCLUSION

The literature describing traumatism in male elite gymnasts is scarce which makes the comparison along the factor gender relatively difficult. The injury rate among the researched male artistic gymnasts in this study was lower than that described in the literature for this sport. Optimal training volume in combination with adequate warm-up will significantly reduce the risk of traumatism. The application of regular physical and clinical check-ups will lead to an early diagnosis of the injuries and to a reduced recovery time. The study of the mechanisms of traumatism and the reasons for its appearance will significantly improve its prevention.

ACKNOWLEDGMENTS

This study was part of the project "Epidemiology profile of injuries of elite CrossFit athletes for Bulgaria" – National Sports Academy "Vassil Levski", Sofia.

REFERENCES

Bak, K., Kalms, S.B., Olesen, S., et al. (1994). Epidemiology of injuries in gymnastics, *Scand J Med Sci Sports*, Vol. 4, pp. 148–54.

Bergeron, M.F., Nindl, B.C., Deuster, P.A., Baumgartner, N., Kane, S.F., Kraemer, W.J., et al. (2011). Consortium for Health and Military Performance and American College of Sports Medicine consensus paper on extreme conditioning programs in military personnel, *Curr Sports Med Rep*, Vol. 10, pp. 383–389.

Bradshaw, E.J. & Hume, P.A. (2012). Biomechanical approaches to identify and quantify injury mechanisms and risk factors in women's artistic gymnastics, *Sports Biomech*, Vol. 11, pp. 324–41.

Caine, D.J. & Harringe, M.L. (2013). Epidemiology of injury in gymnastics, *Handbook of sports medicine and science-Gymnastics*, John Wiley & Sons, Ltd, International Olympic Committee, pp. 109–24.

Caine, D.J. & Nassar, L. (2005). Gymnastics injuries, *Med Sport Sci*, Vol. 48, pp. 18–58.

Campbell, R.A., et al. (2019). Injury epidemiology and risk factors in competitive artistic gymnasts: a systematic review, *Br J Sports Med*, Vol. 53, Issue 17, pp. 1–15.

Clarsen, B., Rønsen, O., Myklebust, G., Flørenes, T., Bahr, R. (2013). The Oslo Sports Trauma Research Center questionnaire on health problems: a new approach to prospective monitoring of illness and injury in elite athletes. *BJSM*, Online First, publish ed on February 21.

Cuk, I., Pajek, M.B., Jakse, B., Pajek, J., Pecek, M. (2012). Morphologic bilateral differences of top level gymnasts, *Int J Morphol*, Vol. 30, Issue 1, pp. 110-4.

De Carli, A., Mossa, L., Larciprete, M., Ferretti, M., Argento, G., Ferretti, A. (2012). The gymnast's shoulder MRI and clinical findings, *J Sports Med Phys Fitness*, Vol. 52, Issue 1, pp. 71–79.

Dexel, J., Marschner, K., Beck, H., et al. (2014). Comparative study of elbow disorders in young high-performance gymnasts. *Int J Sports Med,* Vol. 35, pp. 960–5.

Elliott, C.B. (1999). Overuse injury in sport: a biomechanical approach, *Safety Science Monitor*, Vol. 3,pp. 1-6.

Feito, Y., Burrows, E., and Tabb, L. (2018). A 4-Year Analysis of the Incidence of Injuries Among Crossfit-Trained Participants, *Orthop J Sports Med*, Oct, Vol. 6, Issue 10: 2325967118803100.

Gendre, P. & Boileau, P. (2021). The Injured Shoulder in High-Level Male Gymnasts, Part 1: Epidemiology and Pathoanatomy of Surgically Treated Lesions, *Orthopaedic Journal of Sports Medicine*, Oct, Vol. 9, Issue 10: 23259671211043449.

Ghasempour, H., Rajabi, R., Alizadeh, M.H., et al. (2013). Ankle injuries of elite male Iranian gymnasts and anthropometric characteristics, *Turkish Journal of Sport and* Exercise, Vol. 15, pp. 35–41.

Gones, G.L. & Wolf, B.R. (2008). Evaluation and management of gymnastic injuries, *Sport medicine update*, Vol. 15, Issue 3, pp. 35-41.

Grapton, X., Lion, A., Gauchard, G.C., et al. (2012). Specific injuries induced by the practice of trampoline, tumbling and acrobatic gymnastics, *Knee Surg Sports Traumatol Arthrosc*, Vol. 21, pp. 494–499.

Hrazdira, L. & Binder, A.J. (2010). Ankle Injuries in gymnastics, *FIG Medical Information,* pp. 1-10, Available from: http://www.fig-docs.com/Medical%20Docs%20for%20Website/Les%20accidents%20de%20la%20cheville%20en%20gymnastique-e.pdf

Mcnitt-Gray, J.L. (2001). Mechanical demand and multijoint control during landing depend on orientation of the body segments relative to the reaction force, *J Biomech*, Vol. 34, pp. 1471-82.

Meeusen, R., Borms, J. (1992). Gymnastic injuries,

Sports Med, Vol. 13, pp. 337–356.

Paxinos et al (2019). Musculoskeletal injuries among elite artistic and rhythmic Greek gymnasts: A ten-year study of 156 elite athletes, *Acta Orthopædica Belgica*, Vol. 85, Issue 2, pp. 145-149.

Westermann et al, (2015). Evaluation of Men's and Women's Gymnastics Injuries, *Sports Health*, Vol. 7, Issue 2, pp. 161–165.

Corresponding author:
Dilyana Zaykova
Department "Heavy athletics, boxing, fencing and sport for all"
National Sports Academy "Vasil Levski"
Acad. Stefan Mladenov №21
Sofia, Bulgaria
E-mail: dilyana.zaykova@nsa.bg

 DOI: 10.37393/ICASS2022/78 31 - 37

SPORTS INJURIES – A SURVEY AMONG YOUNG BULGARIAN ATHLETES

Evelina Miloshova
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
Injuries received during sports are the most common cause of sports incapacity and lead to many failed dreams and plans. Therefore, research on sports injury and its prevention has always been of interest. The present study aimed to determine the frequency, location, and severity of injuries received by athletes in one year. Methodology: The survey was conducted online in May 2022, using Google forms. More than 500 athletes, with an average age of 24.9 years, and with sports experience of 11.9 years, were interviewed. Respondents practice various sports, most of them in sports games. Statistical processing of the results was done using IBM SPSS 23.0 software. Results: From the answers received, it is clear that the respondents exercise regularly, as over 64% have an intensive sports schedule, train more than 3 times a week, and the duration of each workout is at least 2 hours. The frequency of injuries received over one year is as follows: 40% have not received any injuries, and only about 4% - four or more of them. According to the localization, the most common injuries are those of the lower extremities - soft tissue injuries and distortions of the knee or ankle, and of the upper extremities - overuse injuries of the shoulder. Over 60% of the incidents occurred during practice, and the injured athletes miss about 8 training sessions.

Keywords*: survey, acute sports injuries, overuse injuries, athletes*

INTRODUCTION

Sports injuries (traumas) are a cause-and-effect relationship with physical exercise activities, sports, and tourism. Traumatism dominates the structure of sports-specific pathological conditions. Almost 80% of these conditions are injuries.

Sports injuries analysis can be carried out based on different types of studies: direct (register of athletes admitted to an emergency center after receiving an injury; providing medical assistance during training/competition; athletes treated in specialized orthopedic clinics, etc.), and indirect (survey studies on trauma among different contingents of athletes; meta-analysis of literature sources, etc.). Direct observations are preferable, as they include accurate diagnoses that give a more complete picture regarding the anatomical localization and the affected structure of the resulting injuries (Gabbe et al., 2004; Valuri et al., 2005; Elbaih et al., 2017).

The analysis of sports injuries by type, frequency, and severity, together with the establishment of sports-related disability, can help identify better the factors with an impact on injury prevention. For example, warming up before physical activity, including stretching exercises, and regular use of protectors are proven factors leading to a reduction in sports injuries (Woods et al., 2007; McHugh & Cosgrave, 2010; Padua et al., 2019; Iwata et al., 2019; Avedesian et al., 2020).

Many epidemiologic studies show a diverse frequency of acute injuries in different sports. Injuries in team sports (football and basketball), gymnastics are usually indicated with a high frequency, while swimming and water polo - are with a low frequency (Ricard et al., 2007; Zemper & Dick, 2007; Wanivenhaus et al., 2012; Atilla et al., 2020).

Depending on the practiced sport, the anatomical localization and type of injuries also differ. The knee joint is most often affected in sports such as soccer, alpine skiing, basketball, ice hockey, track, and fields, etc. (Caine & Nassar, 2005; Ricard et al., 2007; Argibay-González et al., 2022), and the damages are mostly soft tissue (meniscal and ligamentous lesions). In combat sports, swimming, and volleyball, the shoulder joint suffers often (Wanivenhaus et al., 2012; Seminati & Minetti, 2013; Didace et al., 2017; Jeong et al., 2022), and in aesthetic sports, running, basketball, and handball – the ankle joint (McKay et al., 2001; Dagorov, 2002; Gamboa et al., 2008; Vila et al., 2022).

D. Shoylev (1983) pays special attention to overuse injuries in various sports, e.g., ARS is mainly an overuse disease in soccer players, gymnasts, and wrestlers the shoulder joint is most affected; the knee joint - in weightlifters, volleyball players, and basketball players.

The question of when athletes get more injured - during training or competition is important, since competitions are necessarily provided with medical specialists, and training - sometimes. Many of the injuries occur during training when health professionals are not usually available to intervene immediately. The athlete can help himself or delay it if the symptoms are not severe or disabling. In this case, tissue damage can increase in the absence of rapid therapeutic intervention, and the loss of working capacity can be prolonged (Dagorov, 2002; Frontera, 2003).

The present study aimed to determine the frequency, location, and severity of injuries received by athletes in one year, as well as to determine the influence of some factors in injury prevention.

METHODOLOGY

Over 600 athletes were invited to participate in the survey. The inclusion criteria were: a) being active sportsmen for at least 2 years; b) having an intensive, weekly, training schedule; c) not suffering from an injury or illness that would be an obstacle to their sports training at the time of completing the questionnaire. Informed consent was obtained from the parents of athletes under 18 years of age. The link to the questionnaire was distributed via social media and email by 20 volunteers.

The survey was conducted by a self-admitted, anonymous questionnaire, realized online in May 2022 using Google forms, and was completed by 564 male and female athletes. Twenty-six of them did not allow their answers to be published, that is the reason the statistical processing of the results was made on 538 people. The age of the respondents was 25.2 ± 10.2 years (women – 23.3 years, men – 26.5 years), and their sports stage was 11.6 years on average. The majority of respondents were from team sports – 220 people. The distribution by sports practiced is presented in Table 1.

Table 1. *Distribution of respondents (men and women) by sports group (%)*

Sports (groups)	Male		Female	
	n	%	n	%
Team Sports	140	44.3	80	36.0
Combat Sports	52	16.5	23	10.4
Water Sports	19	6.0	13	5.9
Aesthetics Sports	2	0.6	38	17.1
Winter Sports	16	5.1	13	5.9
Power/Resistance Sports	29	9.2	20	9.0
Other	51	16.1	32	14.4
Missing	7	2.2	3	1.4
Total	316	100	222	100

Statistical processing of the results was done by IBM SPSS 23.0 software. Student's t-test and Pearson's $\chi 2$-test were used to establish statistical significance for hypothesis testing.

RESULTS AND DISCUSSION

Questions were asked, at the beginning of the survey, to provide information about the weekly frequency of training activities and the duration of a training session. The results showed that two-thirds of the athletes train more than three times a week, and the average duration of one training session is 2 hours. With a view to the prevention of sports injuries, questions were asked about warm-up and stretching exercises before each training session. It is satisfactory that 90% of the respondents always warm up before training (only 0.5% - never warm up), and stretching exercises are always performed by 75% of them. Unfortunately, 40% of athletes never use personal protective equipment (helmets, protectors, bandages, etc.), and 31% use them sometimes during training (Figure 1).

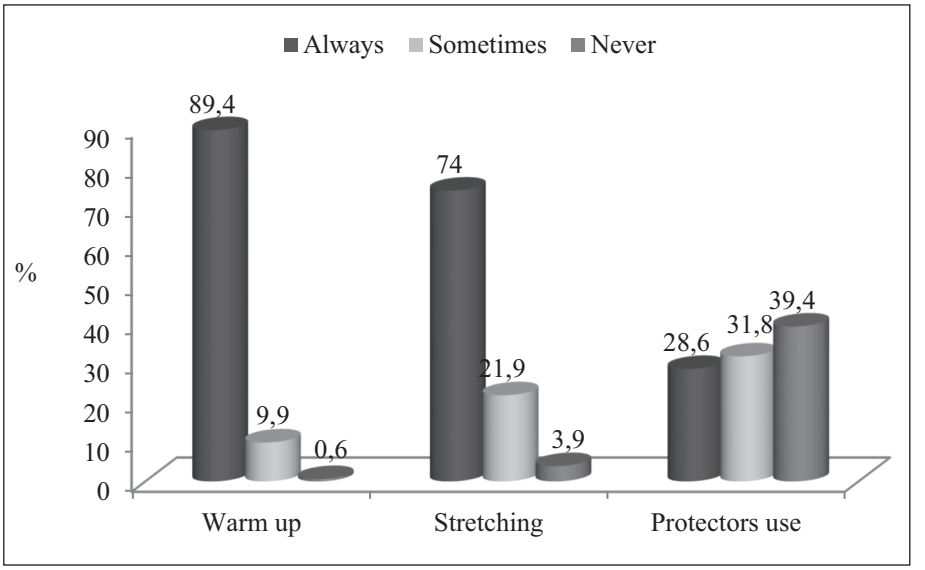


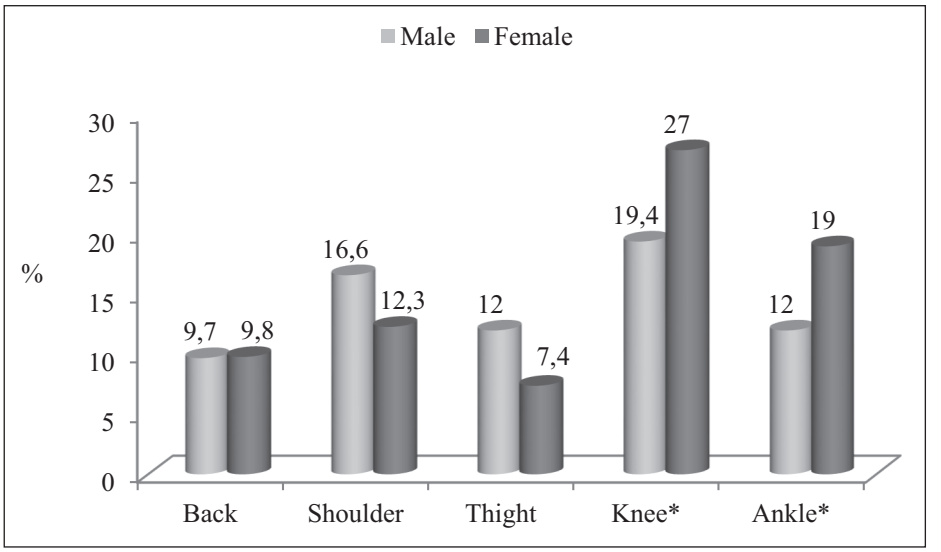
Figure 1. *Performance of warm-up, stretching, and use of protectors during training*

To get an idea of sports injuries, we asked the respondents how many injuries they had received in the past year (March 2021 - March 2022). Approximately one-third of athletes (32%) had only one sports injury in the past year, 35% had no injuries, and 17% had more than 3 injuries.

For a detailed description of sports trauma, the surveyed athletes had to specify the type of injury received, its location, when the incident occurred (during training or competition), how long it took to recover, and who provided first aid to the injury. In this way, respondents had to characterize their most severe traumas.

Location of injuries

The knee was the most affected part of the body, and the most severely injured in both men (19.4%) and women (27%). Other localizations of injuries are the shoulder and ankle joints, with the shoulder being more often affected in men and the ankle in women. The head and hip are the least injured. The locations shown in Figure 2 account for about 70% of reported injuries.



(*) - there is statistical significance, p < .05

Figure 2. *Most frequent location of injuries according to gender*

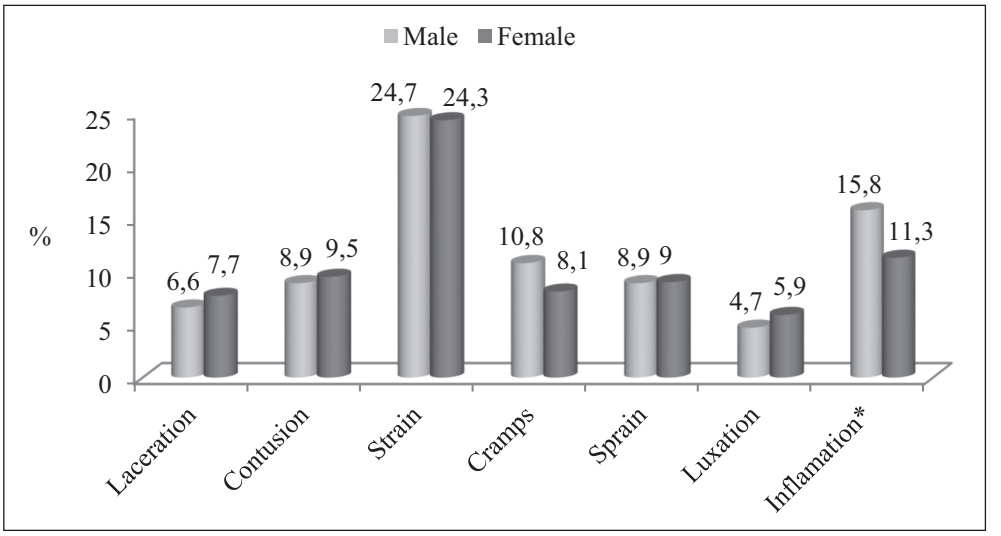
The knee is exposed to wounds and abrasions (31.6%), contusions (18.4%), and hyperextensions of the ligaments (14.4%). A pain syndrome accompanied by an inflammatory process due to overuse occurs in 28% of the responses. Ankle injuries are most often associated with dislocations of the joint surfaces - sprains (47.9%) and luxation (10.7%). Problems related to the surrounding musculature were reported in the shoulder - strains (13.6%), cramps (5.8%), and inflammation (17.3%).

Injury pattern

Systematization of the different injuries pattern was done according to the affected structures – soft tissue injuries, cramps, joint, bone, skin injuries, and overuse injuries with pain and inflammation (Figure 3).

Skin injuries are most often of low frequency and include superficial abrasions and lacerations. These were reported by 6.6% of men and 7.7% of women, with the most affected areas being the knee and elbow. Bruises, cramps, sprains, and sprains are also of low frequency.

At first, sprains and luxation affect the athletes' ankles in team sports, second - the wrist, and finally the small joints of the palm and fingers. Ankle joints are also most vulnerable in aesthetic sports athletes, and shoulder joints - are in power sports and combat sports athletes.



(*) p < .05

Figure 3. *Injury pattern by gender.*

Almost a quarter of athletes of both sexes cite as the most serious injury strain, which affects the muscles of the back, around the shoulder and knee, and the muscles of the thigh. In the different groups of sports, the location is similar: in team sports, combat, and power/resistance sports - the strain in the thigh and around the shoulder predominate, and in water and aesthetic sports - in the back.

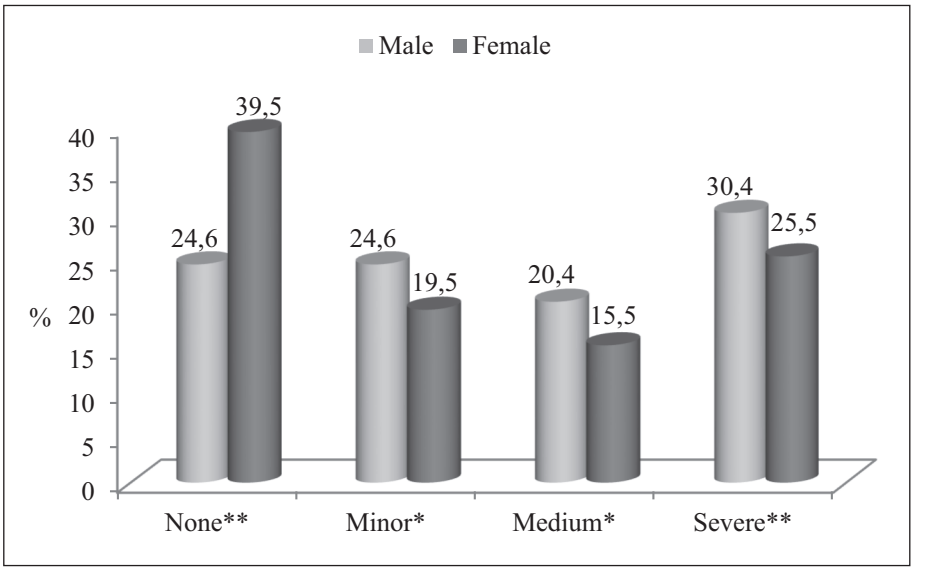
Muscle cramps, although not typical injuries, are accompanied by severe pain and are a reason for the immediate interruption of the training load. The pain symptom can persist even after the cramp has passed and this can be a reason for sports incapacity. The frequency of cramps is low according to the respondents – 10.8% in men and 8.1% in women. From the answers received, it is clear that the most common are cramps of the trunk, back, and thigh muscles. Cramps of the back muscles are most common in power/resistance and water sports, and of the trunk and thigh - in team sports.

Inflammations due to overuse injuries are more common in men (15.8%) compared to women (11.3%), and their localization is in the shoulder, knee joint, and back. In the group of team sports, there are the most similar cases with localization in the back and knee joint, and in combat sports - in the shoulder.

Sports incapacity

Interruption of training load after receiving an injury can last for a shorter or longer time. The duration of sports incapacity is a way of assess-

ing the injury severity. The survey asked about the number of training sessions missed after sustaining an injury, with one-third of respondents reporting that they had not missed a single training session. The rest have lost an average of 11 training sessions. According to the number of missed training, we can claim that about 30% of the athletes suffered from severe injuries (more than 10 missed training), and for the rest, the injuries were mild or medium (Figure 4).



(*) p < .05; (**) p< .01

Figure 4. *The severity of received injuries by gender*

Besides the severity of the injuries, the period during which they were received is also of interest. Since the training, as part of the athletes' preparation, takes up much more time than official competitions, it is logical that most injuries are received during training. This hypothesis is confirmed by the answers received - almost 65% of injuries were received during training, and 15% - were during competition or other times.

The time of receiving is also related to the severity of the injury. Injuries sustained during training are mild or moderate, while those sustained during competition are severe. Pursuing victory at any cost is a prerequisite for neglecting real work capacity; the conditions under which the competition is held; breaking rules and rough play, which factors lead to an increase in injury both in quantity and quality (Figure 5). The responses confirm this hypothesis with a high level of confidence.

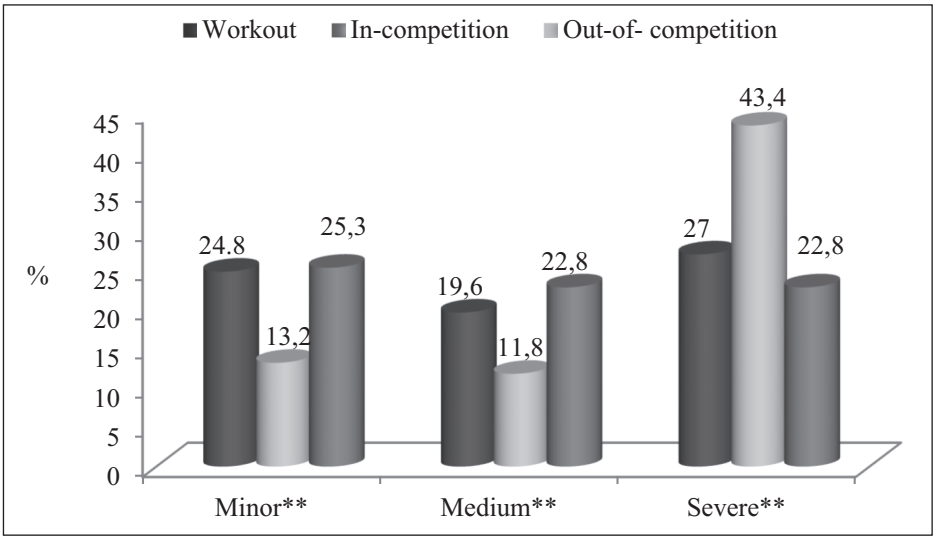


Figure 5. *Dependence between the severity of injuries and the time of receiving; (**) p < .01*

At the end of the survey, a question was asked regarding the provision of first aid in case of an injury – whether this aid was provided by a medical person or by someone else. The highest percentage of respondents (29.4%) answered that they administered first aid themselves. On the second are the coaches who help in case of injuries, and on the third - are the doctors.

Providing first aid by the coach is twice as common when working with women, while male athletes prefer to deal with the situation themselves. The coach is the one who helps the athletes mainly during training, while at competitions - these are the doctors. If the accident occurred outside of training or competition time, again, it was the doctors who helped. 13.8% of respondents stated that no one helped them during the accident (Figure 6).

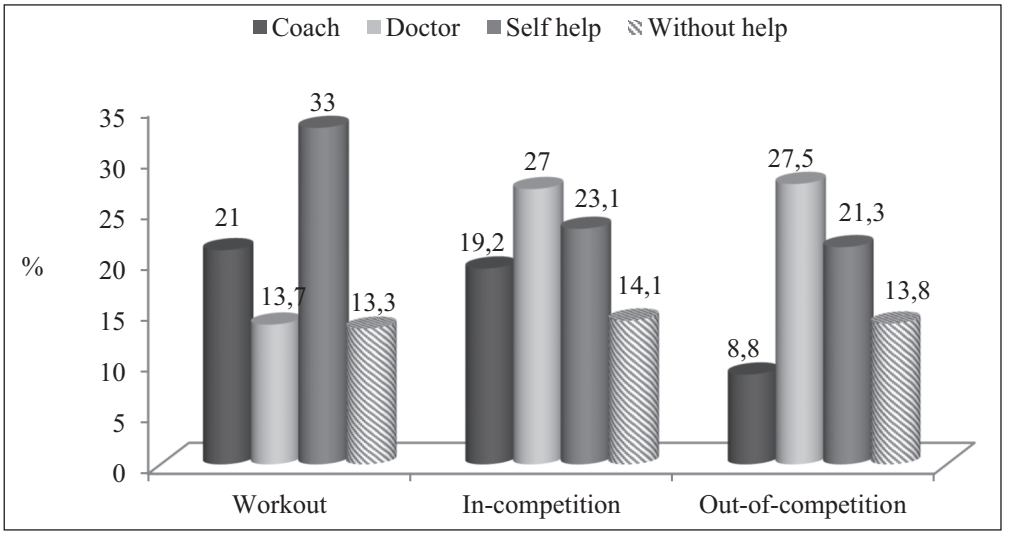


Figure 6. *Provision of first aid in case of injury*

CONCLUSION

The results of the survey largely overlap with those of other authors regarding the location, pattern, and severity of the injuries received:

- Most injuries, both acute and from overstrain, occur in the knee area;
- The most affected structures are the joints (knee, ankle, and shoulder), followed by the muscles of the thigh and back;
- The largest number of injuries was received during training and the most severe - during competition;
- The frequency of injuries is greatest in team sports, combat, and aesthetic sports;
- Athletes regularly apply warm-up and stretching before exercise, a factor that leads to decreasing injuries. We recommend that coaches promote the use of protectors, which also contributes to injury prevention;
- First aid methods should be widely learned by athletes, coaches, and parents, as it is not always possible to provide this help immediately by a medical specialist.

ACKNOWLEDGMENTS

I would like to express my gratitude to the Master's students from the „Sports for high performance" program (2021/2022), who actively participated in the survey and provided the respondents.

REFERENCES

Argibay-González, J.C., Vázquez-Estévez, C., Gutiérrez-Santiago, A., Paramés-González, A., Reguera-López-de-la-Osa, X., Prieto-Lage, I. (2022). Analysis of Injury Patterns in Men's Football between the English League and the Spanish League. *Int J Environ Res Public Health*. Sep 8; (18):11296. doi: 10.3390/ijerph191811296. PMID: 36141571.

Atilla, H., Akdogan, M., Öztürk, A., Ertan, M.B., Kose, O. (2020). Musculoskeletal Injuries in Master Swimmers: A National Survey in Turkey. *Cureus*. Jun 3; 12(6): e8421. doi: 10.7759/cureus.8421. PMID: 32642337; PMCID: PMC7336593.

Avedesian, J.M., Judge, L.W., Wang, H., Dickin, D.C. (2020). The biomechanical effect of warm-up stretching strategies on landing mechanics in female volleyball athletes. *Sports Biomech*. Oct;19 (5): 587-600. doi:

10.1080/14763141.2018.1503322

Caine, D. J., Nassar, L. (2005). Gymnastics injuries. *Med Sport Sci*; 48:18-58. doi: 10.1159/000084282.

Dagorov, N. (2002). *Sportni travmi*. RIA „DIMI Stile", Sofia

Didace, M. M., André, M. J. G., Victoire, K. M. A., Justy, M. C. S. I., & Alphonse, M. (2017). Combat Sports Injuries in Well-Trained Athletes during African Games 2015 in Brazzaville, Congo. *Advances in Physical Education*, 7: 274-285. https://doi.org/10.4236/ape.2017.73022

Elbaih, A.H., Ismail, M.T., Salh, M., Algwad, E.A., & Elfatah, A.F. (2017). Prevalence and types of sports injuries presenting to emergency department Suez Canal University Hospital. *International Journal of Surgery and Medicine*, 3, 45-51.

Frontera, W. (2003). Epidemiology of Sports Injuries: Implications for Rehabilitation. In: *Rehabilitation of Sports Injuries: Scientific Basis*. IOC, Blackwell Science Ltd

Gabbe, B.J., Finch, C.F., Bennell, K.L., Wajswelner, H. (2003). How valid is a self-reported 12 month sports injury history? *Br J Sports Med*. Dec; 37(6):545-7. doi: 10.1136/bjsm.37.6.545.

Gamboa, J.M., Roberts, L.A., Maring, J., Fergus, A. (2008). Injury patterns in elite preprofessional ballet dancers and the utility of screening programs to identify risk characteristics. *J Orthop Sports Phys Ther*. Mar; 38(3): 126-36. doi: 10.2519/jospt.2008.2390. PMID: 18383646.

Iwata, M., Yamamoto, A., Matsuo, S., Hatano, G., Miyazaki, M., Fukaya, T., Fujiwara, M., Asai, Y., Suzuki, S. (2019). Dynamic Stretching Has Sustained Effects on Range of Motion and Passive Stiffness of the Hamstring Muscles. *J Sports Sci Med*. Feb 11;18(1):13-20

Jeong, G., Chun, B. (2022). Differences in Sports Injury Types According to Taekwondo Athlete Types (Sparring, Poomsae, and Demonstration). *J Sports Sci Med*. Sep 1;21(3):473-481. doi: 10.52082/jssm.2022.473

McHugh, M.P., Cosgrave, C.H. (2010). To stretch or not to stretch: the role of stretching in injury prevention and performance. *Scand J Med Sci Sports*. Apr; 20(2):169-81. doi: 10.1111/j.1600-0838.2009.01058. x.

McKay, G.D., Goldie, P.A., Payne, W.R., Oakes, B.W. (2001). Ankle injuries in basketball: injury rate and risk factors. *Br J Sports Med*. Apr;35(2):103-8. doi: 10.1136/bjsm.35.2.103. PMID: 11273971; PMCID: PMC1724316.

Padua, E., D'Amico, A.G., Alashram, A., Campoli, F., Romagnoli, C., Lombardo, M., Quarantelli, M., Di Pinti, E., Tonanzi, C., Annino, G. (2019). Effectiveness of Warm-Up Routine on the Ankle Injuries Prevention in Young Female Basketball Players: A Randomized Controlled Trial. *Medicina (Kaunas)*. Oct 16; 55(10): 690. doi: 10.3390/medicina55100690

Ricard, C., Rigou, A., Thelot, B. (2007). Description et incidence des accidents de sport. Enquète permenente sur les accidents de la vie courante 2004-2005. *Reseau Epac. Saint-Maurice* (Fra): Institut de veille sanitaire.

Seminati, E., Minetti, A. E. (2013). Overuse in volleyball training/practice: A review on shoulder and spine-related injuries. *Eur J Sport Sci*.; 13 (6): 732-43. doi: 10.1080/17461391.2013.773090

Shoylev, D. (1983). *Sportna traumatologya*. Medicina I fizcultura, Sofia

Valuri, G., Stevenson, M., Finch, C., Hamer, P., Elliott, B. (2005). The validity of a four-week self-recall of sports injuries. *Injury Prevention*; 11:135–137. doi: 10.1136/ip.2003.004820

Vila, H., Barreiro, A., Ayán, C., Antúnez, A., Ferragut, C. (2022). The Most Common Handball Injuries: A Systematic Review. *Int J Environ Res Public Health*. Aug 27; 19(17): 10688. doi: 10.3390/ijerph191710688

Wanivenhaus, F., Fox, A.J., Chaudhury, S., Rodeo, S.A. (2012). Epidemiology of injuries and prevention strategies in competitive swimmers. *Sports Health*. May; 4(3): 246-51. doi: 10.1177/1941738112442132.

Woods, K., Bishop, P., Jones, E. (2007). Warm-up and stretching in the prevention of muscular injury. *Sports Med*.; 37(12):1089-99. doi: 10.2165/00007256-200737120-00006

Zemper, E., Dick, R. (2007) *Epidemiology of athletic injuries. Primary Care Sports Medicine.* (2nd Edition), D. McKeag and J. Moeller (eds.), Philadelphia, PA: Lippincott Williams & Wilkins

Corresponding author
Evelina Miloshova, MD, PhD
National Sports Academy „Vassil Levski"
Department of Sports medicine
21, Acad. Stefan Mladenov str.
1117 Sofia, Bulgaria
E-mail: evelina.miloshova@nsa.bg

RISK FACTORS FOR STRESS FRACTURES IN MALE ATHLETES

Diana Dimitrova, Evelina Miloshova
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
Stress fractures (SF) are common injuries in athletes caused by overuse and repetitive activity. The prevalence and risk factors for SF in male athletes are not well documented as they are assumed to be more common in female athletes. Our study was aimed at establishing the prevalence of SF among male athletes and analyzing the selected risk factors for their occurrence. Ninety-three randomly selected volunteer male athletes from different sports aged 19.2±2.8 years participated in this cross-sectional study. The participants provided information about their demographic data, history of SF, and lifestyle risk factors and completed the Eating attitude test (EAT-26) for identifying eating disorders risk. Crude odds ratios (OR) of the groups with and without a history of SF were calculated to assess the association of SF with the studied factors. A total of 23 (24.7%) of the athletes reported at least one SF in the past, and 23.7% of them have had two or more SF. Most of the injuries (69.6%) were located in the lower extremity, and 60% were in the foot and ankle. Participation in competitions and weight loss of more than 10 kg in the past were identified as the only significant factors associated with SF incidents in male athletes (OR 24.8, 95% CI: 1.4-425.4; OR 153.3, 95% CI: 8.5-2770.6, respectively). These results suggest that engagement in competitive sports, which is associated with higher training volume and extreme weight loss practices, should be considered as a factor for increased risk of SF in male athletes.

Keywords*: stress fractures, risk factors, male athletes, EAT-26*

INTRODUCTION

Stress fractures (SFs) are the most common overuse injury in athletes and are a common cause of disability and interruption of the training process. It was recognized that their etiology is multifactorial, and several risk factors were identified. The SFs are associated with increasing age (Bennell et al., 1999), low body weight (Bennell et al., 1995,1996, Nattiv et al., 2000), disordered eating (Bennell et al., 1995,1996, Nattiv et al., 2000), low bone mineral density (Bennell et al., 1995,1996, Carbon et al., 1990, Nattiv et al., 2000), menstrual irregularities (Bennell et al., 1995,1996, Carbon et al., 1990, Nattiv et al., 2000), smoking (Bouillon, 2008), both high volume and intensity of physical activity (Pegrum et al., 2012, Sharma, 2013), low fitness level (Bennell et al., 1999). The findings from studies of female and male athletes are contradictory regarding the associations of stress fractures with these risk factors due to the small sample size and use of different research methodologies.

Until recently, eating disorders were considered a risk factor for SFs, mainly in female athletes, and therefore very little information is available concerning male athletes. However, in recent years there has been an increase in restrictive eating patterns followed by compulsive exercise behaviors in male athletes (Karrer et al., 2020). The main triggering factors are performance pressure, pressure to maintain a specific body weight, perfectionism, and preoccupation with body image. (Filaire et al., 2007, Meyer et al., 2011).

This study aimed to establish the prevalence of SF among male athletes and to analyze the selected risk factors for their occurrence.

METHODS

Ninety-three randomly selected volunteer male athletes from different sports aged between 20 and 36 (mean age19.2±2.8 years) participated in this cross-sectional study. Exclusion criteria were sports experience of fewer than five years and weekly training duration of fewer than 6 hours/per week.

After informed consent and detailed instructions, all athletes completed a comprehensive questionnaire that consisted of four parts.

In the first part of the questionnaire, the participants provided information about their demographic data, sporting experience, training practices, participation in competitions, and competitive level.

The second part of the questionnaire assessed the stress fractures (SF) history. The presence of a stress fracture was assumed if they were diagnosed by a physician or confirmed by x-ray, bone scan, or magnetic resonance imaging.

The athletes were divided into two groups depending on whether or not they had SF in the past five years. The athletes with a history of one or more SF comprised the stress fracture group (SFG) (n=23), and those without a history of SF were the control group (CG) (n=70).

The third part of the questionnaire aims to identify the occurrence of selected lifestyle risk factors for SR, such as smoking, alcohol, and intake of caffeine-containing beverages.

In the fourth part of the questionnaire, the respondents completed the Eating attitude test (EAT-26) to identify the presence of eating disorders risk based on attitudes, feelings, and behaviors related to eating (Garner et al., 1982).

The test consists of three sections, as follows:

1) Total score based on the answers to the EAT-26 questions

The total score ranges between 0 and 78, with higher scores indicating a greater risk of an eating disorder. A score of 20 or above on the EAT-26 was taken as a cutoff for an overall pattern of disturbed eating which includes a high level of concern about dieting, body weight, or problematic eating behaviors.

The questions of EAT-26 are related to how often an individual engages in certain behaviors and form three subscales:

- Dieting - related to pathological refusal of high-density foods and concern for physical appearance,
- Bulimia and food preoccupation - refer to episodes of binge eating, followed by purgative behaviors to lose/control body weight,
- Oral control - reflects self-control concerning food and assesses the environmental and social forces that stimulate food intake (Marques et al., 2021).

The responses were scored on a four-point Likert scale as follows: Always = 3 points; Usually = 2 points; Often = 1 point; Never, Rarely, and Sometimes = 0 points. Item 26 was scored in the opposite direction (Never, Rarely, Sometimes = 3, etc.), and a final score was calculated by summing items from 1 to 26.

2) Answers to behavioral questions related to eating symptoms and weight loss

The four questions assess self-reported binge eating, self-induced vomiting, use of laxatives, and treatment for eating disorders. The last question is about weight loss over the preceding six months. We used a six-point Likert scale based on how often a person has engaged in extreme weight control behaviors over the preceding six months ("Never," "Once a month or less," "2–3 times a month," "Once a week," "2–6 times a week," and "Once a day or more") to score the items.

3) Body mass index (BMI)

It was calculated from self-reported height and weight to estimate the low body weight compared to age-matched norms.

Statistical analyzes were performed using SPSS-23.0. The normality of all parametric variables was tested using the Shapiro-Wilk normality test. Descriptive statistics (mean ± standard deviation) were computed for sociodemographic variables (age, height, weight, BMI, sports experience) and EAT-26 total score. The categorical data were presented as percentages. An independent samples t-test was used to evaluate the differences in demographic characteristics and sport experience data of both groups. The comparison of the categorical variables of the SF group and the C group was performed by Chi-square analyses. To determine the association of SF with the studied factors crude odds ratios (OR) and 95% confidential interval (95% CI) of both groups were calculated. The .05 level of significance was selected to test the statistical hypotheses.

RESULTS

Ninety-three male athletes with a mean age of 19.23±2.8 and a training experience of 9.34±4.25 years participated in this study. Sixty-nine of them (74.19%) participated in competitions, of whom 63 (67.74%) were at of national and 6 (6.45%) at of international level. The mean age at commencing competition for the whole group was 12.53±3.59. (Table 1).

Table 1. *Comparison of the demographic characteristics and risk factors of the studied groups*

Variable	Total group n=93	SFG n=23	CG n=70	Mean diff. between SFG and CG
Age and anthropometric characteristics				
Age (years)	19.23±2.80	19.26±2.60	19.21±2.91	0.05
Height (cm)	180.16±7.01	181.04±5.83	179.87±7.37	1.17
Weight (kg)	80.03±11.81	78.78±7.59	80.44±12.93	1.66
BMI (kg.cm^{-2})	24.60±2.98	24.04±2.12	24.78±3.21	0.74
Sports experience				
Training experience (years)	9.34±4.25	10.31±4.59	9.03±4.13	1.28
Training duration (hours/week)	8.95±4.90	9.90±5.58	8.63±4.66	1.27
Participation in competitions (% / n)	74.19 (69)	100.00 (23)	65.71 (46)	34.29*
Age at commencing competition (y)	12.53±3.59	12.50±3.96	12.54±3.46	0.04
Competitive level (% / n)				
- National	67.74 (63)	95.65 (22)	92.86 (41)	2.79
- International	6.45 (6)	4.35 (1)	7.14 (5)	2.79
Behavioral (lifestyle) risk factors				
Smoking history (percent/number)				
- never	64.52 (60)	60.87 (14)	65.71 (46)	4.84
- in the past	21.51 (20)	21.74 (5)	21.43 (15)	0.33
- currently	13.98 (3)	17.39 (4)	12.86 (9)	4.53
Alcohol intake (percent/number)				
- never	49.46 (46)	47.83 (11)	50.00 (35)	2.17
- up to 5 glasses/week	40.86 (38)	52.17 (12)	37.14 (26)	15.03
- 6 and more glasses/week	12.86 (9)	–	12.86 (9)	12.6
Caffeine-containing beverages intake (percent/number)				
- never	17.20 (16)	13.04 (3)	18.57 (13)	5.53
- up to1cup/day	52.69 (49)	60.87 (14)	50.00 (35)	10.87
- more than 1 cup/day	30.11 (28)	26.09 (6)	31.43 (22)	5.34
Eating pathology				
EAT score ≥ 20 (% / n)	6.45 (6)	4.35 (1)	7.14 (5)	2.79
- Dieting	8.52±3.14	8.61±3.77	8.49±2.94	0.12
- Bulimia and food preoccupation	1.04±1.84	0.74±1.14	1.14±2.02	0.40
- Oral control	2.89±2.23	2.45±2.54	3.03±2.13	0.58
Extreme weight control behaviors (% / n)				
- Self-reported binge eating	22.58 (21)	34.78 (8)	18.57 (13)	16.21
- Self-induced vomiting	6.45 (6)	13.04 (3)	4.29 (3)	8.75
- Use of laxatives	10.75 (10)	21.74 (5)	7.14 (5)	14.60
- Treatment for ED	6.45 (6)	8.70 (2)	5.71 (4)	2.99
- Extreme loss of weight	57.12 (12)	57.12 (12)	–	57.12*

Table 1 shows the characteristics and risk factors of the participants with and without a history of stress fractures. As can be seen, all of the participants of the SF group (n=23) were competitive athletes. Their percentage was significantly higher than the percentage of athletes who participated in competitions in CG (65.71%) ($p < .05$). No significant differences were found between the two

groups studied in the other parameters characterizing sports experience, anthropometric indicators, and age. Both groups didn't differ significantly in behavioral risk factors, such as smoking, alcohol intake, and the drinking of caffeine-containing beverages ($p< .05$).

On the EAT-26, most athletes studied were below the cutoff value for screening for abnormal eating attitudes. One athlete (4.35%) of the SFG and five players (7.14%) of the CG scored in the high-risk range (>20), but the difference was insignificant. The comparison between the SFG and CG did not show significant differences in the subscales of the EAT-26 – dieting, bulimia, food preoccupation, and oral control ($p< .05$). Both groups also did not differ significantly in the incidents of extreme weight control behaviors, such as binge eating, self-induced vomiting, or the use of laxatives. The individuals with a history of prior eating disorder treatment were also similar - SFG (8.7%) and CG (5.7%). However, the number of athletes who reduced their weight was significantly higher in the SFG – 57.12% (12) compared to CG (0%).

Twenty-three of the athletes (24.73%), who comprised the SF group, reported having experienced 39 SFs. Fourteen of these 23 athletes (60.87%) had one SF, and the remaining 9 (39.13%) reported two or more SFs (Table 2).

Table 2. *Characteristics of the sustained stress fractures in male athletes*

Variable	**n (%)**	**Variable**	**n (%)**
Stress fractures sustained (n=39)		Localization	
- one SF	14 (60.87)	- arm	2 (5.13)
- more than one SF	9 (39.13)	- forearm	2 (5.13)
Time of occurrence		- wrist, hand, and fingers	4 (10.26)
- during training	27 (69.2)	- spine	1 (2.56)
- during competition	3 (7.7)	- pelvis	2 (5.13)
- other times	9 (23.1)	- thigh	4 (10.26)
Participation restriction time		- calf	6 (15.38)
- up to 1 month	22 (56.4)	- ankle, foot, and fingers	24 (60.0)
- 1-6 months	17 (43.6)		

Most SFs occurred during the training process – 27 (69.2%) and only 3 (7,7%) during competition. The rest of the SFs occurred at other times and were not directly related to sports activity. The most common localization of SFs is the ankle, foot, and fingers 24 (60%), followed by the calf – 6 (15,38%), tight – 4 (10.26%), wrist, hand, and fingers – 4 (10,26%), 2 SFs (5.13%) each occurred in the arm, forearm, and pelvis, and 1 SF (2.56%) involved the spine. More than half of the SFs – 56.4% (22) took to recover for up to 1 month. For the rest of the SFs – 43.6% (17), the participation restriction time was from 1 to 6 months.

We calculated odds ratios to examine the potential association between SF and the possible predictors (Table 3). As shown in Table 3, the odds ratio for participation in competitions in athletes with SF and those without SF was 24.76 (95% CI: 1.44 - 425.38, p=.027). The odds ratio for extreme weight loss of 153.26 (95% CI: 8.48 – 2770.56, p=.0007) was also significant. For all other risk factors, the odds ratio with 95% CI spun the null value and was insignificant.

Table 3. *Odds ratios for the various risk factors for stress fractures*

Variable	Odds ratio	95 % CI:	*P*
BMI<age-matched norms	0.58	0.03 to 12.59	0.731
Participation in competitions	24.76	1.44 to 425.38	0.027*
Higher competitive level	0.59	0.07 to 5.34	0.639
Smoking history	1.23	0.47 to 3.26	0.674
Alcohol intake	1.09	0.42 to 2.80	0.856
Caffeine-containing beverages intake	1.52	0.39 to 5.89	0.544
EAT score<20	0.59	0.07 to 5.34	0.639
Self-reported binge eating	2.34	0.82 to 6.67	0.112
Self-induced vomiting	3.35	0.63 to 17.91	0.16
Use of laxatives	3.61	0.94 to 13.86	0.061
Treatment for ED	1.57	0.27 to 9.20	0.616
Extreme weight loss	153.26	8.48 to 2770.56	0.0007*

DISCUSSION

In this study, 23 of 93 male athletes, representing 24.73 %, experienced stress fractures in the past five years. This incident rate is comparable with this in females and shows that the problem with stress fractures in male athletes is underestimated. The distribution of stress fractures in this study correlates well with previous studies. The ankle, foot, and fingers were the most common stress fracture sites, followed by the calf and tibia. 69.6% of all fractures were located in the lower limb, and this result is consistent with data from other authors (Rizzone et al., 2017, Sharma & Heagerty, 2017).

All of the athletes who experienced SFs participated in competitions in the past. We identified two risk factors for the incidents of stress fractures in male athletes – participation in competitions and weight loss of more than 10 kg in the past. Our study failed to identify any differences between SFG and CG in terms of other studied risk factors related to anthropometric characteristics, sports participation, lifestyle risk factors, and eating pathology.

One possible explanation for the higher incidence of SFs in competitive athletes could be the greater workloads than those in CG. Several articles were devoted to the study of the association between sport participation patterns and injury risk in athletes, but the results are conflicting (Gabbett et al., 2014, Denay, 2017, Tiernan et al., 2020, Verstappen et al., 2021). As the main factors for injuries in athletes, a disturbed balance between training loads and the body's capacity to tolerate these loads is highlighted. The training load is a function of the training volume (intensity, frequency, and duration) and recovery. An increase in the training volume and insufficient recovery will therefore affect the risk of injuries. The athletes in both groups had similar mean training duration per week, respectively 9.90±5.58 for SFG and 8.63±4.66 for CG. However, this study does not provide information on the training intensity of the athletes. Along with higher physiological demands, competitive sport is accompanied by increased psychological stress, which also plays a pivotal role in the increased risk of injuries (Pedersen et al., 2016, Jia-Sheng, & Kok-Yong, 2021).

The global EAT score of £ 20 identified individuals at risk of an eating disorder (Garner et al., 1982). The differences in this score between both groups were insignificant, as were the differences in its subscales. Although the percentage of athletes from the SF group practicing different purging behaviors, such as self-induced vomiting, and use of laxatives and diet pills, was higher than those from the HP group, no significant differences were found. However, 57,12% of the participants in the SF group engaged in pathogenic weight loss methods, and no athlete in the control group reported extreme weight loss in the previous five years. The calculated odds ratios confirm the association between weight loss and SF risk. The weight loss rises by 153.26 times (95% CI: 8.48 to 2770.56) the risk of having SF ($p = 0.0007$).

One of the explanations for this result is that the reduction of the lean and fat mass associated with

insufficient nutrition contributes to impaired the bone metabolism (Misra & Klibanski, 2014). Dietary restraint can also depress immune function and is associated with micronutrients and vitamin deficiencies that may affect bone mineral density and elevate the risk of SF (Ghoch et al., 2013). In addition to the deficit of Vitamin D and calcium, minerals and trace elements such as zinc and magnesium also are required for normal bone metabolism (Moran et al., 2012).

This study has several limitations. The retrospective pattern of the study may be a source of erroneous findings. Furthermore, the use of self-reported questionnaires to assess behavioral and dietary risk factors always carries risks. Although EAT-26 is a widely used self-report measure for symptoms and behaviors associated with eating disorders and is recommended for use in both clinical and non-clinical settings. We also did not have information about the intensity of the athletes' physical exertion and their psychological characteristics. Finally, the questionnaire did not examine the energy and nutrient intake of the athletes to detect possible nutritional deficiencies.

CONCLUSION

These results from this study suggest that male athletes are at increased risk for stress fractures, as are females, and this is an underrecognized problem. Engagement in competitive sports of male athletes, which is associated with higher training volume and extreme weight loss practices, should be considered as a factor for increased risk of SF in male athletes. Further analysis of the training practices and dietary analysis could provide more information on risk factors for stress fractures in male athletes and contribute to the implementation of prevention strategies.

REFERENCES

Bennell, K., Malcolm, S., Thomas, S., Ebeling, P., McCrory, P., Wark, J. & Brukner P. (1995). Risk factors for stress fractures in female track-and-field athletes: a retrospective analysis, Clinical Journal of Sport Medicine, Vol. 5 No. 4, pp. 229–235.

Bennell, K., Malcolm, S., Thomas, S., Reid, S., Brukner, P., Ebeling, P. & Wark, J. (1996). Risk factors for stress fractures in track and field athletes. A twelve-month prospective study. American Journal of Sports Medicine, Vol. 24 No. 6, pp. 810–818.

Bennell, K., Matheson, G., Meeuwisse, W. & Brukner, P. (1999). Risk factors for stress fractures. Sports Medicine, Vol. 28 No.2, pp. 91–122.

Bouillon R. (2008). How effective is nutritional supplementation for the prevention of stress fractures in female military recruits? *Nature Clinical Practice Endocrinology & Metabolism*, Vol. 4 No. 9, pp. 486–487.

Carbon, R., Sambrook, P., Deakin, V., Fricker, P., Eisman, J., Kelly, P., Maguire, K. & Yeates, M. (1990). Bone density of elite female athletes with stress fractures. *Medical Journal of Australia*, Vol. 153 No. 7, pp. 373–376.

Denay, K. (2017). Stress Fractures. *Current Sports Medicine Reports*, Vol. 16 No. 1, pp.7-8.

El Ghoch, M., Soave, F, Calugi, S. & Grave, R. G. (2013). Eating disorders, physical fitness and sports performance: a systematic review. *Nutrients*, Vol. 5 No. 12, pp. 5140–5160.

Filaire, E., Rouveix, M., Christelle, P. & Ferrand, C. (2007). Eating Attitudes, Perfectionism and Body-esteem of Elite Male Judoists and Cyclists. *Journal of Sports Science and Medicine*, Vol. 6 No. 1, pp. 50–57.

Gabbett, T.J., Whyte, D.G., Hartwig, T.B., Wescombe, H. & Naughton, G.A. (2014). The relationship between workloads, physical performance, injury and illness in adolescent male football players. *Sports Medicine*, Vol. 44 No. 7, pp. 989–1003.

Garner, D.M., Olmsted, M.P., Bohr, Y, & Garfinkel, P.E. (1982). The eating attitudes test: Psychometric features and clinical correlates. *Psychological Medicine*, Vol. 12 No. 4, pp. 871-878.

Jia-Sheng, Ng. & Kok-Yong, Chin. (2021). Potential mechanisms linking psychological stress to bone health. *International Journal of Medical Sciences*, Vol. 18 No. 3, pp. 604-614.

Karrer, Y., Halioua, R., Mötteli, S., Iff, S., Seifritz, E., Jäger, M. & Claussen, MC. (2020). Disordered eating and eating disorders in male elite athletes: a scoping review. *British Medical Journal Open Sports Exercise Medicine*, Vol. 6 No. 1, pp. e000801.

Marques, I.L., Menezes, V.O., Silva, R.G., Lourenço, M.R.A., Gomes, J.H. & Mendes R.R. (2021). Risk behaviors for relative energy deficiency in sport in young high-performance Brazilian rhythmic gymnasts, *Revista Brasileira de Fisiologia do Exercício*, Vol. 20 No. 6, pp. 618-32.

Meyer, C., Taranis, L., Goodwin, H. & Heycraft, E. (2011). Compulsive exercise and eating disorders. *European Eating Disorder Review*, Vol.19 No. 3, pp. 174–189.

Misra, M. & Klibanski, A. (2014). Anorexia nervosa and bone. *Journal of Endocrinology*, Vol. 221 No. 3, pp.

R163–176.

Moran, D. S., Heled, Y., Arbel, Y., Israeli, E., Finestone, A.S., Evans, R. K. & Yanovich, R. (2012). Dietary intake and stress fractures among elite male combat recruits. *International Society of Sports Nutrition*, Vol. 9 No. 1, doi: 10.1186/1550-2783-9-6.

Nattiv, A., Puffer, J. & Casper, J. (2000). Stress fracture risk factors, incidence, and distribution: a 3-year prospective study in collegiate runners. *Medicine and Science in Sports and Exercise*, Vol. 32, Suppl. 5, pp. S347.

Pedersen, A.B., Baggesen, L.M., Ehrenstein, V., Pedersen, L., Lasgaard, M. & Mikkelsen, E.M. (2016). Perceived stress and risk of any osteoporotic fracture. *Osteoporosis International*, Vol. 16 No. 27, pp. 2035-2045.

Pegrum, J., Crisp, T. & Padhiar, N. (2012). Diagnosis and management of bone stress injuries of the lower limb in athletes. *British Medical Journal*, Vol. 344: e2511.

Rizzone, K.H., Ackerman, K.E., Roos, K.G., Dompier, T.P. & Kerr, Z.Y. (2017). The Epidemiology of Stress Fractures in Collegiate Student-Athletes, 2004-2005 Through 2013-2014 Academic Years. *Journal of Athletic Training*, Vol. 52 No. 10, pp. 966-975.

Sharma J. (2013). The development and evaluation of a management plan for musculoskeletal injuries in British Army recruits. A series of exploratory trials on medial tibia stress syndrome. Ph.D. Thesis, Teesside University.

Sharma, J. & Heagerty, R. (2017). Stress Fracture: A Review of the Pathophysiology, Epidemiology and Management Options. *Journal of Fractures and Sprains*, Vol.1 No. 1, pp. 1006-1015.

Tiernan, C., Comyns, T., Lyons, M., Nevill, A. & Warrington, G. (2020). The Association Between Training Load Indices and Injuries in Elite Soccer Players. *Journal of Strength and Conditioning Research*, doi: 10.1519/JSC.0000000000003914.

Verstappen, S., van Rijn, S.V., Cost, R. & Stubbe, J.H. (2021). The Association Between Training Load and Injury Risk in Elite Youth Soccer Players: A Systematic Review and Best Evidence Synthesis. *Sports Medicine – Open*, Vol. 7 No. 6, https://doi.org/10.1186/s40798-020-00296-1.

Corresponding author:
Prof. Diana Dimitrova, MD, PhD
Department of Sports Medicine,
National Sports Academy "Vassil Levski"
Sofia, Bulgaria
e-mail: diana.dimitrova@nsa.bg

 DOI: 10.37393/ICASS2022/80 45 - 50

OXYGEN SATURATION AND HEART RATE VARIABILITY DURING ORIENTEERING RACES

Todor Pedev, Ljubomir Mladenov, Anton Gochkov, Silvia Shandurkova
National Sports Academy „Vassil Levski", Sofia, Bulgaria

ABSTRACT
Orienteering is a hard, physically demanding sport. The combination of running and map reading tests competitors' mental and physical endurance. The high speed during races requires an intense oxygen uptake.
This paper discusses oxygen deficiency during orienteering races. Competitors' oxygen saturation and heart rate values were monitored by smart watches and pulse oximeters. A group of eight male elite orienteers were tested from March 2021 to October 2021 through laboratory and terrain tests.
The laboratory spiroergometry was carried out on a treadmill. Spiroergometric parameters and gas analysis results were recorded in real time (breath-by-breath) with a Meta Max 3B metabolic analyzer. The terrain tests - pulmometry and measurement of oxygen levels in the blood (SpO2) were taken by Huawei GT Pro 2 watches. Indicators of movement, speed per kilometer, average and maximum heart rate values were collected. Field studies to monitor oxygen levels in the blood (SpO2) were conducted during orienteering competitions for the first time in Bulgaria. Descriptive statistics, hypothesis testing, and correlation analysis were used for data analysis.
The research results revealed that the orienteers do not suffer oxygen deficiency during orienteering races, which led us to the conclusion that the level of oxygen in the blood (SpO2) does not influence technical errors during the competitions. Statistically significant differences in the average heart rate values of the subjects for forest versus sprint disciplines were observed, which implies specialization of the competitors by discipline. Further studies should be done for interpreting and comparing the terrain tests data with the laboratory functional tests by taking into account the individual characteristics of each competitor.

Keywords: *orienteering races, oxygen saturation, heart rate variability*

INTRODUCTION

Over the ages, athletes have primarily relied on their physical fitness and willingness to win. The technological achievements in the field of sports and the implementation of the scientific approach of the recent years led to constantly improving of the sports results. The use of GPS devices and software products for analysis of physical, technical and tactical training in orienteering played a vital role both during the training process and the competition (Shandurkova et al, 2008).

According to the International orienteering federation (IOF), orienteering is a sport in which the competitors navigate independently through the terrain. Competitors must visit a number of control points marked on the ground in the shortest possible time aided only by a map and a compass. The course, defined by the location of the controls, is not revealed to competitors until they start. (IOF 2021).

The sports researchers define orienteering as "work around the anaerobic threshold with exceptional requirements in terms of aerobic capacity" (Garkov, Dasheva, 2003).

The ability to run for a long time at high speed without an intensive increase in the lactate content in the blood is one of the main criteria for efficiency in middle and long-distance running (Bonov, 1989). The aerobic energy supply consists of 59-63% of the total energy exchange in endurance sports (Pedev, 2011). The dosage of the training load and the improvement of the aerobic capacity of the body during the orienteering training process are of exceptional importance (Georgiev, 2004, Garkov, 2001).

The oxygen supply has a vital role for the human body. An important indicator of the movement of oxygen in the body is the oxygen saturation. Oxygen saturation measures the percentage of oxyhemoglobin in the blood and shows whether enough oxygen is being supplied to the body, especially to the lungs (Dutta, 2021). Determining blood oxygen saturation with a pulse oximeter is the most accessible method. It does not break the integrity of the

skin and doesn't need to take blood for analysis. Normal SpO2 (arterial blood oxygen saturation) values in humans are between 95% and 99%. Venous blood contains less oxygen and therefore its saturation is about 75%. A saturation below 90% is considered to be an emergency state (Hafen, Sharma, 2021).

The aim of the study is to analyze the conditions of oxygen deficiency by monitoring the oxygen saturation and pulse rate values using smart watches and oximeters during orienteering races. The tasks of the research were:

1. To study the literature sources on the problem
2. To measure the values of the oxygen saturation and heart rate values during field tests.
3. To investigate the relationship between anaerobic threshold (AnT) and the average heart rate values in laboratory and field conditions.
4. To formulate specific conclusions and recommendations for practice.

METHODS

The research methods were laboratory and field tests for assessing the oxygen saturation and heart rate values during orienteering races.

1. Laboratory tests - the laboratory spiroergometry was carried out on a treadmill with the standard methodology of the "Sport and Health" center in Sofia. The tests took place on a treadmill (H/P Cosmos, Germany), according to the protocol of Prof. Dr. Ilcho Iliev (1974) with duration of the step 1'30", initial speed 6 km/h, acceleration of the treadmill at each step by 1.2 km/ h and a constant slope of 2.5°. Spiroergometric parameters and gas analysis results were recorded in real time (breath-by-breath) with a Meta Max 3B metabolic analyzer.
2. Terrain tests - pulmometry and measurement of oxygen levels in the blood (SpO2) were taken by Huawei GT Pro 2 watches. Indicators of movement, speed per kilometer, average and maximum heart rate values were collected during races of the national orienteering championships. It is the first time in Bulgaria that a field research was held to measure the level of oxygen in the blood (SpO2) during orienteering competitions. The tests took place in areas with different altitudes, from 400m to 1150m above sea level.
3. Statistical methods and analysis - descriptive statistics, normality tests, hypothesis testing with T-Wilcoxon tests and correlation analysis were used for data analysis.

The research was conducted from March 2021 to October 2021. The contingent of the study were 8 men, aged 20-50, with 8 years competitive experience, at least, five of them students from the National Sports Academy in Sofia. An informed consent statement for permission to include in the field tests was signed by the competitors.

RESULTS

The results of the spiroergometric tests are displayed in Table 1. The running time varies between 13 and 18.30 minutes, the range of VO_2 is 1537 ml/kg/min, with maximum of 5253ml. The heart rate values vary between 163 and 204 bpm, with an average of 189bpm. The variability coefficients varied between 5 and 18%, which indicates small and medium variations in the groups.

Table 1. *Spiroergometry of the laboratory tests*

No	Name	Time min:s	VO_2 max				HRmax	% of move	HR at RER=1	% от HRmax at RER=1	O_2HR max ml	VE max l/min	VTex max I	BF max min^{-1}
			ml/min	ml/kg/min	% of move	% max at RER=1								
1	P. B.	18:30	4697	70	145	91.0	204	102.5	195	95.5	23	173.9	2.66	**65**
2	B. I.	17:30	4029	64	138	99.4	192	96.4	191	99.4	21	126.9	2.77	46
3	M.A.	16:30	3716	60	133	100	183	91.5	183	100	20	132.1	2.28	59
4	M.R.	15:30	4215	65	144	99.2	196	97.5	196	100	22	151.5	2.34	68
5	S.Y.	18:30	5253	69	156	72.2	194	98.4	184	94.8	23	183.1	2.82	65
6	D. J.	17:00	4303	67	146	94.2	185	94.8	180	92.3	23	144	2.29	63
7	B. S.	16:00	5238	68	152	93.5	195	100	189	96.9	27	187	3.10	60
8	T. P.	13:00	4112	60	150	91.2	163	96.4	161	95.2	25	**117.8**	2.12	56

The terrain tests, which used Huawei GT Pro 2 watches, led to the conclusion that it is possible to measure the blood oxygen level (SpO2) only at rest. After the first field test, oxygen saturation values were not established, and a Wrist pulse oximeter was used in the subsequent measurements. The oxygen saturation levels, determined during an orienteering competitions, remain within the norm, regardless of the type of discipline, terrain, vegetation, altitude, and running speed. The level of oxygen in the blood (SpO2) during the national championships in the long distance are displayed in Figure 1.

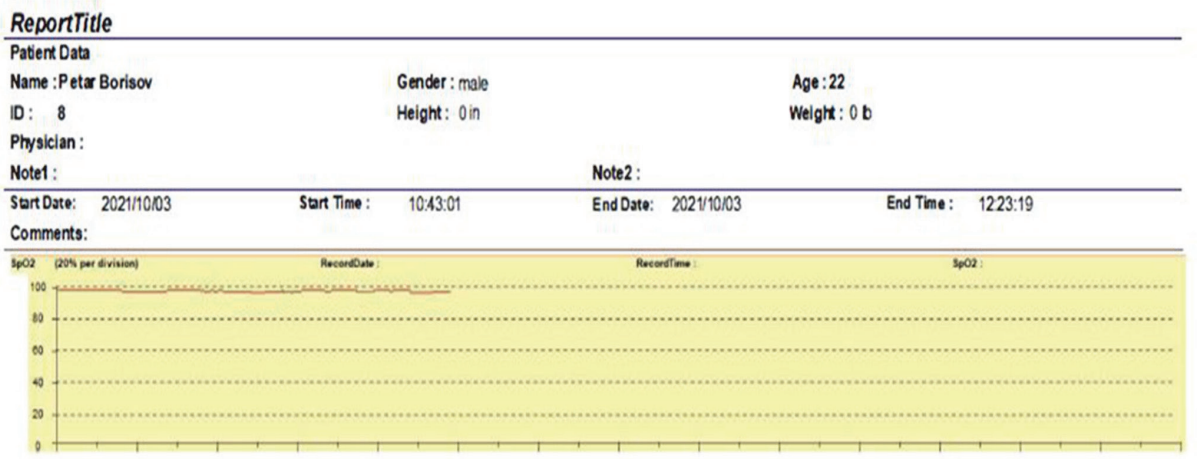


Figure 1. *Blood oxygen level (SpO2) chart during long-distance competition*

Orienteers does not suffer oxygen deficiency during orienteering races, which led us to the conclusion that the level of oxygen in the blood (SpO2) is not the reason that may cause technical mistakes (Figure 2).

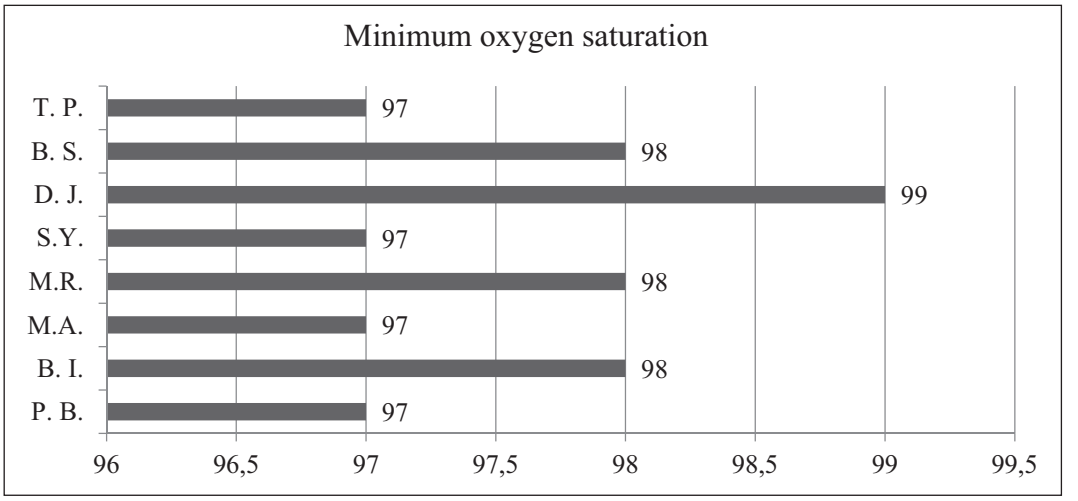


Figure 2. *Minimum oxygen saturation levels during orienteering races*

The descriptive statistics analysis displayed the average values, the minimum and maximum values, the range, the standard deviation, the coefficients of variation and the coefficients of normality – asymmetry and skewness for the results of heart rate measurements during competition in each of the disciplines in the orienteering and in laboratory tests (Table 2). The Shapiro-Wilk test for normality of the distribution was applied and non-parametric tests were used for hypothesis testing, where the distribution of values differs from normal. The variability coefficients varied between 4 and 6%, which indicates small variations in values of the different disciplines.

Table 2. *Descriptive statistics of the laboratory and terrain tests*

discipline	N	Xmin	Xmax	R	Mean	STD	V%	As	Ex
laboratory	8	161	196	35	184.8	11.21	6.06	-1.492	2.778
long	8	143	166	23	159.3	7.09	4.45	-2.064*	4.947 *
middle	8	150	181	31	171.5	9.84	5.74	-1.676*	3.425 *
sprint	8	156	191	35	179.4	10.89	6.07	-1.518*	3.06 *

**Indicates that distribution differs from normality and non-parametric tests and coefficients were used*

The Laboratory test values are between 161 and 196 bpm, with an average of 184.8 bpm. The variation is small (V=6.06%), and the distribution is normal. The heart rate for the long distance varies from 143 to 166 bpm. (Figure 3), the average value is 159.3 bpm. The sample is homogeneous (V=4.45%), and the distribution of values differs from normal.

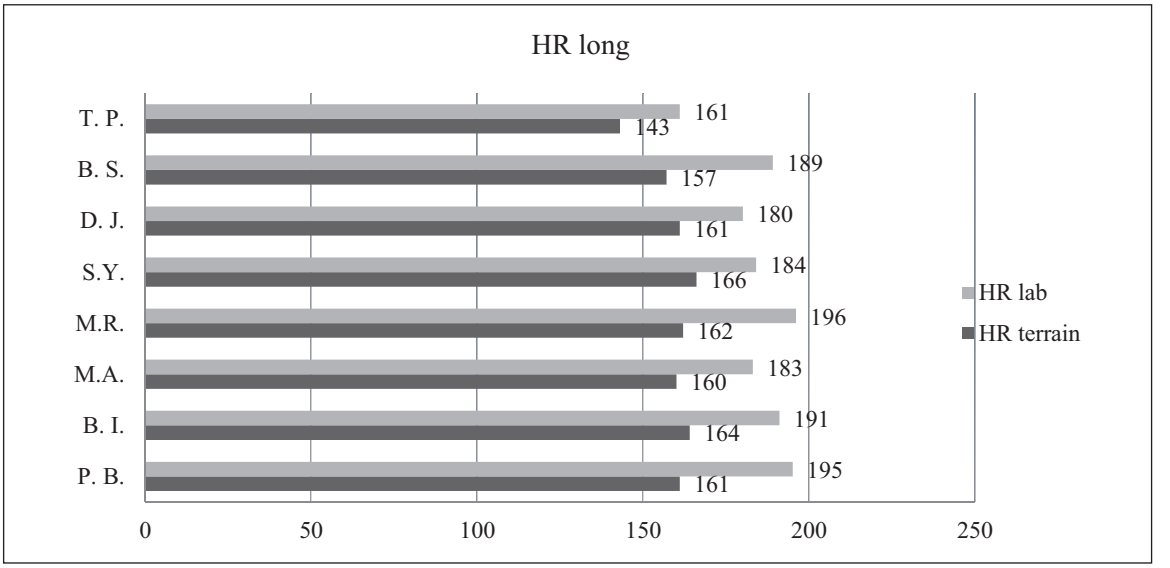


Figure 3. *Heart rate values of laboratory test and long distance terrain test*

The range of the values in the middle distance is from 150 bpm to 181 bpm. (Figure 4). The average value is 171.5 bpm. The group is homogeneous, the variation is small (V=5.74%). Skewness and kurtosis values are higher than critical and the distribution shape is not normal.

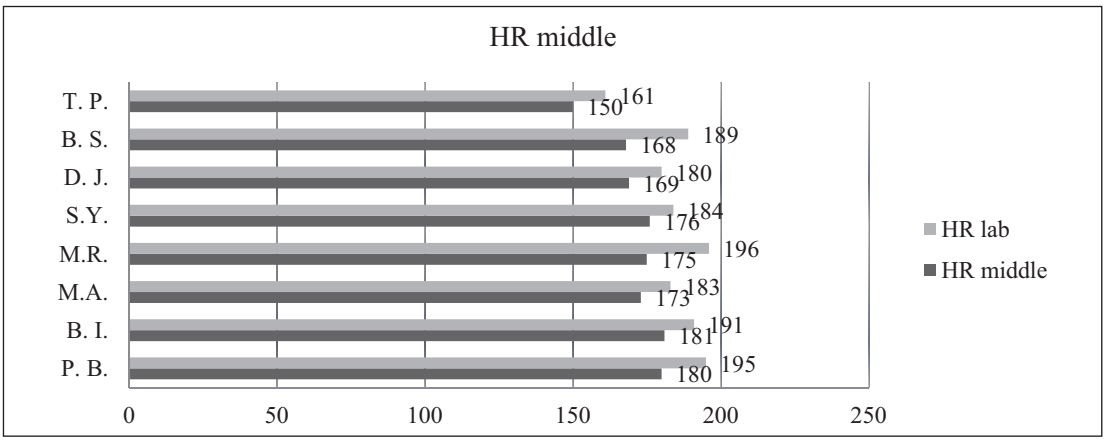


Figure 4. *Heart rate values of laboratory test and middle distance terrain test*

In the sprint distance, the values vary between 156 bpm and 191 bpm (Figure 5). The variation is also small (V=6.07%).

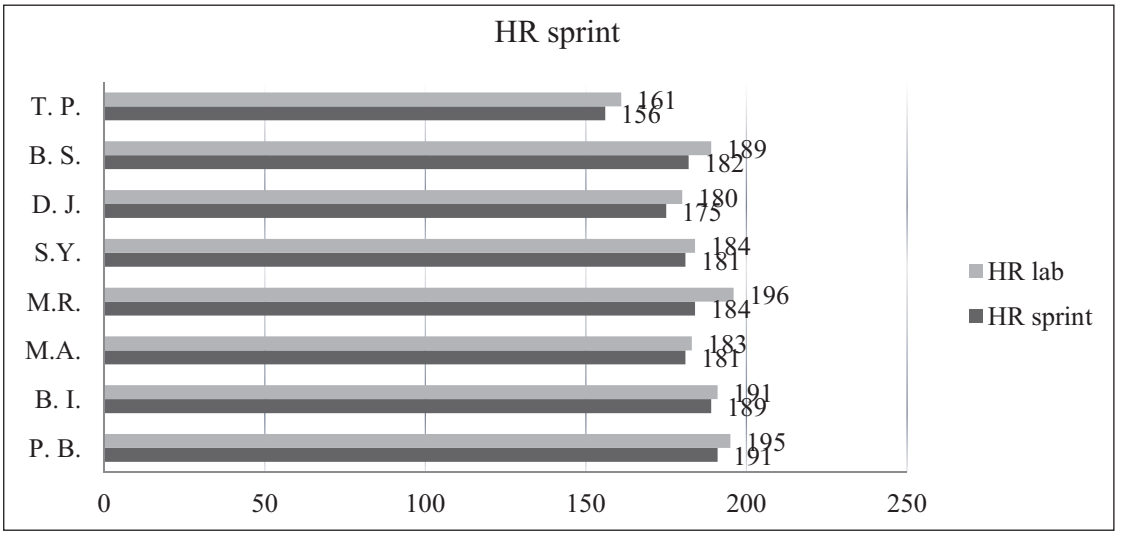


Figure 5. *Heart rate values of laboratory test and sprint distance terrain test*

The hypothesis testing for statistical significance of the means were made with the Wilcoxon T-test. The comparisons of the average values in the laboratory test (184.8bpm) and in the long-distance (159.3 bpm), revealed a difference of 25.5bpm, which was statistically significant ($p < .05$). The results of the competitors in the two tests differ (Table 3).

Table 3. *Statistical differences in HR values – laboratory test and long distance terrain test*

n	Me1 Lab test	Mean1	Me2 Long test	Mean2	d	Z(T)	p
8	186.50	184.88	161.00	159.3	25.50	2.521	.012

Me-median; d-difference in the two studies; z(t) – Wilcoxon T test; Sign. diff. (p < .05)

The difference between the average values - 184.8 bpm in the laboratory test and the average HR value in the terrain test in the middle distance - 171.5bpm is also statistically significant – Table 4 (p =.012).

Table 4. *Statistical differences in HR values – laboratory test and middle distance terrain test*

n	Me1 Lab test	Mean1	Me2 Middle test	Mean2	d	Z(T)	p
8	186.50	184.88	174.00	171.5	25.50	2.521	.012

Me-median; d-difference in the two studies; z(t) – Wilcoxon T test ; Sign. diff. (p < .05)

Comparing the average values from the laboratory test (184.8 beats/min) and the sprint distance (179.4 beats/min), a difference of 5 beats/min is observed, which is also statistically significant (p <.05) - Table 5.

Table 5. *Statistical differences in HR values – laboratory test and sprint distance terrain test*

n	Me1 Lab test	Mean1	Me2 Sprint test	Mean2	d	Z(T)	p
8	186.50	184.88	181.50	179.4	5.0	2.521	.012

Me-median; d-difference in the two studies; z(t) – Wilcoxon T test ; Sign. diff. (p < .05)

Correlation analysis and Spearman's Rho coefficient were used to analyze the strength of association between the tests (Table 6). A very strong and statistically significant correlation between the laboratory results and the sprint distance was found (r = .929). Statistically significant correlation (r = .814) was present between long- and middle-distance results and a weaker but significant correlation between sprint and middle-distance results. The correlation coefficients between laboratory tests and sprint and laboratory tests and long distance were not statistically significant. Without statistical significance is the correlation coefficient between sprint and long distances.

Table 6. *Correlations between tests*

Correlations	Laboratory	long	middle	sprint
laboratory	1			
long	.491	1		
middle	.667	.814**	1	
sprint	.929**	.479	.786*	1

***. Correlation is significant at .01 level, * Correlation is significant at .05 level*

DISCUSSION

The levels of oxygen saturation during orienteering races does not influence the sports results, regardless of the discipline.

The heart rate values are close to the AnT or exceed it in certain periods. There are statistically significant differences in the average heart rate values for the different disciplines in orienteering and the laboratory tests, which implies a specialization in forest or sprint disciplines.

Physiological measurements must be interpreted after comparison with the data from the laboratory and terrain tests, taking into the account the individual characteristics of the competitors. The use of smart watches is beneficial for training modeling in orienteering.

REFERENCES

Bonov, P. (1989). *Kriterii za natovarvane pri trenirovkata v byagane na sredni razstoyaniy,*. VFK, Sofia

Dutta, S. (2021). *Oxygen saturation*, available at https://www.news-medical.net/health/What-is-Oxygen-Saturation, (accessed 9 June 2022).

Garkov, V., Dasheva, D. (2003). Opredelyane na natovarvaneto v sastezaniya po ski-orientirane chrez registratsiya na pulsovata chestota. *Sbornik dokladi - Nauchna konferentsiya*, Sofia

Garkov, V. (2001). *Usvarshenstvane begovata podgotovka na sastezateli po orientirane*, Diss., Sofia

Georgiev, M. (2004). *Funktsionalni sastoyaniya*, NSA PRES, Sofia

Hafen, B, Sharma,S. (2021) available at https://www.ncbi.nlm.nih.gov/books/NBK525974/, (accessed 19 July 2022)

IOF, (2021). Competition rules for International Orienteering Federation Foot Orienteering Events, IOF, p.3, available at https://onedrive.live.com/embed?resid=663580750D0C0BCE%2146285&authkey=!AJuccVZHkUEJh7Q&em=2&wdHideHeaders=True&wdDownloadButton=False (accessed 13 August 2022)

Pedev, T. (2011). *Metodika za opredelyane na pragovite pulsovi chestoti v sportnoto orientirane chrez modifitsirani terenni i laboratorni testove*, Diss. Sofia

Shandurkova, S., Galov, M., Iliev, L. (2008). Optimizirane na trenirovachnia protses po orientirane s GPS navigatsia. *Sport i Nauka- Sport and science* (Izv.br 2) pp.82-85

Corresponding author:
Todor Pedev, PhD
"Tourism, alpinism and orienteering" Department
National Sports Academy "Vassil Levski"
Sofia, Bulgaria
E-mail: todor_pedev@nsa.bg

OXYGEN CONSUMPTION IN SHORT-, MIDDLE- AND LONG-DISTANCE YOUNG SWIMMERS

Rumen Iossifov & Mihail Kachaunov
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
The aim of the study was to compare the maximal oxygen consumption of highly trained adolescent swimmers competing in short, middle and long distances, taking into account their skeletal muscle mass and body fat mass. These data may be useful for better assessing the aerobic capacity of young swimmers and better planning their training loads.
A total of 92 swimmers (31 girls and 61 boys) aged 15–17 years who were part of the Bulgarian Youth National Swimming Team were included in the study. The participants were divided into groups according to the distance of their main event: short (50 and 100 m), middle (200 and 400 m), and long (800 and 1500 m) distances. Height, weight, muscle mass, and body fat mass of swimmers were measured to assess their physical development and body composition. Maximal aerobic test was performed on a cycle ergometer.
There was only one statistically significant difference between female groups – in maximal oxygen consumption per body weight between short- and middle-distance female swimmers. There was a difference in muscle mass in percentages between short- and long-distance male swimmers. Differences between the means of three variables from the maximal aerobic capacity test were revealed: between maximal workload per body weight of short-distance swimmers and middle-distance swimmers; between maximal oxygen consumption per body weight of short-distance swimmers and middle- and long-distance swimmers; and between maximal oxygen consumption per muscle mass of short-distance swimmers and middle- and long-distance swimmers.
In summary, short-distance swimmers had lower maximal oxygen consumption than middle- and long-distance swimmers. The results suggest that maximal oxygen consumption per muscle mass can be used to assess the aerobic capacity of swimmers. The differences in this variable were more pronounced compared to the differences in maximal oxygen consumption per body weight, and in boys, they were even more statistically significant.

Keywords: *swimming, aerobic capacity, muscle mass*

INTRODUCTION

Achievements in swimming depend to a large extent on the power of the energy supply systems to ensure the work of the muscles. While at short distances anaerobic systems dominate, at middle and long distances the importance of the aerobic system for energy supply increases. This determines the specificity of planning the preparation of swimmers competing at different distances.

Physical activity provides the greatest demand for energy transfer. In sprint running and swimming energy output from the active muscles exceeds their resting value by 120 times or more. During less intense but sustained marathon running, whole-body energy requirement increases 20 times or more above resting levels (McArdle et al., 2015). Energy is stored in human body in combination with the following chemical compounds: adenosine triphosphate (ATP), creatine phosphate (CP), carbohydrates, fats, and proteins. ATP is the only source of energy that our bodies can use for muscular contraction. All the other energy-containing chemicals are used to recycle ATP after its energy has been used for muscular work (Maglischo, 2003).

ATP is recycled through three different biochemical systems that can be found under different names in the literature. Two of these systems do not require oxygen and are considered anaerobic: the ATP-CP system (phosphagen system or alactic anaerobic system) and the anaerobic glycolytic system (anaerobic glycolysis, lactic acid energy system or anaerobic metabolism). The third one has been called the aerobic energy system or aerobic metabolism (Kenney et al, 2012; Kraemer et al., 2016; Maglischo, 2003; McArdle et al., 2015).

Each of these systems recycles ATP at different rates of speed. The ATP-CP system is the fastest one of the three and provides immediate energy for intense physical activity of short duration. The

maximum rate of energy transfer from the high-energy phosphates exceeds by four to eight times the maximal energy transfer from aerobic metabolism. Muscle fibers can contract at a maximum rate of speed for only 4 to 6 s because the CP supply in muscles declines rapidly in the beginning after starting high-intensity work. It becomes fully depleted within 20 to 30 s of all-out exercise.

Glycolysis is a series of enzymatic reactions that metabolize glucose which can be obtained from either blood glucose or intramuscular stores of glycogen. The process has two phases. The first phase is anaerobic and releases energy and phosphate rapidly when not enough oxygen is available. As a result, lactic acid is formed. The rate of ATP recycling by anaerobic glycolytic system is approximately half the rate of the phosphagen system.

Approximately 5 s after the start of swimming race and for the duration of the event, muscle glycogen becomes the principal source of energy. When lactic acid accumulates in muscles, they develop a condition known as acidosis which is believed to be the principal cause of fatigue in all events longer than 20 to 30 seconds. Rapid and significant accumulation of lactate in the blood occurs during movements with a maximum effort between 60 and 180 seconds, involving large muscle mass. Decreasing intensity to extend the movement period correspondingly decreases the rate of lactate accumulation and the final blood lactate level.

The aerobic phase of glycolysis is much more efficient than the anaerobic phase and does not produce any end products that cause fatigue, but ATP is recycled at a slower rate. Fats and proteins are also metabolized aerobically, with proteins being used as a minor energy source in the event of severe energy depletion or starvation. Aerobic metabolism provides the majority of needed ATP to perform long-duration, low-intensity physical activity.

The relative contribution of the body's energy transfer systems differs markedly depending on intensity and duration of physical activity and the participant's current fitness status. Swimming events are usually called aerobic or anaerobic, but all three phases of the metabolic process operate from the first moment of exercise. The difference is in the contribution of each phase to the different distances. Experts try to make estimates using different methods for the percentage of ATP obtained from anaerobic and aerobic sources for physical activity of different lengths, as well as for specific activities (Izov, 2017; Kraemer et al., 2016).

Anaerobic metabolism is the major contributor for short race distances in swimming. Aerobic metabolism delivers up to 20–25% of the energy for 50 m and up to 35–44% for 100 m. Its role becomes more important for middle-distance races – 53–58% for 200 m and 65–73% for 400 m, with a significant contribution of anaerobic glycolysis. Aerobic metabolism is the chief source of energy for long-distance races. Its share is 75–80% for 800 m and 85–86% for 1500 m (Maglischo, 2003; Ribeiro et al., 2015; Rodrigues, Mader, 2010; Wilke, Madsen, 2015).

Knowledge of the metabolic requirements of the different swimming events and strokes may help the coach to develop training plans to enhance the underlying metabolic capacities. 100-m events require the complete and rapid activation of both the glycolytic and aerobic energy systems since the decreasing glycolytic energy supply is compensated in part by increasing oxidative ATP production during the last two-thirds of the race. Middle-distance events require very high maximal oxygen consumption ($\dot{V}O_{2max}$) values, as well as moderate to high glycolytic power. Long-distance events are characterized by a predominance of the aerobic energy delivery processes (Rodrigues, Mader, 2010). According to E. Maglischo, aerobic metabolism plays a minor role in delaying acidosis during the shorter events, but its contribution becomes more important, although still minor, at the 200 distance (Maglischo, 2003). However, J. Olbrecht believes that sprinters must possess a strong aerobic capacity for better competition results (except perhaps for a 50 m sprint). Furthermore, a good level of aerobic capacity speeds up the regeneration process between intensive workouts and between starts in competition (Olbrecht, 2013).

Oxygen consumption can be expressed either as an absolute rate in liters of oxygen per minute (L/min) or as a relative rate in milliliters of oxygen per kilogram of body mass per minute (mL/kg/min) (Kraemer et al., 2016). The latter expression is often used to compare the performance of endurance sports athletes with different body size. Some reports showed that relative oxygen consumption

is associated with body fat mass and with fat-free body mass (Durkalec-Michalski et al, 2019; Vargas et al, 2018) and also that maximum oxygen uptake calculated per lean body mass or per skeletal muscle mass can be useful as a tool for more accurate differentiation between groups with different training specialization and status (Trinschek et al, 2020). Achieving high personal result in swimming requires a good multi-year training plan. Methods of training over the years depend on the physiological characteristics during the various stages of human growth and development, sex, and main swimming distance that swimmers compete in. Emphasis on different motor skills during the sensitive periods for their development is a necessary condition for achieving maximum results in the optimal period for this - the stage „maximum realization of individual potential" (Angelov, 2021). It is essential when working with adolescent swimmers to control their ability to adapt to aerobic exercise, as well as their muscle mass and body fat (Kamenov, Stoyanova, 2021). The main aim of the study was to compare the maximal oxygen consumption of highly trained adolescent swimmers competing in short, middle and long distances, taking into account their skeletal muscle mass and body fat mass. These data may be useful for better assessing the aerobic capacity of young swimmers and better planning their training loads.

METHODS

Participants

A total of 92 swimmers (31 girls and 61 boys) aged 15–17 years took part in the study. Their age was determined by the year of birth. All participants were part of the Bulgarian Youth National Swimming Team. The best personal times of the boys equaled between 663 and 910 FINA points, and those of the girls between 567 and 810 FINA points. The participants were divided into groups not only by gender but also according to the distance of their main event: short (50 and 100 m), middle (200 and 400 m), and long (800 and 1500 m) distances. Thus, six groups were formed as follows: girls – short-distance (n = 14), girls – middle-distance (n = 14), girls – long-distance (n = 3), boys – short-distance (n = 28), boys – middle-distance (n = 22), and boys – long-distance (n = 11).

Procedures

The study was conducted over a period of 4 years between 2016 and 2020. The tests were conducted at the end of the general preparation periods of the training seasons. Only the cases with the highest oxygen consumption were included when the swimmers passed more than one test over those years. The measurements were performed in the sports laboratory at the National Center for Sports Medicine in Sofia, Bulgaria according to approved standard protocols and in accordance with the ethical standards established in the Declaration of Helsinki for Human Research.

Anthropometric data

The following indicators were used to assess physical development and body composition of swimmers: height, weight, muscle mass and body fat mass. The height (cm) was determined in the morning in an upright position with an anthropometer to the nearest 0.5 cm. Body weight (kg) was measured with medical scale to the nearest 50 g. Body fat (BF) was measured by the skin fold method – 10 skin folds were measured in different parts of the body with a caliper. Muscle mass (MM) was calculated based on body fat and the circumference of the arm, thigh and lower leg. BF and MM are presented in absolute values (kg) and in percentages by weight (%). The calculations were made according to a methodology approved by the sports laboratory.

Maximal aerobic capacity test

Maximal aerobic test was performed on cycle ergometer according to standard method. The initial workload is 60 w and increases by 30 W every 90 seconds. The test is terminated when the subject is unable to continue his work. The following variables were measured by the test: Total time (Tt in min) is the time for which the test continued; Maximal workload (Wmax) – the highest workload that is reached in the maximal aerobic test to failure – in watts (W) and relative to body weight (Wmax/BW in W/kg); Maximal oxygen consumption ($\dot{V}O_{2max}$) – absolute value [mL/min] and relative to body weight ($\dot{V}O_{2max}$/BW in mL/kg/min); Maximum heart rate (HRmax in bpm) – the highest heart rate reached during the test. In addition, the maximal oxygen consumption relative to the muscle mass ($\dot{V}O_{2max}$/MM in mL/kg/min) was calculated.

Statistical analysis

Statistical analysis was conducted using Statistical Package for Social Sciences (SPSS) version 26, IBM, USA. The lowest (Min), highest (Max) and average

(Mean) values were determined for each variable, as well as the standard deviation (SD). Distribution normality tests were performed using the Shapiro-Wilk test. Differences between the mean values of the studied variables with normal distribution were analyzed by one-way ANOVA for independent samples with the Bonferroni post hoc test. The Kruskal-Wallis H test was used for non-normal distributions.

RESULTS

The anthropometric characteristics and the results of the ergometry test of the three studied groups of female swimmers are presented in Table 1. Their height was between 157 and 180 cm, and their weight between 57 and 66.5 kg. BF in absolute values ranged between 3.4 and 13 kg, and in percentage terms between 6 and 20.9%. MM in absolute values was between 20.7 and 31.5 kg, and in percentage terms between 39.5 and 52.4%. The test lasted between 8 and 12.5 minutes, with the maximal workload reached at the end of the test being between 160 and 250 W in absolute values and between 2.94 and 4.18 W/kg in relative values. The maximal oxygen consumption of the girls was between 2050 and 3650 mL/min. In relative terms, their $\dot{V}O_{2max}$ was between 40.91 and 60 mL/kg/min. Maximal oxygen uptake relative to the muscle mass of the female swimmers was between 86.1 and 144.9 mL/kg/min. The maximum heart rate measured at the end of the test was between 163 and 208 bpm.

Table 1. *Descriptive statistics of anthropometric data and test results of female swimmers (n=31).*

Variables	Unit	Short-distance (n=14)				Middle-distance (n=14)				Long-distance (n=3)*			
		Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD
Age	yrs	15	17	15.64*	0.84	15	17.0	15.57*	0.85	15	16	15.30	0.58
Height	cm	161	175	168.6	4.37	157	177	166.8	5.73	159	180	169.7	10.5
Weight	kg	50.5	65.5	58.2	4.35	50.3	66.5	57.4	5.13	50	63.5	57.7	6.93
BF	%	6	20.9	13.7	4.15	10.2	17.9	14.3	2.20	14.9	18.2	16.6	2.33
BF	kg	3.4	13	7.97	2.61	5.1	11.9	8.28	1.84	7.4	11.6	9.03	2.25
MM	%	39.5	52.4	44.23	4.41	41	48.1	43.77	1.65	41.5	44.7	42.9	1.65
MM	kg	21.9	31.5	25.74	2.55	22	27.6	25.09	1.80	20.7	26.9	24.7	3.50
Tt (min)	min	8	12	10.3	1.25	9	12.5	10.6	1.10	10	11	10.5	0.50
W_{max}	W	160	240	205	24.96	180	250	211	22.05	200	220	210	10.0
W_{max}/BW	W/kg	2.94	4.18	3.52	0.34	3.19	4.14	3.69	0.30	3.31	4	3.67	0.35
$\dot{V}O_{2max}$	mL/min	2250	3300	2828	289	2050	3650	2943	394	2950	3050	3000	50
$\dot{V}O_{2max}$/BW	mL/kg/min	40.91	56.42	48.67	3.97	47.37	58.12	52.55	3.30	46.46	60	52.60	6.86
$\dot{V}O_{2max}$/MM	mL/kg/min	97.4	121.5	110.1	7.0	86.1	133.2	117.2	12.1	109.7	144.9	123.1	19.1
HR_{max}	bpm	172	200	188.1	7.25	163	208	193.0*	11.1	175	191	184.7	8.51

**non-normal distribution*

The results of the measurements of the three studied groups of male swimmers are presented in Table 2. The height of the boys was between 161 and 190 cm, and their weight was between 59.5 and 84 kg. Body fat in absolute values was between 3.9 and 11 kg, and in percentage terms between 6.1 and 14.2%. Muscle mass was between 22.8 and 42.7 kg and between 45 and 53.1%, respectively. The test lasted between 9.5 and 16.5 minutes, with the maximal workload reached at the end of the test being between 220 and 390 W in absolute values and between 3.3 and 4.9 W/kg in relative values. $\dot{V}O_{2max}$ of the boys was between 2700 and 5200 mL/min and between 51 and 68.2 mL/kg/min, respectively. Their maximal oxygen uptake relative to the muscle mass was between 89.4 and 142 mL/kg/min. The maximum heart rate measured at the end of the test was between 171 and 210 bpm.

Table 2. *Descriptive statistics of anthropometric data and test results of male swimmers (n=61).*

Variables	Unit	Short-distance (n=28)				Middle-distance (n=22)				Long-distance (n=11)			
		Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD
Age	yrs	15.0	17.0	16.29*	0.81	15.0	17.0	16.09*	0.81	15.0	17.0	16.18*	0.87
Height	cm	171.0	190.0	180.0	5.64	165.5	188.5	179.5	5.07	161.0	185.0	175.8	7.96
Weight	kg	60.5	82.5	71.1	5.40	59.5	80.0	71.1	5.58	61.0	84.0	69.8	7.48
BF	%	7.6	11.9	9.4	0.97	6.1	14.2	9.5	1.70	7.5	13.4	9.9	1.92
BF	kg	5.6	9.8	6.65*	0.88	3.9	9.4	6.72	1.38	4.6	11.0	6.94	1.72
MM	%	45.3	53.1	50.08	1.94	46.2	52.8	49.19	1.75	45.0	51.3	48.19	2.26
MM	kg	28.3	42.7	35.68	3.61	22.8	39.9	34.74	3.98	29.0	42.4	33.68	4.48
Tt	min	9.5	15.0	12.6	1.53	9.5	16.5	13.3	1.85	10.5	14.5	12.6	1.53
Wmax	W	220.0	390	285.5	36.7	220.0	360.0	297	37.0	240.0	320.0	283	30.7
Wmax/BW	W/kg	3.3	4.6	3.97	0.33	3.7	4.9	4.20	0.31	3.8	4.4	4.05	0.24
$\dot{V}O_{2max}$	mL/min	2700	5200	4114	548	3050	5200	4330	518	3750	4850	4300	408
$\dot{V}O_{2max}$/BW	mL/kg/min	51.0	66.8	58.32	4.61	54.5	68.2	61.23	3.14	57.7	65.9	61.70	2.59
$\dot{V}O_{2max}$/MM	mL/kg/min	89.4	133.9	115.4	11.5	107.4	139.4	124.8	7.86	114.4	142.0	128.5	9.75
HR_{max}	bpm	176.0	210.0	190.9	9.21	171.0	206.0	195.1*	8.40	182.0	201.0	192.6	7.22

**non-normal distribution*

The differences between the means of the three groups of swimmers are shown in Table 3. There was only one statistically significant difference between female groups – in $\dot{V}O_{2max}$/BW between short- and middle-distance female swimmers (48.67 and 52.55 mL/kg/min). There was a difference in MM in percentages between short- and long-distance male swimmers (50.08 and 48.19%). Differences between means of three variables from the maximal aerobic capacity test were revealed: between Wmax/BW of short-distance swimmers (3.52 W/kg) and middle-distance swimmers (3.69 W/kg); between $\dot{V}O_{2max}$/BW of short-distance swimmers (58.32 mL/kg/min) and middle- and long-distance swimmers (61.23 and 61.70 mL/kg/min); and between $\dot{V}O_{2max}$/MM of short-distance swimmers (115.4 mL/kg/min) and middle- and long-distance swimmers (124.81 and 128.5 mL/kg/min).

Table 3. *Comparison of the mean values of the studied parameters in short - (1), middle - (2) and long-distance (3) swimmers*

Variables	Girls						Boys					
	Mean			p-value			Mean			p-value		
	1	2	3	1-2	1-3	2-3	1	2	3	1-2	1-3	2-3
Age (yrs)	15.64	15.57	15.30	1.000	1.000	1.000	16.29	16.09	16.18	1.000	1.000	1.000
Height (cm)	168.6	166.8	169.7	1.000	1.000	1.000	180.0	179.5	175.8	1.000	.154	1.000
Weight (kg)	58.2	57.4	57.7	1.000	1.000	1.000	71.1	71.08	69.82	1.000	1.000	1.000
BF (%)	13.7	14.3	16.6	1.000	.765	1.000	9.35	9.49	9.87	1.000	.945	1.000
BF (kg)	7.97	8.28	9.03	1.000	1.000	1.000	6.65	6.72	6.94	1.000	1.000	1.000
MM (%)	44.23	43.77	42.9	1.000	1.000	1.000	50.08	49.19	48.19	.332	**.024**	.499
MM (kg)	25.74	25.09	24.7	1.000	1.000	1.000	35.68	34.74	33.68	1.000	.469	1.000
Tt (min)	10.25	10.57	10.5	1.000	1.000	1.000	12.6	13.34	12.63	.361	1.000	.760
Wmax (W)	205	211	210	1.000	1.000	1.000	285.5	296.8	282.7	.823	1.000	.876
Wmax/BW (W/kg)	3.52	3.69	3.67	.551	1.000	1.000	3.97	4.20	4.05	**.032**	1.000	.607
$\dot{V}O_{2max}$ (mL/min)	2828	2943	3000	1.000	1.000	1.000	4114	4330	4300	.445	.947	1.000
$\dot{V}O_{2max}$/BW (mL/kg/min)	48.67	52.55	52.6	**.046**	.399	1.000	58.32	61.23	61.70	**.030**	**.049**	1.000
$\dot{V}O_{2max}$/MM (mL/kg/min)	110.1	117.2	123.1	.275	.205	1.000	115.4	124.81	128.5	**.005**	**.002**	.994
HRmax (bpm)	188.1	193.0	184.7	.516	1.000	.510	190.9	195.1	192.6	.287	1.000	1.000

$p < .05$ – significant difference

DISCUSSION

The difference found in $\dot{V}O_{2max}$/BW of girls can be attributed to the expected greater need for oxygen for middle distances than for short distances. Distance swimmers and sprinters can be divided into several categories according to their innate propensity to perform better at certain race distances. Distance swimmers usually have greater aerobic capacity. One reason for this is that they have a higher percentage of slow-twitch muscle fibers (Maglischo, 2003). The lack of significant differences in $\dot{V}O_{2max}$/BW of long-distance female swimmers with the other two groups may be due to the small number of subjects (n = 3). This is probably also the reason for the lack of a statistically significant difference in the relative muscle mass between the two groups (44.23% for short-distance and 42.9% for long-distance female swimmers). The greater body fat mass of long-distance female swimmers (statistically non-significant difference) also affects their $\dot{V}O_{2max}$/BW. They had 16.6% BF, versus 14.3% and 13.7% for middle- and short-distance female swimmers.

We found a logically higher percentage of muscle mass in short-distance male swimmers than in long-distance ones. Sprinters tend to be more muscular than distance swimmers and have a greater potential to improve muscle size, strength, and power because they possess more fast-twitch muscle fibers (Maglischo, 2003). Short-distance swimmers had lower oxygen consumption per body weight and per muscle mass than middle-distance and long-distance swimmers, with differences in $\dot{V}O_{2max}$/MM being more pronounced and of greater statistical significance. This is in accordance with the results of study with runners (Trinschek et al, 2020). They did not find that maximal oxygen uptake per skeletal muscle mass was more useful than standard measures for tracking longitudinal changes (1-year training cycle of 34 weeks) in sprinters and endurance athletes, but they also did not find significant changes in in any measure of their aerobic capacity.

$\dot{V}O_{2max}$/BW and $\dot{V}O_{2max}$/MM of middle-distance swimmers were close to those of long-distance swimmers, suggesting that training to develop the aerobic capacity of this category of swimmers should not be neglected. On the other hand, only they reached a significantly higher relative power during the test than the short-distance swimmers, even though the mean value of this variable for the long-distance swimmers was similar. These results suggest that it is likely that anaerobic capacity also influences W_{max}/BW, in addition to aerobic capacity.

Unlike females, male swimmers in all three groups had closer fat mass values, despite the same tendency – swimmers of longer distances had more fat tissue. The lack of significant differences in absolute values of oxygen consumption between the different groups in boys and girls was probably due to the fact that the sprinters had a greater body weight than the long-distance swimmers, although the differences were not statistically significant.

CONCLUSION

In summary, short-distance swimmers had lower maximal oxygen consumption than middle- and long-distance swimmers. The results suggest that $\dot{V}O_{2max}$/MM can be used to assess the aerobic capacity of swimmers. The differences in this variable were more pronounced compared to the differences in $\dot{V}O_{2max}$/BW, and in boys they were even more statistically significant.

REFERENCES

Angelov, B. (2021). Prodalzhitelnost na etapa „maksimalna realizatsiya na individualnite vazmozhnosti" pri svetovniya pluven elit – mazhe, *Sport i nauka*, No 3, 4, pp. 34-42. // Ангелов, Б. (2021). Продължителност на етапа „максимална реализация на индивидуалните възможности" при световния плувен елит – мъже, *Спорт и наука,* кн. 3, 4, стр. 34-42.

Durkalec-Michalski, K., Nowaczyk, P., Podgórski, P., Kusy, K., Osiński, W., Jeszka, J. (2019). Relationship between body composition and the level of aerobic and anaerobic capacity in highly trained male rowers, *Journal of Sports Medicine and Physical Fitness,* Vol. 59 No 9, pp. 1526-1535.

Izov, N. (2017). *Trenirovachni natovarvaniya v sportnoto pluvane.* NSA PRES, Sofia. // Изов, Н. (2017). *Тренировъчни натоварвания в спортното плуване.* НСА ПРЕС, София.

Kamenov, L., Stoyanova, N. (2021). Izsledvane na nyakoi antropometrichni pokazateli i aerobnite vazmozhnosti pri sastezateli po pluvane v yunosheska vazrast, *Sport i nauka,* No 3, 4, pp. 23-33.// Каменов Л., Стоянова Н. (2021). Изследване на някои антропометрични показатели и аеробните възможности при състезатели по плуване в юношеска възраст, Спорт и наука, кн. 3, 4, стр. 23-33.

Kenney, W., Wilmore, J., Costill, D. (2012). Physiology of Sport and Exercise, Fifth Edition, Human Kinetics, Champaign, Illinois.

Kraemer, W., Fleck, S., Deschenes, M. (2016). Exercise physiology: Integrating theory and application, Second edition, Wolters Kluwer Health, Philadelphia.

Maglischo, E. (2003). Swimming fastest, Human Kinetics, Champaign, Illinois.

McArdle, W., Katch, F., Katch, V. (2015). Exercise physiology: Nutrition, Energy, and Human performance, Eighth edition, Wolters Kluwer Health, Philadelphia.

Olbrecht, J. (2013). The Science of Winning: Planning, Periodizing and Optimizing Swim Training, F&G Partners, Kindle Edition.

Ribeiro, J., Figueiredo, P., Sousa, A., Monteiro, J., Pelarigo, J., Vilas-Boas, J., Toussaint, H., Fernandes R. (2015). VO_2 kinetics and metabolic contributions during full and upper body extreme swimming intensity, Eur J Appl Physiol., Vol. 115 No 5, pp. 1117-1124.

Rodrigues, F., Mader, A. (2010). Energy systems in swimming. In: Seifert, L., Chollet, D., Mujika, I. (Eds), World Book of Swimming: From Science to Performance, Nova Science Publishers, Inc.

Trinschek, J., Zieliński, J., Kusy, K. (2020). Maximal oxygen uptake adjusted for skeletal muscle mass in competitive speed-power and endurance male athletes: changes in a one-year training cycle, International Journal of Environmental Research and Public Health, Vol. 24 No 4, DOI: 10.3390/ijerph17176226.

Vargas, V., de Lira, C., Vancini, R., Rayes, A., Andrade, M. (2018). Fat mass is negatively associated with the physiological ability of tissue to consume oxygen, Motriz, Journal of Physical Education, Rio Claro, Vol. 24 No 4, DOI: 10.1590/s1980-6574201800040010.

Wilke, K., Madsen, O. (2015). Wege zum topschwimmer. Band 2. Aufbau- und Anschlusstraining, Hofmann-Verlag, Schorndorf.

Corresponding author:
Rumen Iossifov, PhD
Department "Aquatic Sports"
National Sports Academy "Vassil Levski"
Sofia, Bulgaria
E-mail: rumennsa@yahoo.com

ASSOCIATION BETWEEN CHRONOTYPE, STRESS, AND GENDER IN BULGARIAN SPORTS STUDENTS

Mariya Zaharinova, Nikolay Zaekov, Krassimir Rankov & Milena Nikolova

National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT

Introduction: There are many internal and external factors (like chronotype, stress, gender, and level of activity) that may affect athletes performances. The aim of this study was to evaluate the association between chronotype, perceived stress, and gender in Bulgarian sports students.

Methodology: In total, 29 male and female university students were surveyed using the Horne and Ostberg Morningness and Eveningness questionnaire (1976) and the Perceived Stress Scale (1983). Results: Mann-Whitney U test showed an association between perceived stress scores and chronotype groups. Moderate evening type perceived more stress than intermediate type (p = 0,01). Also, students with high physical activity were more stressed than students with moderate physical activity (p = 0,06) and females were more stressed than males (p = 0,01). Students identified as moderate evening type (n = 7) were more than moderate morning type (n = 1) in the sample. Discussion: Surprisingly, most of the moderate evening-type subjects (n = 7) were females (n = 5). Usually, males tend to be moderate evening types. Of these 5 females, 2 were with a moderate level of activity, and 1 was with a high level. And they perceived more stress than males. Conclusions: Collectively, these results show that chronotype and gender can affect susceptibility to stress in sports students from different levels of activity. Also, training schedules should not be arranged without taking into account circadian preferences.

Keywords: *Chronotype, stress, athletes, students.*

INTRODUCTION

The circadian rhythm (oscillating processes, with an endogenous, genetically encoded period of approximately 24 h) governs our physiological and biochemical processes, and as a consequence diurnal variations in both cognitive (Kline, 2010) and physical performance exist (Chtourou, 2012). One factor that shows each individual unique is a complex phenotype, which represent the circadian rhythmicity in humans (Montaruli, 2021). It is known as chronotype or circadian typology (Adan, Archer, 2012) and describes individual differences for functioning at different times of the day and sleep-wake timing. Chronotypes are divided into three groups (assessed by questionnaires): morning (MT), intermediate (IT) and evening types (ET). Chronotypes differ in their circadian function either biological parameter (e.g., sleep-wake, body temperature, melatonin, and cortisol) or cognitive performance (e.g., attention, memory, and executive functions) (Alshana & Khan, 2022). The evening type has been related to a number health problems. These health issues are often connected with the conflict between the circadian clock (preferences for later bedtimes) and the social clock (morning activities imposed by society). The evening preferences also lead to sleep loss if an individual attempt to sleep accordingly to their biological clock but must to wake up early to fulfill morning social obligations (Wittmann et al., 2006). Morning chronotypes, on the contrary, tend to develop sleep debt during the weekend (Wittmann et al., 2006). Athletes who simultaneously hold the role of a student experience a lot of additional demands that may disturb their natural sleep-wake rhythm (Litwic-Kaminska & Kotysko, 2020). When the body runs on two different clocks the resulting mismatch is called social jetlag. It can be a chronic condition and a reason for high-stress levels (Watson, 2016). Chronotypes can influence both the severity of social jetlag and the susceptibility to stress. In addition, chronotype may vary by age and sex. In general, morningness dominates during the childhood, and sex differences are not apparent (Paine, 2006). At the onset of puberty shift towards eveningness begins and reaches its peak at around 18 – 21 years of age (Roenneberg et al., 2007). Puberty is also the time when sex differences appear, with men being more evening

orientated, which diminishes around menopause (Randler & Engelke, 2019). These findings have led us to think that academic athletes with evening chronotype perceive a higher level of stress than morning types, especially when they are females. The aim of this paper was to explore the relationship between chronotype, perceived stress, and gender in university athletes.

METHODOLOGY

Participants

The study was conducted in the laboratory of the Department of Physiology and Biochemistry at the National Sports Academy, Sofia, Bulgaria in accordance with the research ethical code of the University. Participants from different sports were screened for eligibility and informed consent was taken. The subjects included in this study were between 19 and 22 years old. A total of 44 university students were screened based on inclusion criteria. The inclusion criteria were: 19 - 25 years old, in good health (no drug use 2 months prior to the measurements), not taking working night shifts and submission of all tests.

Measures

The subjects were examined for the inclusion criteria and baseline data. Demographic and anthropometric data were collected (participants' height (centimeters) and body mass (kilograms). The participants who met the inclusion requirements completed the Morningness-Eveningness Questionnaire (MEQ) and the Perceived Stress Scale (PSS-10)(29 from 44 subjects). MEQ (Horn-Ostberg, 1976) comprises 19 items, with usually four or five answers that are scored from one to four or five points. The higher the score, the more intense the morningness (MT) preference. The total scores range from 16 (definite evening type) to 86 (definite morning type). The Morningness-Eveningness Questionnaire is a reliable instrument for chronotype assessment (Cronbach alpha, r = 0.7).

Perceived stress was assessed by the Perceived Stress Scale (PSS-10)(Cohen et al., 1983). It is a 10-item scale that evaluates the intensity of perceived stress during the previous month. The responses are given on a five-point Likert-type scale. The total scores range from 0 (no stress) to 40 points (extreme stress).

Procedure

Before the start of the activities, the participants of the study from all groups were familiarized with the aim of the research. Following ethical principles of academic research, each participant was assured that he or she could resign from further participation at any stage of the study and that the collected data would be used for scientific purposes only. The participants individually filled out a set of questionnaires, and each received detailed feedback on the results obtained.

Statistical analyses

All analysis was executed using SPSS for Windows, IBM® SPSS® Statistics V19 (Statistical Package for the Social Sciences). Data gathered in the study were normally distributed. The comparison between the student-athletes groups in accordance with the MEQ and PSS was conducted by employing the Kruskal-Wallis H test and Mann-Whitney U test. The statistical significance was set at $p \leq .05$. The effect size was measured with eta (η^2) test. Variables that were statistically significant ($p \leq .05$) were included in the results.

RESULTS

Participant characteristics – the general characteristics of the participants are presented in Table 1. The mean age of all the subjects was 20,31±1. The mean weight, the mean height and BMI (body mass index) were statistically significant (according to gender) and also BMI according to chronotype. The mean chronotype scores of all participants was 46,59, which indicates an intermediate chronotype for our sample. Surprisingly most of the individuals defined as evening type were females (5 from 7). The mean scores from PSS was 21,24 that shows moderate levels of stress.

Table 1. *General characteristics of the participants divided by sub-groups. The data are presented as mean±standart deviation (SD), ([a]) indicates statistical significance (α= .05)*

Groups	**n** = 29	**Characteristics**			
Gender		**Age(y), mean±SD**	**Body mass (kg), mean±SD**	**Height (cm), mean±SD**	**BMI, mean±SD**
Males	16	20.5±0.81	83.3±10.0	182.0±8.0	25.24±1.0
Females	13	20.07±0.5	58.3±7.0	167.0±4.2	20.82±2.0
p		>.05	.000[a]	.000[a]	.003[a]
Chronotype					
MT	1	20.0±0	55±0	160±0	21.4±4.0
IT	21	20.2±0.7	69±11.2	178±11	21.8±2.4
ET	7	20.7±0.8	81.75±13.7	171±12	28.20±1.2
p		>.05	>.05	>.05	.003[a]
Level of stress					
High	4	20.5±0.6	62±11	168±11	22.1±3.0
Moderate	17	20.2±0.8	74±17	176±11	24.6±2.0
Low	8	20.4±0.7	71.5±22	178±14	23.6±1.0
p		>.05	>.05	>.05	>.05

Chronotype, age, and gender - Age did not correlate with MEQ scores and gender, therefore age was not included as control variable in subsequent analyses. We found an association between chronotype scores and gender, but it was week (χ^2 (1) = 3,10; p = .06).

Level of student' activity, chronotype and stress scores – Student with high physical activity (n = 3 from 10 were females, one was evening type) were more stressed than students with moderate physical activity (n = 3 from 8 were females, two were ET) (p = .06). Level of physical activity did not show association with chronotype.

Stress, chronotype, and gender – Kruskal-Wallis H test showed a strong association between scores from PSS and chronotype (χ^2 (2) = 9.01; p = .01), and also between PSS scores and gender (χ^2 (1) = 4,26; p = .04). The within group comparison of the three chronotype groups was done with Mann-Whitney U test. It revealed that evening-type subjects perceived more stress than intermediate types (p = .01) and morning types (but we found no statistical significance). Mann-Whitney U test indicated that females had higher stress levels than males according to PSS scores (five of seven ET respondents are females). The results are presented in Table 2.

Table 2. *Comparison of chronotype and gender groups by stress scores. The data are presented as mean±standart deviation (SD), ([a]) indicates statistical significance (p≤ .05)*

Chronotype	**n 29**	**Mean stress scores**	**Standard Deviation**	**p-value**
Morning type	1	16	-	
Intermediate type	21	15.8	5.2	
Evening type	7	24	6.7	0.01[a]
Gender	**n 29**	**Mean stress scores**	**Standard Deviation**	**p-value**
male	16	15.4	4.7	
female	13	20.7	7.2	0.04[a]

DISCUSSION

All participants (29) completed the MEQ. The mean MEQ score was 46,59±6,7. According to the mean scores from MEQ there was no difference in chronotype distribution when comparing participants by age and by level of physical activity. This finding was most likely due to the relatively small sample size of the group of individuals assessed in this study. Surprisingly, in our sample there were more evening types (n = 7) than morning types (n = 1). And most of the ETs were females (n = 5). One reason may have been the age of the female group (mean age for females 20,1). Women (in their early 20s) have body clocks that are progressively delayed, with the delay reaching its peak at around the age of 20 (i.e., they manifest a late chronotype) (Komada et al., 2018). The main purpose of the presented study was to examine how chronotype, stress and gender

could be interrelated in Bulgarian sport students. Our results showed that gender is associated with stress ($\eta^2 = 0.177$). Females (n = 4) perceived higher stress than males (n = 0), and most of them were assessed with evening chronotype (n = 3 from 4). We also found that chronotype and perceived stress are strongly related ($\eta^2 = 0.302$; evening types had higher stress scores than intermediate and morning types). The chronotype significantly influences the perceived stress. The presented results are consistent with the data obtained by Roeser et al., 2012, in which the chronotype had a significant impact on the level of the self-perceived stress response (this study procedure included an induction of acute stress to the participants via mental arithmetic task). In addition, Litwic-Kaminska & Kotysko, 2020, reported that the perceived stress (measured by a questionnaire and related to everyday life) is a significant mediator in the relation between the chronotype and sleep quality (partial mediation), which means that perceived stress can further aggravate sleep problems that arise from the chronotype of an individual. Arbinaga et al. 2019 observed a significant negative correlation between the chronotype (arranged in order from evening to morning) and the scale of perceived stress and depression among the group of physical therapy students. Evening and definitely evening chronotypes, scored higher in both scales, which proves their stronger perception of stress and a higher risk of depression. The link found among the students may be due to the fact that classes usually start early in the morning, which may be a reason for a greater perception of stress among students who were assigned with ET (indication of social jetlag).

A questionnaire, although a subjective method, is always useful, inexpensive, and sufficiently informative for a general assessment of a group's chronotype and perceived stress.

Limitations

The presented results should be approached with some caution. It is mainly due to the small number of morning-type individuals and that we did not examine in which phase of the menstrual cycle the females were. An important limitation of the study is that we did not investigate the association between chronotype, stress, and sleep quality. Yet, perceived stress was assessed solely on the basis of self-description, and future research should take into account its' biological markers e.g., hormone levels.

CONCLUSIONS

1. The evening chronotype and female sex were associated with a higher level of perceived stress.
2. Students with an evening chronotype may find it difficult to actively participate in morning activities.
3. We believe that determination of athlete's chronotype through a questionnaire should be done in any case, if possible and that effective coping with stress may be a buffer to help reduce sleep problems.

ACKNOWLEDGEMENTS

We would like to thank sports students from National Sports Academy "Vassil Levski" for their participation in this study.

REFERENCES

Adan, A., Archer, S. N., Hidalgo, M. P., Di Milia, L., Natale, V. & Randler, C. (2012). Circadian typology: A comprehensive review. *Chronobiology International*, 29(9): 1153– 1175

Alshana, O. & Khan, M.H. (2022). Impacts of Chronotype on Personality, Stress-Anxiety, and Physical Activity in a University Teaching Staff. *Journal of Global Scientific Research*, 7 (1): 2011-2018

Arbinaga F, Fernandez-Cuenca S, Fernández-Ozcorta E, Toscano-Hermoso MD & Joaquin-Mingorance M. (2019). Level of physical activity and sleep characteristics in university students. *Sleep Sci.*;12(4):265-71

Chtourou, H. & Souissi, N. (2012). The effect of training at a specific time of day: a review. *J Strength Cond Res.*; 26 (7):1984 - 2005

Cohen S, Kamarck T& Mermelstein R. (1983). A global measure of perceived stress. *J Health Soc Behav.*;24(4):385-96.

Cornwall, J., Mayland, E.C., van der Meer, J., Spronken-Smith, R.A., Tustin, C. & Blyth, P. (2019). Stressors in early-stage doctoral students. Stud. Contin. Educ. 41, 363–380. [https://doi.org/10.1080/0158037.2018.1534821] (accessed 30 September 2022)

Horne JA & Östberg O. (1976). A self-assessment questionnaire to determine morningness- eveningness in human circadian rhythms. *Int J Chronobiol.*;4(2):97-110. PubMed PMID: 1027738.

Kline, C.E., Durstine, J.L., Davis, J.M., Moore, J.A., Devlin, T.M. & Youngstedt, S.D. (2010) Circadian rhythms of psychomotor vigilance, mood, and sleepiness in the ultra-short sleep/wake protocol. *Chronobiol Int.* 27(1): 161–180

Komada, Y., Ikeda, Y., Sato, M., Kam, A., Masuda, C. & Shibata, S. (2019). Social jetlag and menstrual symptoms among female university students, *Chronobiology International,* 36:2, 258-264, DOI: 10.1080/07420528.2018.1533561

Litwic-Kaminsk, K. & Kotysko, M. (2020). Sleep quality of student athletes and non-athletes - the role of chronotype, stress and life satisfaction. *Sleep Sci.* 13(4):249-255, DOI: 10.5935/1984-0063.20190153

Montaruli, A., Castelli, L., Mule, A., Scurati, R., Esposito, F., Galasso, L. & Roveda, E. (2021). Biological rhythms and chronotype: new perspectives in helth. *Biomolecules*, 11, 487. https://doi.org/10.3390/biom11040487

Paine, S.J., Gander, P.H. & Travier, N. (2006). The epidemiology of morningness/eveningness: influence of age, gender, ethnicity, and socioeconomic factors in adults (30-49 years). *J Biol Rhythms*.;21(1):68-76. PubMed PMID: 16461986. Epub 2006/02/08. eng.

Randler, C. & Engelke, J. (2019). Gender differences in chronotype diminish with age: a meta-analysis based on morningness/chronotype questionnaires. *Chronobiol Int*. 36: 1–18.

Roenneberg, T., Kuehnle, T., Juda, M., Kantermann, T., Allebrandt, K., Gordijn, M. & Merrow, M. (2007). Epidemiology of the human circadian clock. *Sleep Med. Rev.* 11, 429–438. https://doi.org/10.1016/j.smrv.2007.07.005

Roeser, K., Meule, A., Schwerdtle, B., Kübler, A. & Schlarb, AA. (2012). Subjective sleep quality exclusively mediates the relationship between morningness-eveningness preference and self-perceived stress response. *Chronobiol Int.;* 29(7):955-60

Watson, J.C. (2016). The effect of athletic identity and locus of control on the stress perceptions of community college student-athletes. *Community Coll J Res Pract.* 40(9):729-38

Wittmann, M., Dinich, J., Merrow, M. & Roenneberg, T. (2006). Social jetlag: misalignment of biological and social time. *Chronobiol Int.* 23(1-2):497-509. PubMed PMID: 16687322. Epub 2006/05/12. eng

Corresponding author:
Mariya Zaharinova, Ph.D.
National Sports Academy "Vassil Levski"
E-mail: mariazaharinova@nsa.bg

PROTOCOL OF HEART RATE AND BLOOD LACTATE MONITORING IN RHYTHMIC GYMNASTICS

Maria Gateva
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
After several years of investigations of the training load in rhythmic gymnastics unification of testing in the field is needed. The aim is to implement a protocol for monitoring the physiological parameters.
Two high-level rhythmic gymnasts aged 17 (Seniors) took part in this study. The physiological changes of the gymnasts were followed by measuring HR and blood lactate. At first, we tested the minute at which the peak of the blood lactate concentration appeared in order to take only one sample after the routines. In the literature different minutes are given to assess the peak value. Heart rate was recorded during each training for the duration of one micro cycle (a week) and the heart rate and the blood lactate were tested on a certain day of the week (Wednesday) for the duration of one mesocycle (month). The testing was carried out at the end of the preparatory and the beginning of the competitive period. The aim was to check the reliability of the testing with high-level athletes and to implement it into practice. The peak values of the heart rate and blood lactate were taken a few times during the training – before the start of the training; after the warm-up; before 1st routine (specific warm-up with apparatus); after the first, middle, and last routine of the day.
The aim was to reduce the number of blood samples taken for each gymnast during the training sessions and also to optimize and simplify the procedure of the testing. With the implementation of this protocol in practice, it will be much more accurate to make a comparison among gymnasts or between the periods of the preparation for the same athlete. However, pilot studies should not be used to test hypotheses. Since the appropriate level in elite sport is measured we consider carrying on with further testing with a bigger number of gymnasts to prove the results.

Keywords: *Field testing, physiological parameters, routines, high level gymnastics*

INTRODUCTION

In sports such as gymnastics, it is difficult to monitor the fitness and endurance level of the athletes. Artistic gymnastics is generally considered to be an "anaerobic sport". Anaerobic energy contribution plays a major role in Men's & Women's gymnastics. Both the anaerobic alactic and the anaerobic lactic systems are taxed sub-maximal in artistic gymnastics (Kaufmann et al., 2022). In rhythmic gymnastics, it is proven that the competitive program is in an anaerobic regime of work (Gateva & Andonov, 2006; Gateva, 2008; Manos, Grigore, Popescu, 2012; Batista, 2018).

To build up sport-specific endurance in every sport the physiological profile of the discipline is needed. The training programs in rhythmic gymnastics should strengthen specific routines with a duration comparable to competition time as a form of sport-specific endurance training.

To describe elite rhythmic gymnasts' load in training situations, Fernandez-Villarino, et al. (2015) examined the relationship between different training indicators and the final score of the gymnasts. The authors couldn't prove a clear relationship between RPE (rate of perceived exertion), average heart rate, and the score achieved by the gymnasts. For Douda et al., (2006) RPE appeared to be an applicable measure of exercise intensity mostly in highly trained rhythmic gymnasts and may provide accurate information to coaches for better training regimes. Debien, et al. (2015) did a weekly profile of internal training load (ITL) and recovery of elite rhythmic gymnasts (Brazilian senior group) during a season without any field testing except the questionnaire which includes numbers of routines, parts, elements, etc.

Physiological parameters such as heart rate and blood lactate are best and easiest to follow in field testing. HR is well understood by the gymnastics specialists but La is a parameter which can be explained and researched more. According to Goodwin et al. (2007), peak lactate values of ≈15–25 mmol/l may be observed 3–8 minutes after "all-out" maximal exertion of 30–120 seconds. Some articles give 15th minute to trace the clearance. Jemni et al. (2003) took three blood samples from a hyperaemic earlobe 2, 5, and 10 min after each event in artistic gymnastics. Each gymnast undertook two recovery protocols – they performed a passive or combined recovery. In the same sports discipline, León Prados (2005) took the La sam-

ples on the same minute. Beneke et al. (2005) collected the blood sample, before, immediately after the test, and 1 2, 3, 4, 5, and 7 min post-test. It is well known that the highest blood lactate concentration (BLC) values are determined from blood samples subsequently collected every minute up to the seventh-minute post-exercise (Van Praagh et al., 1990).

After several years of investigations of the training load in rhythmic gymnastics, unification of field testing is needed. After examining the available literature sources to find evidence for field testing protocol in rhythmic gymnastics, we could not find any. Based on previous experiments and experience, we decided to implement a protocol for monitoring the physiological parameters on field testing in RG. Blood lactate may also be a "normal" physiological response to exertion and gives a better characteristic than heart rate itself. We want to eliminate the methodological differences with respect to blood sampling and BLC analysis.

Aim of the study

The aim was to create a unified field protocol for heart rate and blood lactate monitoring in rhythmic gymnastics.

METHODS

Subjects

Two high-level rhythmic gymnasts (preparing for selection for the Bulgarian national team of RG) participated in this study. Both are at the age of 17 and are considered to have a proper high-intensity training volume. We chose one case study instead of surveying a whole group of gymnasts because our aim was to obtain the results of the best gymnasts, not the average for the group. This is a pilot study for providing a field protocol for testing in RG; that is why we targeted two high-level subjects. The parents of the participants in the current study gave signed informed consent about their children's participation in the research and publication of the results.

Research protocol

The testing was conducted at the end of the preparatory and the beginning of the competitive period of the gymnasts (over four weeks from 15th of February to 14th of March 2021). The training sessions were recorded in volume and intensity and the main training parameters were the number of the routines and the parts of the routines.

The measured physiological indicators used in the study were the heart rate and the blood lactate. The heart rate was monitored during and after the routine and also recorded during the entire training sessions with Suunto Ambit2. A drop of blood sample was taken from the fingertip to assess blood lactate with Accutrend Plus Roche. It was taken during the recovery period in order to assess the maximal values of the concentration of the blood lactate.

Protocol content

The heart rate was traced every day over a week (during the 3rd week of the tested period). The duration of the whole training session was followed for each of the six training days. In the other 3 weeks, we chose only one day of the week (Wednesday) to record the heat rate dynamics. As known from previous studies, the most important values to follow in RG training process are the peaks of the HR after completing the routines or the parts of the routines (Gateva, 2019). That is why only those peaks are needed for the protocol and are presented in this paper.

The peak values of the heart rate and blood lactate were taken once a week (Wednesday) a few times during the training – before the start of the training; after the warm-up; before 1st routine (specific warm-up with apparatus); after the first, middle, and last routine of the day.

The subjects were seated after the first routine of the day and blood samples were taken every minute of the recovery until the 9th min. The aim was to reduce the number of blood samples taken for each gymnast during the training sessions and also to optimize and simplify the testing procedure. The highest appearance of blood lactate was individualized and used later in training to minimize the samples.

RESULTS

Table 1 shows the protocol used for the testing (only one day is presented in this paper with all the data needed). The physiological parameters would not provide any information if the volume or the load of the gymnast's training is not known. As this is only a pilot study to check the reliability of the suggested protocol, a comparison is not needed. We want only to present the results for better understanding. One standard training day for a high-level rhythmic gymnast (not part of a National team) has a duration of 5 to 6 h. The standard time for ballet is 60 min a day. As known from the theory (Hadjiev et al., 2011), the time for

conditioning goes down approaching the competitive period. The first gymnast did 25 min physical preparation a day.

Table 1. *Protocol (example). Heart rate & Blood lactate monitoring during RG training.*

Date	**03.03.2021**	**Name of the gymnast**		
Starting time	3 pm	***Sofia Sergieva***		
Ending time	8.30 pm		La	HR
Warm up in min	40	Before training	5.4	-
Conditioning in min	25	After warm-up	5	160
Ballet in min	60	Before first routine	2.3	135
Number of routines	8	After first routine	2.4	193
Number of part of routines	9	After mid routine	4.9	196
Number of elements	385	After last routine	7.2	190

Table 2 presents the values of the HR and La of the first gymnast. As it is shown, the last sample of La was the highest of all taken during each training session. The heart rate of the first gymnast was higher after the mid or first routine but not on the last one like it is on BLC. The reason for this may be fatigue (also proved by the blood lactate values) which may lead to less effort in the last routine of the day.

Table 2. *Heart rate & Blood lactate during Wednesday's trainings (first gymnast)*

		start of training	**after warm-up**	**before 1st routine**	**after 1st routine**	**mid routine**	**after last routine**
17.02.2021	La	2.3	6	2.0	5.4	5.3	8.1
	HR	-	160	110	188	185	191
24.02.2021	La	3.3	4.2	2.5	4.8	6.4	8.4
	HR	-	139	115	190	196	185
03.03.2021	La	5.4	5	2.3	2.4	4.9	7.2
	HR	-	160	135	193	196	190
10.03.2021	La	2	1.5	2.4	3.4	6.5	7.1
	HR	-	153	189	187	193	190

The protocol of the second gymnast (table 3) showed a higher concentration of blood lactate compared to the first gymnast. Despite that fact, HR values between the two gymnasts were pretty much equal.

The second gymnast had only 1 to 2 bpm (HR) less at the last routine of the day compared to the peak reached at the mid routine of the day.

Table 3. *Heart rate & Blood lactate during Wednesday's trainings (second gymnast)*

		start of training	**after warm-up**	**before 1st routine**	**after 1st routine**	**mid routine**	**after last routine**
17.02.2021	La	3.9	3.1	1.3	4.5	7.7	16.1
	HR	-	147	161	183	194	193
24.02.2021	La	3.8	2.8	2.6	6.3	12.4	11.9
	HR	-	125	158	182	191	191
03.03.2021	La	3.4	2	4.5	7.4	11.5	9.5
	HR	-	153	163	187	192	190
10.03.2021	La	1.3	1.4	7.6	9	9.1	8.7
	HR	-	145	187	187	186	185

In the results presented (table 4) we can see an example of individualization of the blood sampling. The first or second minutes are the peak values of the two high-level gymnasts and we considered those minutes to be the individual peak of the concentration of blood lactate.

Table 4. *Examples of the definition of the blood lactate peak values*

	after 1st min	after 2nd min	after 3rd min	after 4th min	after 5th min
1st gymnast 1st routine	4.7	**5.4**	4.1	5.1	5.1
1st gymnast mid routine	5.0	**5.3**	4.3	4.3	4.2
2nd gymnast 1st routine	**6.3**	5.4	5.3	4.3	4.1
2nd gymnast mid routine	**12.4**	9.9	9.9	7.5	7.2

DISCUSSION

All the data obtained in this study confirm previous publications (Gateva, 2008; 2019) and are not surprising. The target is not to prove it but to create a protocol to help the coaches and also the researchers to unify the methodology of the field testing and the control of the training load. In many previous field testing in RG, we saw a gap or a weakness in the guidelines on to do the blood samples. BLC (blood lactate concentration) will provide equivocal results due to differences in the time of blood sampling. Lactate needs some time to reach the sample size (generally, the fingers or the ear lobes) by the time it has been produced in the muscle fibers. The transport of the acid lactic would depend on blood circulation. Its value is the difference between its production and its consumption by other cells/organs and the other muscle fibers too. We believe that individualized protocol for high-level athletes (despite which discipline) will help coaches and gymnasts.

The individual approach will reduce the blood samples and the finance. More blood samples need to be done once (at the beginning of the tested period) every minute from min 1st to min 9 (if needed). After determination of the peak of the BLC, the minute which showed the highest values can be taken for each gymnast.

Day Wednesday was chosen as it is the middle of the training week and will show the state when gymnasts are not very tired (end of the week) or recovered at the beginning of the week.

Checking the reliability of the testing with two high-level athletes and applying it to real conditions is the main goal of this paper. With the implementation of this protocol in practice, it will be much more accurate to make a comparison amongst gymnasts or between the periods of the preparation of the same athlete.

REFERENCES

Batista, A., Gomes, N., Garganta R., Avila-Carvalho, L. (2018). Training intensity of group in rhythmic gymnastics, *Science, movement and health,* Vol. 18 No1, pp. 17-24.

Beneke, R., Hutler, M., Jung, M. & Leithauser, R. (2005). Modeling the blood lactate kinetics at maximal short-term exercise conditions in children, adolescents, and adults. *J Appl Physiol.* Vol. 99, Issue 2, pp. 499–504.

Debien, P., Miloski, B., Timoteo, T., Ferezin C. & Filho, M.B. (2019). Weekly profile of training load and recovery in elite rhythmic gymnasts, *Science of Gymnastics Journal*, Vol. 11 Issue 1, pp. 23-35.

Douda, H., Avloniti, A., Kasabalis, A. Smilios, I. & Tokmakidis, S.P. (2006). Application of Ratings of Perceived Exertion and Physiological Responses to Maximal Effort in Rhythmic Gymnasts, *International Journal of Applied Sports Sciences,* Vol. 18 Issue 2, p78-88.

Fernandez-Villarino, M.A., Sierra-Palmeiro, E., Bobo-Arce, M. & Lago-Peñas, C. (2015). Analysis of the training load during the competitive period in individual rhythmic gymnastics, *International Journal of Performance Analysis in Sport*. Vol. 15, Issue 2, pp. 660-667.

Gateva, M., Andonov, K. (2006). Characteristics of the effect of applied training loading in rhythmic gymnastics. Sport, stress, adaptation, proceeding of the international conference in Sofia, Bulgaria, 2006, Sport & science, extra issue, pp. 63-69.

Gateva, M. (2008). Examination of the training loading in rhythmic gymnastics and perfecting the training methods. *Doctoral dissertation*. National Sports Academy, Sofia.

Gateva, M. (2019). Modified field test for determining the specific endurance in rhythmic gymnastics. *Journal of Applied Sports Sciences,* Vol. 1, pp. 3-12.

Goodwin, M., Harris, J., Hernández, A. & Gladden, B. (2007). Blood Lactate Measurements and Analysis

during Exercise: A Guide for Clinicians J Diabetes Sci Technol. Vol. 1, Issue 4, pp. 558–569. Published online 2007 Jul. doi: 10.1177/193229680700100414

Hadzhiev, N., Andonov, K., Dobrev, D. & Petrov, V. (2011). Fizicheska podgotovka, NSA PRES, Sofia.

Jemni, M., Sands, W., Friemel, F. & Delamarche, P., (2003). Effect of Active and Passive Recovery on Blood Lactate and Performance during Simulated Competition in High Level Gymnasts. *Canadian journal of applied physiology.* Vol. 28 Issue 2, pp. 240-256. DOI: 10.1139/h03-019

Kaufmann, S., Ziegler, M., Werner, J., Noe, C., Latzel, R., Witzany, S., Beneke, R. & Hoos, O. (2022). Energetics of Floor Gymnastics: Aerobic and Anaerobic Share in Male and Female Sub-elite Gymnasts. *Sports Medicine*. Vol. 8, Issue 3 https://doi.org/10.1186/s40798-021-00396

León Prados, J. (2005). Lactate concentration analysis in gymnasts. Guidelines of action in reference to inter-exercises rest and post-training ingestion. *Apunts. Educación Física y Deportes, Vol. 79,* pp. 86-93.

Manos, M., Grigore, V., Popescu, L. (2012). Study about the energy expenditure assessment in rhythmic gymnastics. *Science, movement and health,* Vol. XII, issue 2, pp. 170-175.

Van Praagh, E., Fellmann, N., Bedu, M., Falgaitette, G. & Gender, C. (1990). Difference in the relationship of anaerobic power output to body composition in children. *Pediatr Exerc Sci Vol.* 2, pp. 336–348.

Corresponding author:
Maria Gateva, PhD
Department Gymnastics
National Sports Academy "Vassil Levski"
Studentski grad, 21, Acad. Stefan Mladenov str.
Sofia 1700, Bulgaria
E-mail: maria.gateva@abv.bg

BIOMECHANICAL ANALYSIS OF THE FIGHT BY FRONTAL HEAD PRESSURE ON THE CHEST OF THE OPPONENT IN SUMO

Hristo Hristov
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
Introduction. The Sumo sport discipline is characterized by incomparable by the nature and character force interactions. The briefness of the fight requires the sumo wrestlers to possess a wide range of sports and technical, almost automated skills to manage their motor action depending on the opponent's qualification.
The present study aims to establish the phase structure, functional features, and mechanical principles of the sport-technical skills of the fight by frontal head pressure on the opponent's chest in sumo.
Methodology. For the purposes of the analysis, the fight is divided into separate phases, using a video computer system for determining the kinematic and energetic parameters of the movements.
Results. Taking into account the fact that the mass of the defeating athlete is 23.5% lower and he is 0.05 m shorter than the opponent, the results show three basic mechanical conditions that contribute to his victory during the fight: generating a powerful power torque from the lower limbs to raise and guide the upper body through the initial acceleration phase; creating and increasing the detour force arm in order to disturb the balance of the opponent in the sagittal plane and use its inertia of movement.
Discussion and Conclusion. The results of the study, on the one hand, justify the use of this sport technique against opponents with higher stature and mass. On the other hand, the resulting quantitative values of the parameters can serve to improve the training process, providing guidance on the qualities required for the competitors to use this technique and also for defensive actions.

Keywords: *Sumo; Biomechanical Parameters, Linear Velocity, Kinetic Energy, Center Of Gravity*

INTRODUCTION

The specificity of one or another type of single combat consists of the nature and content of the technical-tactical actions and the immediate conditions in which they are performed. A distinctive feature of the Sumo competitive combats is the creativity and speed of the fight. It usually lasts from 5 to 15 seconds and the first seconds of the fight are decisive. Secondly, there is a size limitation, with overlapping its limit leading to defeat. Third, there are immediate and significant power contacts of the head and body during the fight between the two sumo wrestlers who are powerless and non-comparable with none of the impact in other types of combat. A number of foreign authors have considered this issue in relation to other sports.

For that reason, many controversies arise related to how it is actually necessary to train the sumo wrestlers. In this regard, coaches generally prepare their athletes – sumo wrestlers intuitively, i.e., they use their experience gained from the technical, tactical actions of their past practice. However, considering the specific rules and distinctiveness of competitive activity in Sumo, this practice is not always appropriate for Sumo Sport.

The lack of specific habits to move competitors into the dojo and their misunderstanding of the particularities for performing the technical-tactical actions often lead to the loss of the most important competitions.

Despite its simplicity, the Sumo fight has several specific features, without which it is impossible to successfully and steadily participate in the competitions.

In today's professional sumo, the competition takes place in an inner circle with a diameter of just over 15 feet. The winner is this competitor, who has forced his opponent to touch the floor or forced him out of the circle. In this case, it is sufficient for the floor to be touched with any part of the body - a knee, a hand, or a head. The rules strictly prohibit any punches with a fist, fingers, or the edge of the palm, as well as kicks in the chest and abdomen, as well as attacking the throat and the area between the legs.

In this sport, competitors are not divided into categories, which often lead to ring meetings between unequal by weight partners. Although the technique undoubtedly plays a big role in sumo, nevertheless, the larger mass is decisive.

It is precisely for the reasons given, in practice it is impossible and inappropriate to compare the actions in sumo with other sporting combats.
Also, due to the lack of weight categories in sumo, the competitor with a higher weight usually has the advantage of winning the fight. For this reason, lighter competitor must use a different tactical technique, within the rules, that would have contributed to his victory.

This study examines this particular case of a significant difference in the weight of the two athletes and is an attempt to analyze and justify the use of a specific technique by the lighter competitor.
The aim of the present study is to identify the specific features and quantitative biomechanical parameters in the sport-technical way of fighting by attacking head pressure frontally on the opponent's chest. The established mechanical correlations would contribute to justifying the use of technical-tactical actions when the significant differences in the weight of the two opponents exist.

METHODS

Two sumo wrestlers took part in the experiments with the following anthropometrics data: participant 1, with a height of 1.85 m and weight of 1700 N, and participant 2, with a height of 1.80 m and weight of 1310 N.

A standard video camera with a cadence of 25 fps, set up stationary and with an optical axis perpendicular to the plane of motion, pre-calibrated within the 2D space used, was used to record motion actions, and the video files obtained were processed with a video computer analysis system (Arakchiiski, 2002). The system registers the vertical and horizontal coordinates in the 2D space of selected points on the body of the sumo wrestlers during the selected exercises. A 14-segmented model of the human body was used for each participant in the combat, the 2D coordinates of the following body points were recorded: in the lower limbs - ankle, knee and hip joints; in upper limbs - wrist, elbow and shoulder joints; private center of the mass of the head. Subsequently, the registered coordinates are processed with the corresponding software module of the system, which determines the trajectory of the Centre of gravity of the sumo wrestlers during the fight. The speeds and accelerations of the points scored, the time structure of the fight, and the kinetic energy of the attacking sumo wrestler are also calculated.

RESULTS AND ANALYSIS

Specific for some used combat techniques in sumo is the relatively unusual way of grip during the development of the combat for both athletes. This analyzed combat mode, shown in Figure 1, is slightly different from the one considered since it cannot be applied simultaneously by both sumo wrestlers. While the motor actions during the initial phase of the fight run similarly to other techniques, in the next phase, one wrestler exerts a pressure force frontal to the upper torso through his head. In this case, this is the left sumo wrestler.

For the purposes of the analysis, in Figure 2, the trajectory of the Centre of gravity of the left sumo wrestler is shown, as well as its linear velocities and kinetic energy – respectively, in Figures 3 and 4.

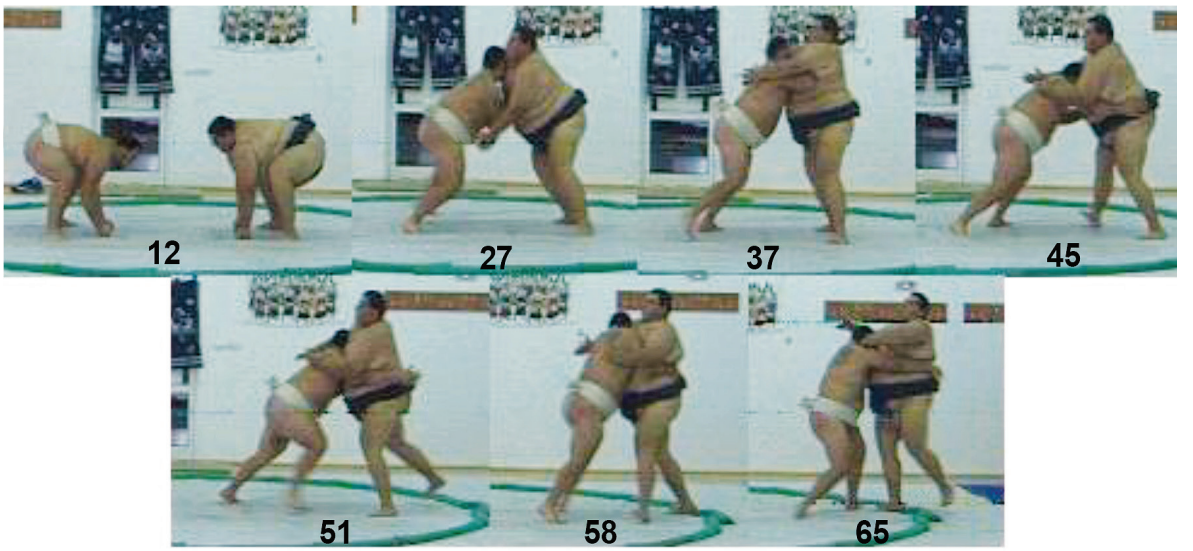


Figure 1. *Typical frames of the development of the fight by pressing the head on the opponent*

In order to accurately evaluate the obtained results, especially when comparing parameters that are the function of weight, it should be noted that the weight of the left wrestler is 23.5% less than the weight of the right one, and he is 0.05 m shorter. If similar parameters are compared between the different techniques, it is necessary to normalize the mass of the sumo wrestlers in advance.

The duration of the first phase (the initial acceleration of contact with the opponent) for the left wrestler here is 0.48 s, with the CG trajectory being "bulging", which means, as can be very accurately determined from the speed chart that the wrestler accelerates the deployment the hip joint (movement of the CG upwards) and subsequently heavily rotated according to knee joint. This mode of movement may be dictated by the objectives of the future attack or is the individual style of the sumo wrestler. Although the horizontal speed is 1.7 m / s, dephasing the maximums and the significantly lower vertical velocity leads to the said non-linearity of the trajectory. The accumulated kinetic energy at the end of the phase has a local maximum of 178 J.

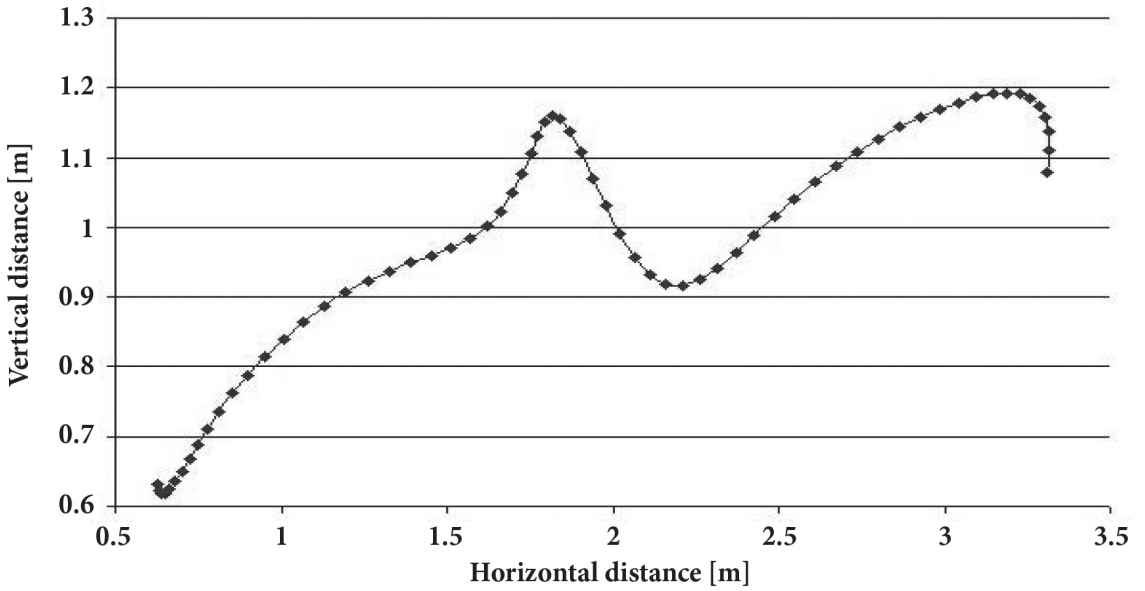


Figure 2. *Trajectory of the CG of the attacking wrestler during the fight by pressing the head on the torso*

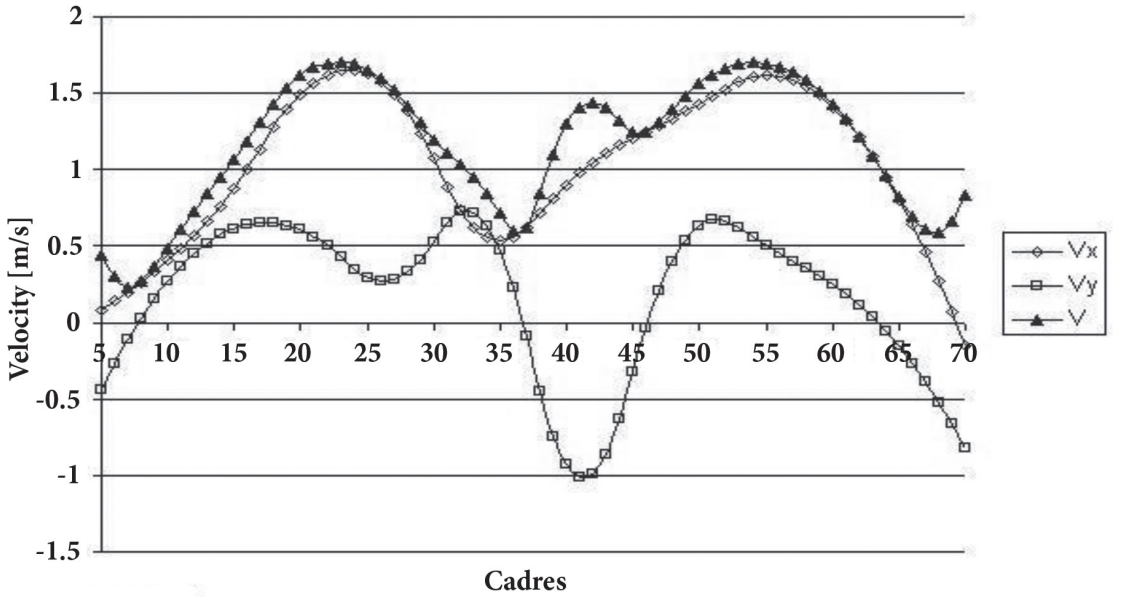


Figure 3. *Linear velocities of the CG the attacker during the fight with the head impact on the torso*

The next contact phase can be divided into two sub-phases. During the first one, the wrestler managed to keep his horizontal speed positive (local minimum of 0.5 m / s) and raise his CG by nearly 0.2 m upwards at the cost of straightening the opponent. In the next sub-phase, for about 0.4 seconds, the left-side sumo wrestler, tilting forward, lowers the CG by nearly 0.25 m and "snaps" his head into the opponent's chest by continuing to push him.

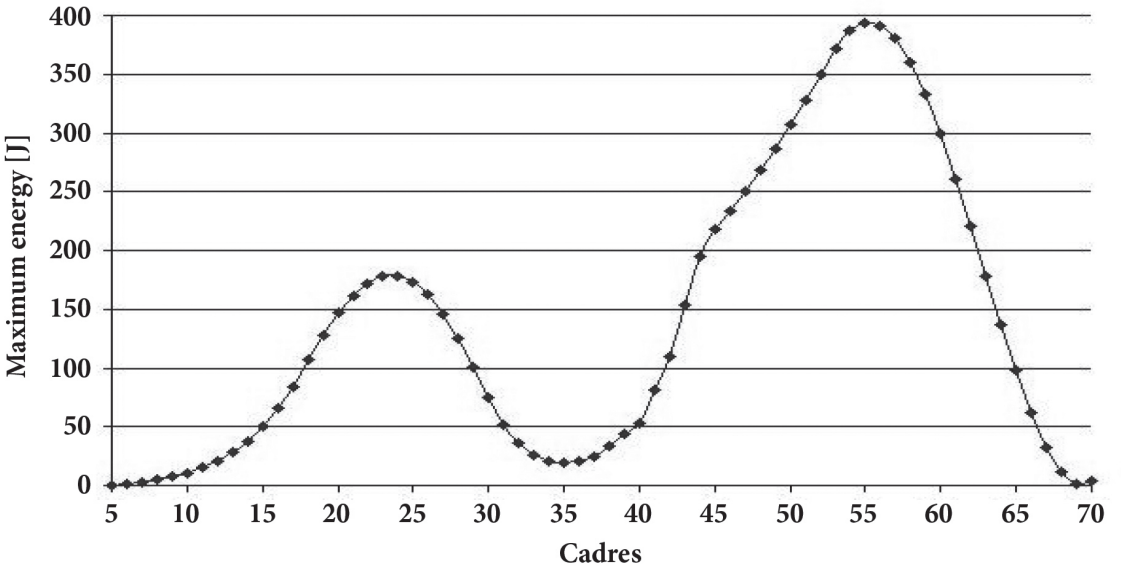


Figure 4. *Kinetic energy in the horizontal direction of the attacking wrestler in the fight with the head impact on the torso*

To keep balance, the attacker takes steps back, increasing the positive speed in the attacker's horizontal direction, with the CG trajectory again moving up and down. Applying the diagonal efforts concentrated in the upper torso, both the straightening of the opponent (which reduces the arm of its resistance torque) and an increase of the attack torque of the attacker are achieved. As a result, the pushing speed increases, which is also helped by the use of the inertia of the opponent in the backward direction. All these prerequisites result in a maximum kinetic energy of 394 J in the final phase, one step before the field limits.

Competitors and coaches can use the resulting quantitative data in various aspects. Generally, they provide information on how the fight takes place and explain the possibility of winning over a considerably heavier opponent. In particular, taking into account the specific data of the investigated participants, the kinematic parameters were obtained to determine the character and direction of the initial accelerator movement in the direction of the opponent and the timing of extension in the knee and hip joints. The CG trajectory gives information about moving the attacking competitor and his posture in the initial contact with the opponent. This determines the size of the attack torque arm, leading to disturbing the opponent's balance. The speed and energy parameters determine the momentum of the attacking competitor associated with the muscle groups used. Thus, through the results obtained, it is possible to learn and improve the motor structure of this sumo combat technique and to pay attention to specific muscle groups responsible for the effectiveness of the movements. This is also the direction of future research.

DISCUSSION

During the sub-phase after the contact, the sumo wrestler manages to keep his horizontal speed positive and raise his CG by nearly 0.2 m upwards. During the next sub-phase, the attacking wrestler tilts forward and lowers the CG by almost 0.25 m. And he sharply puts his head in the opponent's chest, and without changing the movement, he pushes him back. During contact with the attacking head against the opponent's chest, the temporal development of the fight has a wave character with increasing amplitude. The way of applying the force effort allows both the opponent to straighten and the attacker's torque to be raised simultaneously, as well

as the use of the opponent's inertia in the rearward direction. This way of fighting gives priority over higher and heavier opponents.

REFERENCES

Arakchiyski, Z. (2013). O. Povarhnostta EMG kato metod za rezistratsia pri biomehanichen analiz na dvizheniyata v sporta. *Sport i nauka*, br. 2 pp. 1 //Аракчийски, З. (2013. Повърхността ЕМГ като метод за регистрация при биомеханичен анализ на движенията в спорта. *Спорт и наука*, бр. 2 с. 1

Arakchiyski, Zdr. (2002). Videokompyutarna sistema za avtomatiziran analiz, Kinematografichni metodi za biomehanichen analiz, *Sb. statii*, NSA PRES, Sofia, str. 86–91. // Аракчийски, Здр. (2002), Видеокомпютърна система за автоматизиран анализ, Кинематографични методи за биомеханичен анализ, *Сб. Статии*, НСА ПРЕС, София, стр. 86–91.

Bachev, V. (2011). *Osnovi na nauchnite izsledvania v sporta.* Sofia // Бачев, В. (2011). *Основи на научните изследвания в спорта.* София.

Code of ethics. Available at: www.ifs-sumo.org (accessed 25 June 2021).

Gydev, M. (2013). Vzaimovrazka na vzrivnostta na dilnite kraynitsi s dinamichni priznatsi na opornata reaktsia pri nisko kvalifitsirani sportisti. *Sport i nauka* br. 1, pp. 3 //Гъдев, М. (2013). Взаимовръзка на взривността на долните крайници с динамични признаци на опорната реакция при ниско квалифицирани спортисти. *Спорт и наука* бр. 1, с. 3.

Makaveev, R. (2011). *Sredstva i metodi za razvitie na obshtata koordinatsia podpomagashti tehnicheskoto izrastvane na mladi bortsi (12 – 19).* Dissertation. Sofia // Макавеев, Р. (2011). *Средства и методи за развитие на общата координация подпомагащи техническото израстване на млади борци (12 – 19) г.* Дис. София.

Miladinov, O. (1994). *Optimizirane na skorostno-silovata podgotovka v skoka na dalzhina sas zasilvane chrez modelirani uprazhnenia za vzrivna sila.* Dissertation. Sofia.// Миладинов, О. (1994). *Оптимизиране на скоростно-силовата подготовка в скока на дължина със засилване чрез моделирани упражнения за взривна сила.* Дис. София.

Penov, R. (2015). *Usavarshenstvane na sistemata na tehnicheska podgotovka pri 18-22g. sastezateli po karate.* Dissertation. Sofia // Пенов, Р. (2015). *Усъвършенстване на системата на техническа подготовка при 18-22 г. състезатели по карате*. Дис. София.

Stanchev, N. (2013). Klasifikatsia na uprazhneniyata za vsestranna fizicheska podgotovka na sastezateli po svetovna borba. *Sport i nauka* br. 1 pp. 34// Станчев, Н. (2013). Класификация на упражненията за всестранна физическа подготовка на състезатели по световна борба. *Спорт и наука* бр. 1 с. 34.

Tishinov, O., Albert, E. (2010). Izsledvane na ravnovesnata ustoychivost pri statichno-silovi uprazhnenia v iztochnite boyni izkustva mezhdunaroden nauch. kongres „Sport, stres, adaptatsia", *Sport i Nauka*, Kniga 1. // Тишинов, О., Алберт, Е. (2010). Изследване на равновесната устойчивост при статично-силови упражнения в източните бойни изкуства международен науч. конгрес „Спорт, стрес, адаптация", *Спорт и Наука*, Книга 1.

Corresponding author:
Hristo Hristov
Wrestling and Judo Department
National Sports Academy "Vassil Levski"
21, Acad. Stefan Mladenov, str.
Sofia, Bulgaria
E-mail: sumonsa@abv.bg

BIOMECHANICAL EVALUATION OF MOTOR ACTIONS AT THE GRIP "SHOULDER THROW" IN THE SPORT OF WRESTLING

Nikolina Dimitrova, Anna Nikolova & Hristo Pavlov
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
An "active" experiment was performed for kinematic and dynamographic analysis of the motor actions at one of the main wrestling grips "shoulder throw". The general principles of ensuring the success of the grip as well as the individual features demonstrated in the performances of elite athletes are traced. The purpose of this study is to explore and perform a biomechanical analysis of the grip "Shoulder throw". The kinematic characteristics are assessed quantitatively by using a video-computer methodology, and the dynamic ones by measuring the support reactions on a dynamo platform. The object of the study are fighters for whom "shoulder throw" is the main grip. Both general biomechanical regularities and significant individual features in sports and technical mastery have been experimentally derived.
The obtained results raise questions before the training process regarding the measure between the standardization and individualization of sports and technical mastery. In our opinion, these results are of great interest as they reveal a new and sensitive indicator for the coordination abilities and respectively for the sports and technical mastery of the athletes.

Keywords: *"Shoulder throw", individual approach, technical mastery*

INTRODUCTION

It is known that depending on the individual features of the motor apparatus /biomechanical and psycho-physiological/ there is always something characteristic in the actions of each athlete - this is the athlete's individual style (Mileva, 2014; Peneva et al., 2003; Kostova, 2019). In this regard, the disclosure of the theoretical difference between sports technique and style is of interest for in-depth study (Dimitrova, 2017; Yaneva, Miletiev, 2019). Movement mastery is a relatively independent characteristic of technical mastery, independent of efficiency since the inefficient technique can be also well mastered (Avramov,2019; Kostova, 2021). The degree of mastery of the techniques is assessed by means of the stability of the results, the resistance to changing external conditions, the storage of motor skills, and automaticity (Yaneva, Lukanova, 2019).

The practice under competitive conditions, however, shows that at the European and world level there is a huge difference and diversity in biomechanics between models and reality. In other words, the biomechanical expediency, apart from the general regularities, also depends on the individual peculiarities of motor skills, the trends in the development of technical skills, the analysis outcomes of sports-technical intelligence, etc. (Ivanov, Bogdanov 1973). In this sense, it is of particular importance to develop objective quantitative criteria for evaluating the biomechanical efficiency in each specific motor task (Avramova, 2019). Obviously, it is about optimizing the multidimensional structural interrelationships between the concepts of stability-variability and standardization-individualization of sports technical mastery.

AIM AND OBJECTIVES OF THE STUDY

The ***main goal*** of the present study is to carry out a controlled active experiment for a complex biomechanical analysis of the "Shoulder Throw" grip.

On the way to achieving this main goal, it was necessary to develop objective quantitative criteria for evaluating the biomechanical efficiency in each specific motor task, as well as conducting experiments to quantitatively evaluate the individual qualities of the individuals participating in the study. Achieving higher sports results directly depends on scientifically based criteria adequate to the problem for improving the sports technique.

METHODOLOGY

With the means of kinematic and dynamographic analysis, the general principles ensuring the success of the "Shoulder throw" grip, on the one hand, and on the other hand, the individual characteristics demonstrated by classical-style wrestlers have been traced.

The kinematic characteristics were evaluated quantitatively using a video computer methodology, and

the dynamic ones by measuring the support reactions on a dynamographic platform.

A total of 16 persons are the subject of the study. For 8 of them, the "Shoulder throw" grip is basic in technical-tactical terms (experimental group). In the control group are wrestlers with a crown technique other than "Shoulder throw". Thirty runs were analyzed under standard laboratory conditions.

RESULTS AND ANALYSIS

Regardless of the individual peculiarities in the execution technique due to the similarity of the kinematic structure in the movement system, the family of dynamographic curves generally follows the same logic of development Figure 1 shows the typical power function from the execution of one of the main grips in the fight - "Shoulder Throw".

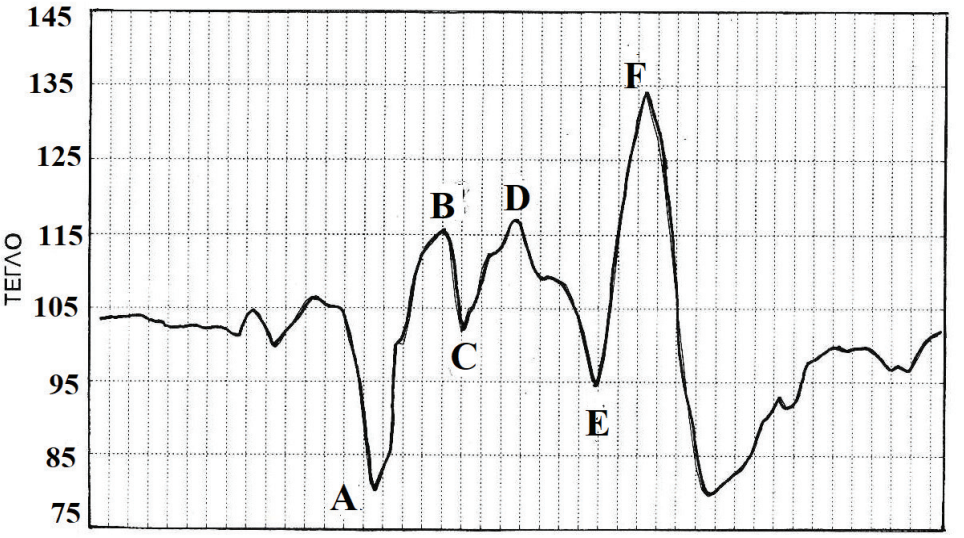


Figure 1. *Power function of shoulder throw representing the weight of the athletes*

The nature of the curve is preserved for all competitors, but with significant deviations in the coordination structure. The attempt to build a general model based on a statistical summary is illustrated in the following Figure 2.

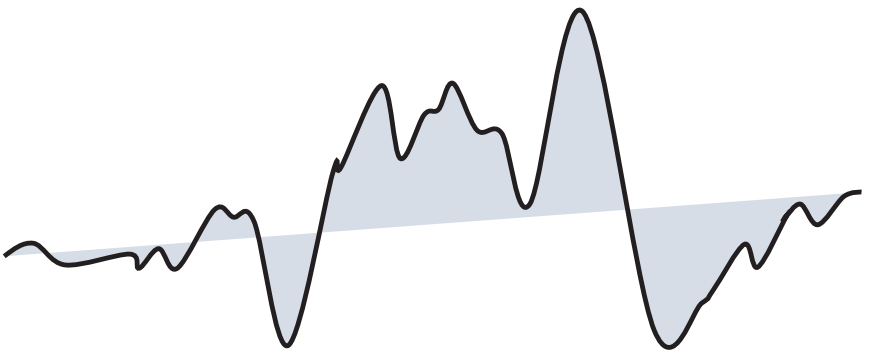


Figure 2. *General model based on a statistical summary*

It should immediately be noted that this type of mathematical formalism does not reflect objective truth. It can only carry information about some integral biomechanical characteristics, such as the average statistical force impulse (area under the graph), work, power, etc. In this statistical interpretation, the causality actually existing in the time series of the force vector data is lost. In practice, every value actually recorded is directly dependent on both the kinematic and dynamic history of the event.

In practice, the statistical model cannot in any case represent a real phenomenon and should not be used as a role model or coordinate system for evaluation. The statistical analysis of these specific values pro-

vides meaningful information about the biomechanical expediency in solving the motor task.

The main disadvantage of this approach is the non-normalized nature of the data, and hence the too high values of the standard deviations and, respectively, the coefficients of variation. Normalization can be done based on the initial values of the force vector and their percentage ratio in the next time series. Invariant with respect to the absolute values of the strength biomechanical characteristics and weight categories is the rhythmic structure.
The statistical model of the rhythmic structure of the shoulder throw grip is illustrated in Figure 3.

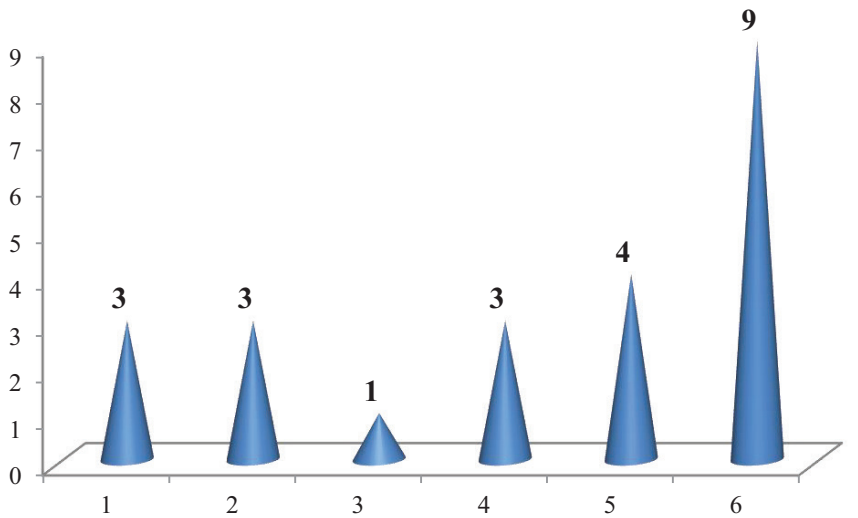


Figure 3. *The rhythmic structure of the "shoulder throw"*

The comparative analysis between the control and experimental groups showed no significant differences in rhythmic structure. This structure to a large extent forms the coordination abilities, but in the case of automated actions with a learned motor habit, in the conditions of standardized external conditions, it does not carry information about the latter.

Therefore, we performed experiments under variable initial conditions – height and weight of the partner and changes in posture and location of the common center of gravity, as well as performance in motion after an external light signal.

Changes in the initial conditions of the motor task led to significant disturbances in the rhythmic structure of the control group. These violations are in two directions - in terms of rhythmic coefficients and in terms of group uniformity. The results for the control group are illustrated in Figure 4.

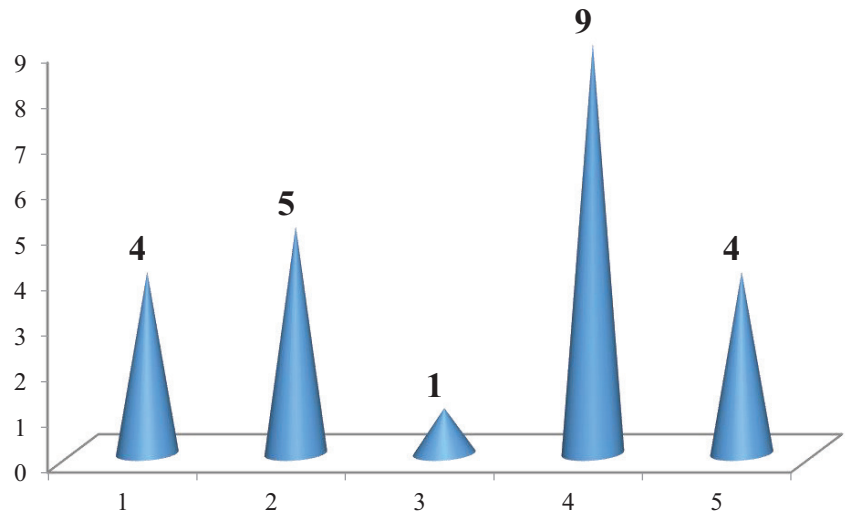


Figure 4. *Rhythmic structure in the control group*

It is noteworthy that the disturbances in rhythmicity refer to all phases of the motor action, while the force characteristics (max. force and force impulse) decrease their absolute values.

Figure 5 presents the analogous results of the experimental group.

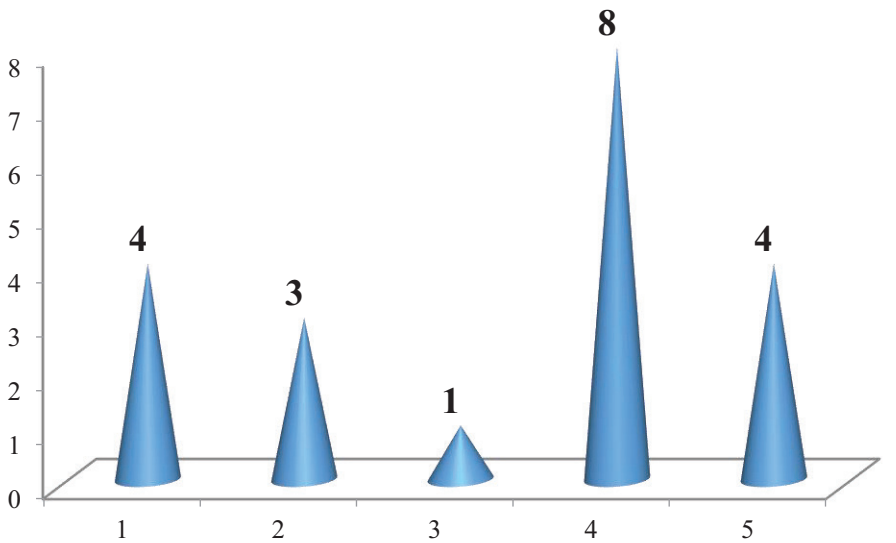


Figure 5. *Rhythmic structure of the experimental group*

The most complete information about the nature of the changes that occurred in the experimental group is contained in the data from the experiments conducted to assess the main biomechanical characteristics when performing the grip. Here, the changes are limited only to the first phase of the rhythmic structure, and in some cases the force biomechanical characteristics in the final phases increase their absolute values.

These results, in our opinion, are of extreme interest as they reveal a new and sensitive indicator of the coordination abilities and, respectively, of the sports-technical mastery of the athletes.

DISCUSSION

Individual wrestlers perform the techniques with a number of specific individual characteristics.

a) Biomechanical expediency of different athletes is based on different coordination structures providing the compensatory mechanisms to stabilize the motor system
b) Sporting technical mastery has a multidimensional nature, hence the failure of attempts to seek evaluation only through the accepted classical dynamographic analysis on the force vector of throws.
c) On the other hand, statistical approaches for assessing the applicability and effectiveness of individual grips in wrestling should not be leading in the process of managing and improving sports-technical mastery.
d) The main problem facing the educational and training process is the optimization of technical mastery in relation to the individual qualities and characteristics of the individual athlete. Individual biomechanical features should be leading here.

REFERENCES

Avramov, E. (2019). Izsledvane na efektivnostta na igrata na vratarya v svetlinniya shampionat po khandbal „Daniya/Germaniya 2019“. *Godishnik na NSA „Vassil Levski*”; tom 1; str. 383-388; NSA PRESS.

Avramova, M. (2019). Sravnitelen analiz na fizicheskata deesposobnost na uchenika. *Godishnik na NSA „Vassil Levski”*. Vol 1, pp. 47-51; NSA PRESS.

Avramova, M. (2019). Promyana v somatotipologichnite kharakteristiki na izrastvaneto na khandbalni vratari. *Godishnik na NSA „Vassil Levski.”* Vol 1; pp. 304-308; NSA PRES.

Kostova, N. (2021). Some aspects of the physical education and sport teaching contents at the secondary schools. *Trakia Journal of Sciences*, Vol. 19, Suppl. 1, pp 830-835, Trakia University.

Kostova, N. (2019). Sastoyanie na fizicheskata deesposobnost na uchenika ot nachalniya etap do osnovnata obrazovatelna stepen. *Godishnik na NSA „Vasil Levski”*. Vol 1, str. 73-81. NSA PRESS. // Kostova, N.

(2019). Състояние на физическата дееспособност при ученици от начален етап на основната образователна степен. *Годишник на Националната спортна академия*, Vol 1, str. 73-81. NSA PRESS

Mileva, E. (2014). *Teoretichni i prilozhni aspekti na pedagogikata na fizicheskoto vŭzpitanie i sporta.* Monograph. Sofia, Avangard Prima. // Милева, Е. (2014). Теоретични и приложни аспекти на педагогиката на физическото възпитание и спорта. Монография. София, Авангард Прима.

Peneva, B., Mileva, El., Peeva, P. (2003). Former and future strategies in physical education, *Primer congreso europeo de educacion fisica*, FIEP 2003, Caceres, pp. 13-25.

Yaneva, A, Lukanova, V. (2019). Examining the opinion of experts in judo on the need for a training methodology for children aged 7 to 10. *Trakia Journal of Sciences.*, Vol. 17, Suppl. 1, pp 731-735, Trakia University.

Yaneva, A., Miletiev, S. (2019). FITNESS EDUCATION FOR STUDENTS IN THE DISCIPLINE "SPORT". *Trakia Journal of Sciences*, Vol. 17, Suppl. 1, pp 723-730, Trakia University.

Corresponding author:
Nikolina Dimitrova, DSc
Department of Language Training and IT
National Sports Academy "Vassil Levski"
Studentski grad 1700 Sofia, Bulgaria
E-mail ninansa@abv.bg

BIOMECHANICAL CHARACTERISTICS OF THE BULGARIAN ELITE ROWERS' TECHNIQUE

Nikola Gospodarski
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
The results of biomechanical analysis have a huge impact on the development of the rowing technique and understanding the process of boat motion. The first biomechanical studies of rowing "on-water" technique date from the end of XIX century. Since then, all methods, measurement tools and tests of biomechanics have made a big step ahead which leads to unification of the elite athletes' technique. Using a BioRowTel Measurement System, developed by Dr. Valery Kleshnev, we tested five elite Bulgarian male rowers (single skull racing boats, 24 ± 4,95 years, 192,6 ± 3,97 cm, 95 ± 3,54 kg) with a 2000 meters standard protocol. Twenty-two different indicators of the rowing technique were measured and calculated. A comparison was made with the "Gold medal standard" of the rowing stroke, created by the same author. The results of data analysis and the lack of significant differences allowed us to consider that the length of the stroke (113,34 ± 3 degrees) is relatively close to the "standard" as well as the ratio between average and maximal force (55% ± 0,03%), the position of the peak of the force applied (37,06% ± 0,06%) and Catch and Finish Angle of the oars (-67,62 ± 6,67 and 45,7 ± 6,98 degrees respectively). The main differences are in the blade slip on catch (8,08 ± 1,21 degrees) and finish (26,28 ± 1,91 degrees) position and the effective rowing angle (69,68% ± 0,02%). This biomechanical analysis reveals some gaps and technical issues of the participants' state and provide a challenge for the coaches for further improvement.

Keywords: *rowing, technique, biomechanics, rowing style*

INTRODUCTION

Rowing is a well-known competitive sport using boats and oars. It's part of the Olympic Games since 1900. The International Rowing Federation is one of the first founded in the year of 1892. Under FISA rules, all races take place over a 2,000-metre straight course on still water, each crew racing in a separate, buoy-marked lane (Baudouin, 2004). Approximately 80% of the total energy comes from the aerobic system, but high-intensity intermittent efforts are performed at strategic moments of the race. Moreover, a technical skill analysis of the movement biomechanics can help improve strength application and the energy reserves used by contracting unrelated muscles. (Miarka, et al, 2018). The racing stroke begins with the entry of the oar blade into the water (the catch). Then follows the Drive phase, when the oar is underwater and moves the boat forward. The end of that phase and extraction the blade out of the water is called Finish. Turning the blade horizontally by wrist motion as the oar handle is depressed to raise the blade clear of the water at the beginning of the recovery is called feathering. Moving the oars horizontally back to the beginning is called Recovery phase. Turning of the blade from horizontal to vertical position as a preparation for the catch is called squaring. (Britannica, 2019)

Performance in rowing is a complex matter as in any sport. It requires high physiological power production, effective technique, mental toughness, and smart management of an athlete's lifestyle and training. The main purpose of biomechanics in rowing is the improvement of technique (Nolte, 1991). The objective of the study of biomechanics in rowing is to make boats go faster. Biomechanics is interested in how the rower converts his/her physiological capacity into moving the boat. Research has shown that there are certain indicators, which point to an individual's aptitude for the sport (body height, arm length, lean body mass), and a number of biomechanical principles, have been identified which apply to all rowers (tall or small, sweep oar or scullers), (Kleshnev, 2002).

Factors that affect boat speed are important determinants of rowing performance and should form the basis of feedback to rowers and their coaches. Biomechanical analysis of rowing has led to variables that are causally linked to boat speed. With modern technology, these variables can be mea-

sured and feedback can be presented instantaneously on-water, or be presented simultaneously with video after the event (Richard, 2002).

The aim of the study is to use in-deep biomechanical analysis of the technical characteristics of the elite Bulgarian rowers, summarize them and compare with the existing models of the rowing cycle. That study would describe some strength and weak points of the "Bulgarian" rowing style and helps coaches to work together with the same goal.

METHODS

Subjects

Five male heavyweight rowers from Bulgarian National Team participated in this study (age 24 y ± 4,95 y, height 192,6 cm ± 3,97 cm, weight 95 kg ± 3,54 kg). They all have an international experience on Juniors, Senior B, and Senior A level.

Design

Rowing data were collected in an individual racing single skull boats, using BioRowTel Measurement System, developed by Dr. Valery Kleshnev, during the period 12.04 – 03.05.2019. The test protocol is designed to provide standard conditions and to make results comparable between rowers and between different tests of the same athlete. The test consists of one continuous 2000m piece at full racing force effort, but with varying stroke rates as shown in Table 1:

Table 1. *BioRow Testing Protocol*

No	Split (m)	Lap (m)	Stroke Rate (1/min)	
			Small boats	Big boats
1	1 – 100	100	Start max.	Start max.
2	100 – 500	400	20	20
3	500 – 1000	500	24	24
4	1000 – 1250	250	28	28
5	1250 – 1500	250	30	32
6	1500 – 1750	250	32	34-36
7	1750 – 1900	150	Racing	Racing
8	1900 – 2000	100	Max.	Max.

The data samples are taken and averaged for every stage. The raw data collected during a testing section usually contains many stroke cycles, which have various durations and biomechanical variables:

- Boat Acceleration 3D (m/s^2)
- Boat Velocity (m/s)
- Boat pitch, roll and yaw (deg)
- Oar Angle Portside (deg)
- Vertical Oar Angle Portside (deg)
- Handle Force Portside (N)
- Seat Position (m)
- Oar Angle Starboard (deg)
- Vertical Oar Angle Starboard (deg)
- Handle Force Starboard (N)
- Trunk Position (m)

Statistical analysis

All the variables were filtered and processed with MS Excel up to one summarized stroke for each distance leg. These typical strokes were compared in the same test and between the athletes. For this study, we used only leg 7 data, which is related to the racing speed and stroke rate. Standard variation analysis was performed (Range, Mean, S, v) for the group of athletes, and all the data were compared with the "Gold Medal Standard", developed by Dr. Valery Kleshnev (Kleshnev, 2011).

RESULTS

In the results presented (Table 2), we measured and calculated 22 different variables of the rowing stroke, plus body dimensions and age. Despite the big difference in their age, they have quite similar anthropometric, kinematic, and dynamic variables. The biggest variation is on the "Catch Factor" indicator. It shows the difference between the moments when the handle and the seat change their directions. The range of this variable is from 2,0 ms up to 28,3 ms or 26,3 ms in total. Other indicators with bigger variations are the Catch force gradient and the Max Blade Depth. Regardless of these differences, most of the variables are homogeneous, so the group can represent the most used rowing style in Bulgaria.

Table 2. *Results from the test (n=5)*

	Criteria	Range	Avg	S	v (%)
1	Age (years)	18-30	24	4.95	20.62%
2	Height (cm)	188-198	192.60	3.97	2.06%
3	Weight (kg)	89-98	95.00	3.54	3.72%
4	Timeover 2000m (m:s,0)	6:54.7-7:05.7	06:58.3	00:06.0	1.42%
5	Prognostic speed at target rate (based on EWpS)	6:38.0-6:55.1	06:46.2	00:07.7	1.89%
6	Racing Stroke Rate (1/min)	33-34.6	33.88	0.61	1.81%
7	Total angle (deg)	110.6-118.4	113.34	3.00	2.65%
8	Average Force (N)	389.6-431.4	409.08	15.38	3.76%
9	Work Per Stroke (J)	755.5-844.7	796.90	34.62	4.34%
10	Rowing Power (W)	434-476	450.20	22.49	5.00%
11	Catch Angle (deg)	-56.9--73.9	-67.62	6.87	10.16%
12	Finish Angle (deg)	36.8-56.4	45.70	6.98	15.28%
13	Catch Slip (Deg)	6.8-9.9	8.08	1.21	14.94%
14	Release Slip (deg)	23.2-28.2	26.28	1.91	7.28%
15	Effective Angle (deg)	67.1-72.7%	69.68%	0.02	2.87%
16	Max. Blade Depth (deg)	-7.3--10.7	-8.36	1.44	-17.20%
17	Max. Force (N)	661.3-796.7	745.62	50.72	6.80%
18	Ratio Aver / Max Force (%)	51.8-58.9%	55.00%	0.03	5.52%
19	Position of peak force (% of SL)	31.3-46.3%	37.06%	0.06	15.27%
20	Catch force gradient (deg)	9.3-17	13.40	3.10	23.15%
21	Finish force gradient (deg)	36.7-48.6	42.44	5.51	12.99%
22	Legs drive (m)	0.46-0.58	0.53	0.04	8.24%
23	Legs Max. Speed (m/s)	1.04-1.44	1.19	0.15	12.81%
24	Catch Factor (ms)	2.0-28.3	13.46	10.49	77.95%
25	Rowing Style Factor (%)	52.7-79.0%	69.12%	0.10	14.99%

The Table 3 shows the comparison between the results achieved by the Bulgarian rowers and the suggested model. Due to the different values and measurement units, we presented the difference in percentage to establish where the biggest digressions were. We can see that all the achieved results were weaker than those of the mode, which is normal and expected. There was only one exception – Finish Angle, which measures the maximal angle of the oar after the perpendicular. The most significant difference was observed in the Catch Factor – 140,93 %. But the problem was not only this but also the positive value of the result which means that upon the change in direction, in the Catch, the handles went before the seat through flexing the arms or opening the back. This was also the reason for the big difference in the indicator Rowing Style Factor. There were also significant differences in the indicators Catch and Release Slip. They determine when the blade of the oar submerges completely after the beginning of the Driving Phase and when it begins to show above water in the end. These are losses of propulsive force and lead to a reduction in the Effective Angle (17,94 %). There was an exceedingly significant loss at the end of the Drive Phase – Release Slip – 121,94 %. The differences in the dynamic indicators were relatively close and expected, considering that the model is an example of achieving the results needed for winning a gold medal.

Table 3. *Comparison between the "Gold Medal Standard Model" and results obtained*

	Criteria / Name	Model	Avg. Results	Execution	Diff.
1	Timeover 2000m (m:s,0)	06:32.5	07:07.8	108.99%	8.99%
2	Prognostic speed at target rate (based on EWpS)	06:32.5	06:56.7	106.16%	6.16%
3	Racing Stroke Rate (1/min)	37.0	34.00	91.89%	8.11%
4	Total angle (deg)	114.0	112.23	98.45%	1.55%
5	Average Force (N)	460.0	399.53	86.86%	13.14%
6	Work Per Stroke (J)	892	764.93	85.77%	14.23%
7	Rowing Power (W)	550	433.33	78.79%	21.21%
8	Catch Angle (deg)	-70.0	-66.55	95.07%	4.93%
9	Finish Angle (deg)	44.0	45.65	103.75%	3.75%
10	Catch Slip (Deg)	6.0	8.00	133.33%	33.33%
11	Release Slip (deg)	12.0	26.63	221.94%	121.94%
12	Effective Angle (deg)	84%	69.10%	82.06%	17.94%
13	Max. Blade Depth (deg)	-7.5	-8.13	108.44%	8.44%
14	Max. Force (N)	850.0	734.27	86.38%	13.62%
15	Ratio Aver / Max Force (%)	55%	54.48%	99.06%	0.94%
16	Position of peak force (% of SL)	38%	36.38%	95.75%	4.25%
17	Catch force gradient (deg)	11.4	13.25	116.23%	16.23%
18	Finish force gradient (deg)	29.6	43.57	146.99%	46.99%
19	Legs drive (m)	0.58	0.53	90.80%	9.20%
20	Legs Max. Speed (m/s)	1.40	1.21	86.07%	13.93%
21	Catch Factor (ms)	-25.0	10.23	-40.93%	140.93%
22	Rowing Style Factor (%)	95%	72.63%	76.46%	23.54%

Figure 1 shows the percentage execution of the model instead of the difference, and the indicators have been sorted in ascending order.

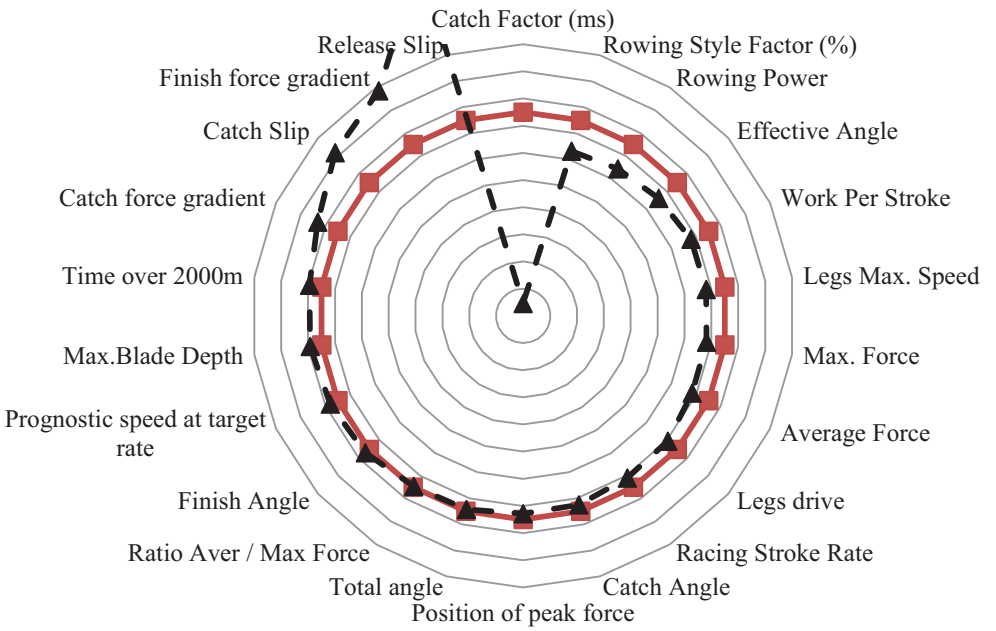


Figure1. *Percentage execution of the model*

Besides the noted big difference in the Catch Factor, we can see the non-execution of the indicators such as the Rowing Style Factor and Effective Angle. The dynamic indicators with values similar to the model follow. As for the indicators for the stroke length and the shape of the force curve, there was an almost complete concurrence with the requirements, while in the losses during the change in the direction of the movement in Catch and Release, the differences got very big.

DISCUSSION

This research presents an average model of the rowing stroke, used by the leading rowers in Bulgaria. The analysis of the obtained results shows the relative values of most of the indicators. There were differences in the group as regards the indicators related to the change in the direction of the movement in front and the depth of submersion of the handles.

The slight differences in the total oar angle indicate the systematic and purposeful work in this direction. The dynamic characteristics of mean and maximal force, their ratio, and the realized work and power also showed quite similar values for the different competitors. The time for overcoming 2000 m, the prognosticated time (at a maximum efficient technique), and the competitive speed fluctuated within under 2 % differences.

All these results and the long period during which the competitors prepared together are indicative of a typified rowing technique and can be accepted as a standard in the work of the National Team.

When comparing the mean values of the group with the "Gold Medal Standard", we can see a number of digressions which hamper the proper technical execution of the rowing stroke and lead to a weaker sports result. Revealing similar, valid for the whole group digressions, is useful for the future work of the team through directing coaches' attention to particular areas which need improvement.

When viewing the percentage execution of the model, we can see grouped digressions in two major areas. The most serious problem is the difference in the CatchFactor. We can see a reversed alternation of the muscle groups in charge of the change in direction in the Catch. According to a lot of authors (Baudouin, 2004; Held, 2020; Jones, 2002; Kleshnev, 2002), the movement of the legs should overtake the change in the direction of the handle. This enables the thigh muscles to develop a strength potential and provoke a greaterforcegradient applied to the handles. According to Kleshnev, V. (2002, 2011), this overcoming should be 0,025 – 0,050 sec. The researched competitors showed a delay in the legs compared to the handles with 0,002 – 0,028 sec (0,013 sec). This delay leads to subsequent digressions such as the Catch Slip (33,33 % more), RowingStyleFactor (23,54 % more), and Catch force gradient (16,23 % more).

The other group of digressions is in the Release and Recovery. Here, the major mistake is the early pressing of the handles downwards and getting the blades out of the water before the endpoint. This is measured with the indicator Release Slip (121,94 % more than the acceptable value according to the model). This leads to a reduction in the Effective Angle (17,94 % less), and a much faster decrease in the applied force in the handles below 70% of the Finish force gradient (46,99 % earlier).

The analyzed results show that the researched competitors have mastered, to a great extent, the outer shape of the rowing stroke, applying the muscle efforts needed. At the critical moment of change in the directions in the Catch and Release, we can see significant reserves for improving the technique. An overall change in the model for the Drive is needed. The legs should overtake the shift in the handles' direction, and the first 20 % of the driving phase should be performed only by them. This would lead to a significant acceleration of the boat in the next driving phases after the subsequent inclusion of the body and arms. At the release, one should pay special attention to holding the blades in the water until the last moment and reducing the loss of strength in the end.

PRACTICAL APPLICATIONS

This research presents an average model of the technique of a group of elite rowers. There has been no similar survey found in literature so far nor a publication of so many biomechanical data. The equipment and testing method used in this research are widely known and used by many leading National Rowing Teams worldwide, but there are no published and systematized data. We could not make another comparison besides the one with the presented testing protocol model, which the author

has created on the basis of his surveys. After the publication of this research, it will provide the other scientists with real data to compare their results.

ACKNOWLEDGMENTS

This research was conducted with the support of "Hebros" RC and the Bulgarian Rowing Federation. Thanks to my colleague and mentor, Prof. Rumian Hristov (1954 – 2022) – a great Biomechanics specialist and the most inspirited person I have ever met.

REFERENCES

Baudouin, A., & Hawkins, D. (2004). Investigation of biomechanical factors affecting rowing performance. *Journal of biomechanics*, *37*(7), 969-976.

Britannica, T. Editors of Encyclopedia (2019, May 21). rowing. Encyclopedia Britannica. https://www.britannica.com/topic/rowing-boat-propulsion-and-sport

Held, S., Siebert, T. &Donath, L. (2020). Changes in mechanical power output in rowing by varying stroke rate and gearing, *European Journal of Sport Science*, 20:3, 357-365, DOI: 10.1080/17461391.2019.1628308

Jones, C. J. F. P., & Miller, C. (2002). The mechanics and biomechanics of rowing. In *Coaching Forum Meeting at York City Rowing Club*.

Kleshnev, V. (2002). Power in rowing. *International research in sports biomechanics*, 224-230.

Kleshnev, V. (2011). Biomechanics for Effective Rowing Technique. *2011 WORLD ROWING COACHES CONFERENCE* – 10-13 November 2011, Varese, Italy

Miarka, Bianca, et al. "Biomechanics of rowing: kinematic, kinetic and electromyographic aspects." *Journal of Physical Education and Sport* 18.1 (2018): 193-202.

Nolte, V (1991). Introduction to the biomechanics of rowing. Coach 2(1), 1-6.

Richard M. Smith & Constanze Loschner (2002) Biomechanics feedback for rowing, *Journal of Sports Sciences*, 20:10, 783-791, DOI: 10.1080/026404102320675639

Corresponding author:
Nikola Gospodarski, PhD
Water Sports Department
National Sports Academy "Vassil Levski"
E-mail: gospodarski@abv.bg

IMPORTANCE OF THE KINEMATIC CHARACTERISTICS OF MAE GERI FIGHTING TECHNIQUE FOR SPORT-RELATED INJURIES IN BULGARIAN KARATE SHOTOKAN ATHLETES

Dimitar Zagorsky
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
Introduction. As a sport to which more and more young people are turning to, Karate, and especially its most prominent martial art associated injuries, is gaining more and more importance in our present. Unfortunately, little is known about the kinematic characteristics while performing Mae-Geri front kick Shotokan Karate. Special emphasis will be placed on the goal of this fighting technique - more skillful control and effective use of body segments by well-trained fighters will allow maximum acceleration and reaching the adversary both faster and yet-in controlled fashion, without the risk of the injury of both participants in the match
The aim of this study will be to compare the kinematic characteristics of the lower limbs when performing a specific fighting technique (Mae-Geri kick) by Karate athletes from two different groups according to rank/sports experience, in relation to the sustained traumatism.
Methods and methodology of the study. For this purpose, a kinematic analysis was performed by video registration (with a digital camera Casio ZR 200 with a frame rate of 120 frames/sec) and subsequent image processing of the video to measure kinematic parameters with a software product (SkilSpector). In our initial experiment, 18 of the 22 Karate fighters belonged to two distinct groups (9 black belts from I and II dan, and 9 from 1 to 3 kyu).
Results and analysis. According to our comparative analysis, we can assume that the Bulgarian Karate athletes are: both on equal grounds based on kinematic characteristics of the Mae-Geri front kick execution, yet also leading their international counterparts in terms of lower frequency of traumatic injuries in key regions of the body and types of injuries. In turn, the resulting increase in injuries in the group of high-performance athletes (1-3) kyu is mainly explained by the increase in self-confidence, executing riskier attacks with higher chances of interception and resulting in injury by their adversary, allowing our Bulgarian elite Karate fighters to stand out (from I dan and up) for which this type of injury is mostly exception.

Keywords: *Karate Shotokan, Sports injuries, kinematic analysis, front-kick*

INTRODUCTION

Nowadays, Karate is one of the most popular combat sports among young people. Karate, or „empty-hand" fighting, is a martial art sport focused on blocking opponent's attacks. Here, insight from Master Funakoshi into the essence of Karate as a martial art will be positive for the awareness of all the challenges - it is a system of self-defense based on the „natural" weapons of the body (hands, legs, etc.), the effective use of which at the necessary moment in the form of techniques to block/parry one attack, would allow the execution of a subsequent counterattack with lightning speed and striking power (Funakoshi, 1973). In Karate, the legs, and in particular the feet, are also extremely important weapons, converting lower extremities as a means of choice selected by the fighter in order to win. Karate lower extremity techniques are so well developed that their use doubles the range and effectiveness of a karate athlete's fighting techniques. When discussing the later, however, we should consider that: they are performed from a greater distance (often in a straddling position), plot a longer trajectory through their execution, and have thereby inherently reduced precision; they are easier to „spread cognition" due to the requirement for compensatory movements of the whole body performed before and after their execution, and are also riskier in terms of maintaining balance and extremely difficult to control in the final phases of their completion. Although these techniques are very attractive in competitive mode, they are nevertheless a product of multiple factors. Success in their application depends on many factors: the level of training, the assessment of distance, coordination, and especially the stability of the position in terms of balance, especially when the performing athlete is on one leg (where the surface of support is only on the heel or the pad of the standing foot), as and at the moment of foot contact with the target.

In today's world, we are witnessing a significant contradiction between the traditions tied to the centuries-old experience of the Karate masters of old and the level of modern sports scientific knowledge applicable to this sport. Therefore, it is important for the future development of this combat sport to apply the methods of the exact sciences to analyze the specific techniques in Karate. But it was only in the last decades that the fighting techniques used in Karate were subjected to targeted scientific research, emphasizing on the principle that the proper execution of each technique, when it is consistent with the limits of the human anatomy, will not allow its practice to damage health of the trainee, and basic principles were extracted for their most effective implementation. Here, the main principle is that accomplishing athletic achievements in Karate is possible only by concentrating high kinetic energy in a single body segment for the shortest period of time. Peak levels of performance in Karateka will inevitably be associated with explosive muscle contraction and resulting force. It would not be an exaggeration to say that the practice of most of the techniques in Karate is actually oriented towards concentrating power at a precise time and in a specific location. However, according to a circle of Bulgarian traumatologists, strength, in a traumatic sense, can also be the ability of the athlete through muscle contraction to create a counteraction to the externally applied kinetic energy to certain units of the musculoskeletal system or the body as a whole (Takov, Tivchev, 1996). In this sense, muscle strength will have a protective role not only in relation to the externally directed kinetic energy imparted by another moving body - an object, another athlete but also to the forces that arise inside the elements of the musculoskeletal system during movements as a component of the combat load and the subsequent risk of injuries.

The forward kick Mae Geri (whiplash) lower limb executes a pendulum movement with a strong swing, as from the bent knee joint (the knee leads), a sharp whiplash movement follows, with a subsequent rapid retracting of the lower leg and the foot back. In the jab kick, the striking part of the lower limb (foot) moves in a straight line towards the target and is associated with a longer period of contact with the opponent's body.

Regardless of the choice of fighting technique, biomechanical expediency in kick execution requires the whole body to be effectively involved, paying particular attention to the supporting leg being firmly fixed to the ground, able to absorb the weight of the body and the acceleration created, without losing balance. Thus, the requirement to conduct an attack and defense leads to a maximum forward lean, with a single supporting leg in a wide stance and feet apart - a fighting stance requiring a lowering of the center of gravity, when the goal is seeking to generate powerful punches or kicks (Winter, 1995). This extended position can become a disadvantageous for the competitor in terms of the speed developed during the bout. Finding the golden mean between a stable and wide stance, and a projection of the center of gravity dynamically shifting according to the requirements for execution of complex techniques, is one of the greatest challenges for any Karate-Shotokan athlete.

The kinematic analysis of various authors of the various Karate strikes presents them all as series of activations sliding from the near to the far end of an extremity, where initially the proximal muscle groups show a greater intensity of activation than the more distant ones (Anson, Mawston, 2000; Zehr, 1997; Baratta, 1988). In analyzing the high forward kick used in most Far East martial arts, we can reasonably use a comparison to the football kick. For a host of researchers, both kicks are extremely good examples of „proximal-to-distal" acceleration, where the cumulative linear velocity of the knee slows to nearly zero at the time of maximum cumulative linear velocity of the foot (Putnam, 1983; Dunn, Putnam, 1988). Sorensen's team observed exactly this - in kicks (Taekwon-Do), the deceleration of the proximal segment is actively performed by muscles synchronizing the acceleration of the distal segment through deceleration of the proximal one (Sorensen, 2008). The main difference with the soccer kick comes from the fact that when kicking the ball the target is usually at ground level or slightly above, while the Karate high kick is aimed (ideally) forward at chin level.

Sbriccoli's analysis is specific in that simultaneous activation of agonist and antagonist muscles may reduce the total muscle angular velocity derived from their divergent actions and lead to a prolongation of the effective meantime for contraction, once again drawing our attention to the fact that in order to stabilize the involved joint the athlete will always lose some of the derived explosive force

(Sbriccoli, 2010). In addition, agonist-antagonist co-activation may result in increased stiffness/stability of the involved joint, especially in high-velocity techniques, versus slower and more accentuated body movements.

As ***the aim*** of the study, we set ourselves to the discovery of the relationship between the kinematic parameters and the effectiveness of the Mae-Geri technique, taking into account the sports experience and acquired degree of the studied experimental group of elite and middle-class Karate-Shotokan athletes, and through apparatus support and methods, and subsequent target analysis of the trajectory and speed of the movements, to determine critical factors for the manifestation of the most serious injuries for this sport among the Bulgarian Shotokan fighters, aiming both to support the training process from the point of view of the improvement of the sports techniques, and reduction of injuries during their execution.

METHODOLOGY

For this purpose, a biomechanical kinematic analysis was performed by video recording (with a Casio ZR 200 digital camera with a recording frequency of 120 frames/s) and post-processing of the video image to display the kinematic indicators with a software product (SkilSpector). Of the twenty-two Karate competitors who participated in our main experiment, 18 belong to two distinct groups (nine 1st and 2nd Dan black belts and nine 1st to 3rd kyu). The author's Questionnaire Card of all 22 Elite Bulgarian Shotokan-Karate competitors is used, and the results are related to indicators of international Karate athletes derived from world literary sources. Variation and correlation analysis of the results was done with the statistical program package SPSS v.19.

RESULTS AND DISCUSSION

The research conducted by our team gave results that come close to those derived by international authors and according to literature data. However, the values of the average amplitude of achieved angle of the studied combat technique (Mae-Geri) in our experiment group were lesser, which is acceptable due to the lower qualification level by our inexperienced fighters (Zagorsky, 2017).

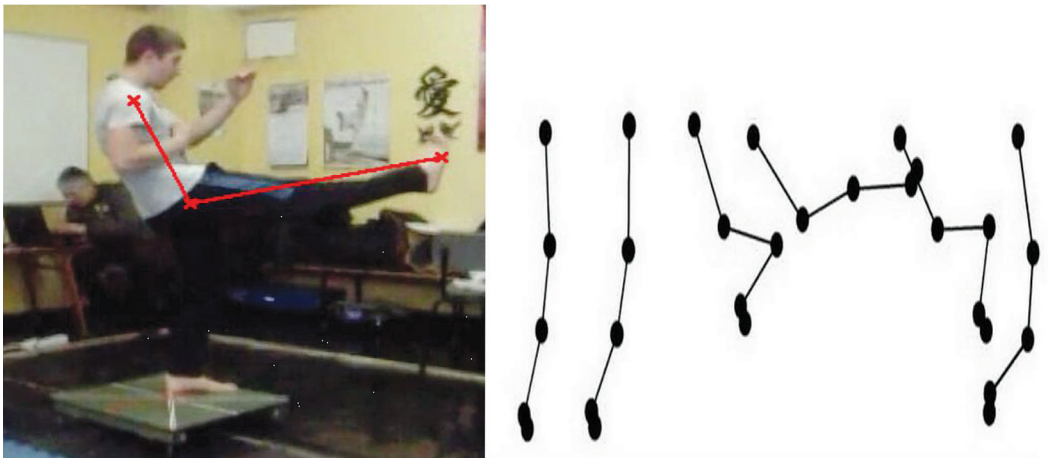


Figure 1. *The Mae-Geri technique, presented through chosen points for measuring effective angles and velocities*

In the Mai-Geri technique we can note a certain biomechanical feasibility: in search of maximum speed, yet under control, to reach the opponent (or the target area of his body), but never with excessive force, so that there is no risk of injury to the player or the opponent.

What is valuable in the research of Sbriccoli's team is the emphasis on the peculiarities of the activation of one of the muscles in the posterior group of the thigh (Sbriccoli, 2010). This analysis presents the high eccentric activation of m.biceps femoris during the Mai-Geri knee extension (phase 2) technique in high-velocity movements as a necessary anticipatory activation. In this way, the lower extremity prepares for the inevitable and sought-after knee flexion parallel to the hip extension in the subsequent return phase of the lower extremity, which are also logically faster performed in the international class of fighters. Using this control

mechanism, international-class athletes demonstrate a greater ability to execute an accurate shot with better hip and knee joint stability.

Applying this detailed approach to the analysis of our colleague Puzo's Mae-Geri kick, we can easily point to the combination of successively activated m.quadriceps femoris from the front group, and m.semitendinosus and m.biceps femoris, from the back of the thigh groups as crucial not only for the quick and successful execution of the kick (phase 2), but also the equally important return of the leg to the starting position (phase 3), and the choice of whether to follow with another attack with the lower limb or to step forward to recover the balance. Even just from this sequence in describing their function, both groups mark the challenges in proper execution and the risks because of desynchronization in the activation-relaxation of related injuries: excessive and rapid shortening of an abnormally developed quadriceps muscle can contribute to knee damage or tendon overload apparatus around the knee joint whether due to contact with/passing through the target. In turn, a slow return to the starting position can compromise the attacker's balance and ability to block a counter-attack. Any rapid change in tactical situation can contribute additionally by excessive knee flexion to unlocking soft tissue or ligament damage, with long-term adverse effects of sport-related injuries to the player's future.

Therefore, it stands to reason that elite athletes will recruit a greater number of fast motor units from the quadriceps during the attack phase, and the ischiocrural group during the return phase. Thus, for the assessment of motor skills and their improvement, even for the purpose of preventing muscle strains in Mae-Geri front kick, it would be justified to focus our attention precisely on these heavily loaded muscles from the posterior/ischiocrural group.

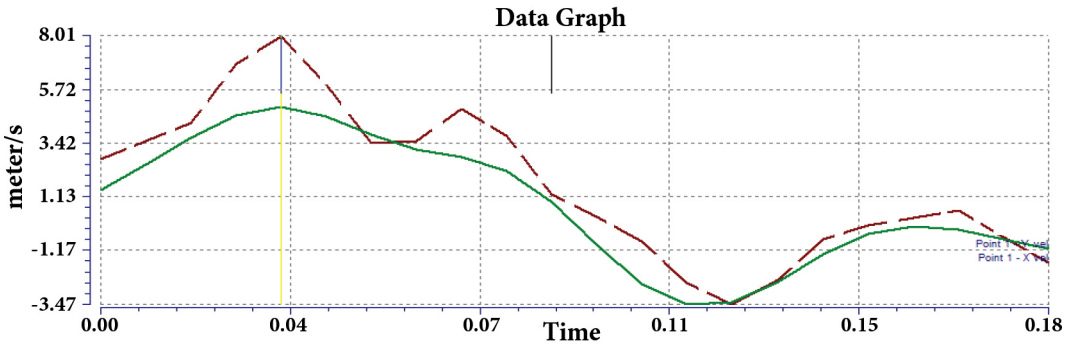


Figure 2. *Visual representation of acceleration of 3 reference points of lower extremity (coxal, knee joint, and foot) during Mae-Geri kick*

Of particular note is the fact that, despite its small contribution to the kick, the quadriceps femoris (m.rectus femoris) has an essential role in bringing the kicking leg to the highest possible level in the execution of a kick toward the target point (chest). As already noted, stopping the hip flexion too early will be a critical error in the execution of the technique, preventing the achievement of the intended goal, and thus leading to an over-compensatory movement of „chasing" the opponent, prone to loss of balance and risk of subsequent trauma. It is also worth noting the active role of the m. multifidi, as the percentage of participation in the performance, is high, although international authors in particular Doder and al., note that the effectiveness of the kick depends particularly strongly on the pelvis being correctly positioned and stabilized in advance in execution (Doder, 2008). Additionally-our own paedagogs suggest when performing this strike, there be no vertical movement of the axial skeleton (raising the shoulders), or rocking of the pelvis back (any changes in the posture that would reduce the efficiency and power of the technique). This shifts the focus when performing Mae-Geri to be on the pelvis pushing forward, and following the attack, so as not to lose balance or focus of the blow (or „Kime") (Bogdanov, Ivanov, 1972).

Our international level athletes develop greater knee acceleration (peak in angular velocity in extension Figure1) in the early phase of kick preparation (the end of the „preload"), explaining the faster first peak angular amplitude of knee exten-

sion. In addition, it can be noted that the upper limit of angular velocity is reached more quickly during plantar dorsiflexion by our Karatekas - international standart. The goal is to activate a wider array of muscles before the contact with the opponent's body and secure the terminal joint where is the greatest load - the ankle joint (in particular, the load is highest on m. triceps suriae).

This analysis of fighting technique brought up the fact that our elite athletes engage a greater volume of the work capacity of their quadricep muscles in the attack phase, as well as the ischiocrural group of muscles in the subsequent return phase of the kick, providing the most explosive force at the end of the preload phase, which can also explain a higher speed of leg movement in the international group, and not only: international athletes expectedly perform a Mai-Geri kick in a shorter time and with a greater impact force. And again, the balance in the co-activation of the mentioned two groups of muscles will further reduce the risk of injuries in the joints involved in the movement (especially the knee). Due to the already mentioned mechanism of sought delay in the execution of the Mai-Geri kick (as not to deliberately injure the opponent), the disproportion presented between the acceleration of the thigh by the muscles around the coxal joint and the acceleration developed by the lower leg is expected and explainable.

Table 1. *Mean values of velocity and effective angle of execution of Mae-Geri kick for Bulgarian Karate athletes*

Individual technique	V Mai-Geri	Degree Mai-Geri
X	12.3	70.8
S	3.6	13.2
V	29%	19%
As	0.0	0.2
Ex	-0.7	-1.4
Max	19.8	94.0
Min	6.8	53.0
R	13.0	41.0

In his research, Giannino gives us an effective pre-strike acceleration of the foot up to a phenomenal 19 m/s, highlighting outstanding acceleration values provided by the thigh muscles up to 108m/s^2, and the lower leg (from the combination of the thigh and calf muscles) up to 78 m/sec^2 (Gianino, 2010). For our elite Karate fighters, the Mai-Geri kick might be performed with a lower average velocity (12.3 m/s), with marked maximal and minimal values from 6.8 to 19.8 m/s for the whole group of athletes (Tabel 1). Compared to his study, our results point out that the executed velocities of the lower extremity vary: ranging from close to those of Gianino for our elite athletes, to three times lower for our less combat-experienced athletes of 1st to 3rd kyu. Regarding the Mai-Geri technique alone, the following stands out: international athletes predictably perform a Mai-Geri kick in a shorter time, with greater impact force, as well as with higher repeatability of lower extremity kinetics and kinematics compared to athletes from a national level, although as mentioned by Pozo no significant difference is determined when measuring maximal applied force between our two groups of Bulgarian Karate athletes (Pozo, 2011).

Such a result is not surprising at all. The ultimate goal of a kick in competitive Karate is not to cause maximum damage to the opponent, but to mark a point and win a victory. These results are an inevitable consequence of the more skillful control and efficient use of the body segments, the purpose of their acceleration being to reach the opponent faster, and yet-controlled: a goal that the mentioned two groups of thigh muscles also fulfill perfectly in our athletes.

After performing this more detailed analysis of the Mai-Geri kick, we gained more detailed infor-

mation about the mechanics of co-activation of the muscle groups involved, surpassing the individual extremity (which was basically one of the drawbacks of the Gyaku-Zuki hand technique). In relation to kicking, a truly effective punch involves the pelvis and opposite leg as of paramount importance, yet this power transfer can easily be lost in the video recording session, obscured by the complex sliding of segments of the upper (hitting) limb. In kicks with the lower extremity, the use of the muscles both of the opposite supportive leg, and accompanied by contraction from the abdominal wall muscles and those around the spine, is not only inevitable, but even mandatory for a stable, forceful, and properly aimed kick. As an additional plus, we will emphasize again that the balance in the co-activation of the mentioned two key groups of muscles (the quadriceps and the ischiocrural group) will further reduce the risk of injuries to the involved (especially the knee) joints of the striking limb.

Table 2. *Comparison between mean values of lower extremity velocities in Mae-geri kick of international and national standart Karate fighters*

International	V Mai-Geri	National	V Mai-Geri
average	12.0	Average	10.6
max	16.8	Max	14.3
min	6.8	Min	7.4

When comparing lower extremity techniques, respectively Mae-Geri‘s average speed drops to 12 m/s (with a range of 6.8 to 16.8 m/s) in our elite players (Table 2). Again, it is striking that our own Karate fighter‘s tendency to match the expected values compared to their international counterparts is not only preserved, but also enhanced by the Mae-Geri kick, where the final average speed may be lower (compared to the Gyaku-Zuki hand technique), but here we also notice the biggest intragroup difference - in fact, our best fighters of national and international rank are 2.4 times faster, compared to the slowest of their group of Karate athletes from 1st Dan and above. This analysis once again highlights the effective control of the body and the execution of successful techniques in terms of speed and power by the athletes with a longer and more successful competitive experience.

Thus, using the developed velocity as an objective measure, our study contributes to the scientific research community by documenting the profiles of different types of muscle coordination during the execution of a selected set of fighting techniques and connecting them to their related velocities. Thus, our research can help in identifying some of the main variables contributing to the performance efficiency of the speed/power combination relative to the execution phases of the Mae Geri kick in Bulgarian Karate fighters, marking crucial elements of the technique in a traumatic plan.

Our own experience and work on traumatism among Bulgarian Karate-Shotokan fighters presented a different picture: our own fighters lead their international colleagues in a positive aspect in terms of all trauma data (Zagorsky, 2019). Here, our fighters stand out on multiple levels: out of 17 injuries (39%), 9 are relatively serious, of which only two are located in the knee region, and other two-are fractures (lateral maleolus and big toe). More precisely, this amounts to 21% of all injuries to be serious and affect the lower extremity, an expression of the attention of our own Karateka to their own safety and the integrity of their opponent in a bout. This feature in the training stands out repeatedly, observing the international observations-McLatchie gives even higher (37%) of lower limb injuries (close to our experience), but of them 27% (every 2 out of 3 injuries) are serious, and he also points out that the observed competitors use aggressive techniques both to attack and to defend against strong and dangerous blows of the opponent (McLatchie 1994). Even when combined joint injuries: sprains, and dislocations, as expected, dominate (both upper and lower limb injuries in our athletes cover 49% of all sustained injuries), compared to international rate of 56% marked by the authors, we see a favorable trend in soft tissue injuries of LMS.

This jump in terms of injuries is not just determined by numbers-with the increase in qualification, a serious increase in the injuries sustained, disproportionate to the years of training, was also noticed. The 1-kyu and 3-kyu Karatekas thus presented are close enough in terms of technical mastery that the increase in confidence and the addition of perilous attacks stand out as a factor where the „payoff" of a gained point does not match the chance of parrying or getting injured. This is also the group that proves the dependencies confirmed by Critchley for a proportion between the years of combat experience, and the accumulation and emergence of more and more serious LMS damage.

Thus, we can reasonably state that the studied Bulgarian elite karate fighters (and even the entire studied group) are marked in each selected category of sustained injuries (compared to international experience), in the extremely low end of the spectrum, and, therefore, favorable values. Bringing out our elite I and II Dan competitors as even less affected by the expected (relative to years of training) injuries associated with practicing this combat sport. This illustrates the rule that the combination of good preparation, and controlled handling of the fight on both sides (attacker and opponent), sparingly and with proper defenses in mind, has a favorable effect on the damage sustained and inflicted on the body during competition and training.

CONCLUSIONS

According to the comprehensively presented analysis, we can allow ourselves to assume that Bulgarian Karate competitors are: both equal in terms of kinematic indicators when performing the Mae-Geri kick, and leading their international opponents in terms of a lower percentage of injuries in key areas and types of injuries.

All of the above is a reason to focus the attention of both coaches and competitors about the importance of the combined proper warm-up and maintenance of the muscle in both groups of Karate fighters, as well as when performing those extremely powerful kicks towards an opponent, the player should set greater emphasis on control over Mae-Geri technique, rather than its combat effectiveness or swiftness. Attention should be focused on the developing and prospective combat behavior forming fighters 1-3 Kyu in Karate, where implementing these advices will have the greatest effect, supporting the training process in terms of improving sports techniques, as well as reducing injuries.

REFERENCES

Anson, J., Mawston, G. (2000). *Patterns of muscle activation in simple reaction-time tasks, In Perceptual-Motor Behavior in Down Syndrome.* Champaign IL: Human Kinetics: pp. 46-67

Baratta, R., Solomonow, M., Zhou, B.H. et al., (1988). Muscular coactivation. The role of the antagonist musculature in maintaining knee stability, *Am J Sports Med* 16: pp. 113–122

Bogdanov, P., Ivanov, Sv. (1972). „Karate", Meditsina i Fizkultura // Богданов, П., Иванов, Св. (1972). „Карате", Медицина и Физкултура

Critchley, G.R., Mannion, S., Meredith, C. (1999). Injury rates in shotokan Karate. *Br J Sports Med*; vol.33: pp. 174–177

Doder, D., Malacko, J. (2008). Diagnostic value of tests for estimation and monitoring of suitability of youth for karate sport. *KinSl* vol.14: p.50-59 Karate Faculty of Sport, University of Ljubljana.

Dunn, E. G., Putnam, C. A. (1988). The influence of lower leg motion on the thigh. *International Congress of Biomechanics. In Biomechanics XI-B*, pp. 787-790. Amsterdam: Free University Press.

Funakoshi, G. (1973). Karate Do Kyohanm [in Japanese].Tokyo: Kodansha International Ltd., pp. 3-14

Gianino, C. (2010). Physics of Karate. Kinematics analysis of karate techniques by a digital movie camera. *Lat. Am. J. Phys. Educ.* Vol. 4, No. 1.

McLatchie, G. R., Commandre, F. A., Zakarian, H., et al. (1994). *Injuries in the martial arts.* In: Renstrom P, ed. Clinical practice of sports injury: prevention and care. Oxford: Blackwell: pp. 609–23

Mohsen, G., Hamed, M.S. (2012) The comparison of injuries in boys' amateur epical athletes in three fields: Kyokushin ka, controlling Karate and Aikido. IRAN *Life Sci J*; 9 (Vol. 4), pp. 1365-1371

Pozo, J., Bastien, G., Dierick, F. (2011). Execution time, kinetics, and kinematics of the mae-geri kick: Comparison of national and international standard karate athletes. *J Sports Sci*.; 29 (Vol. 14), pp. 1553-61

Putnam, C. A. (1983). Interaction between segments during a kicking motion. *In Biomechanics vol.VIII-B*,

(edited by H.Matsui and K. Kobayashi), pp. 688-694. Champaign, IL: Human Kinetics.

Sbriccoli, P., Camomilla, V., Di Mario, A., et al. (2010). Neuromuscular control adaptations in elite athletes: The case of top level karateka. *Eur J Appl Physiol.* 108: pp. 1269–1280

Sorensen, H., Zacho, M.,Simonsen, E.B., Dyhre-Poulsen, P., Klausen, K. (2008). Dynamics of the martial arts high front kick in TAEKWON DO. *Journal of Sports Sciences*, 14 (vol.6). pp. 483-495

Takov, E., Tivchev, P. (1996). Frakturite-diagnostika i lechenie. RIA Venel // Таков, Е., Тивчев, П. (1996). Фрактурите - диагностика и лечение. РИА Венел

Winter, D. A. (1995). Human balance and posture control during standing and walking. *Gait & Posture*, vol. 3: pp. 193-214

Zagorsky, D. (2017). Relationship between joint mastery at one hand and the anthropometric, kinematic and stabilographic characteristics of selected sports techniques in Shotokan-Karate. *International Scientific Congress "Applied Sports Sciences"*. Sofia, pp. 85-91

Zagorsky, D. (2019). A study on origins and incidence of sport-related injuries and possibilities for prophylaxis in bulgarian elite karate athletes. *International Scientific Congress "Applied Sports Sciences"*. Sofia, pp. 94-103

Zehr, E. P., Sale, D. G., Dowling, J. J. (1997). Ballistic movement performance in karate athletes. *Med Sci Sport Exer*, vol.29: pp. 1366–1373

Corresponding author:
Zagorsky Dimitar, PhD, MD
Anatomy and Biomechanics Department
National Sports Academy "Vassil Levski"
Sofia, Bulgaria
E-mail: dimzigzag_solo@yahoo.com

KINEMATIC ANALYSIS OF BACKWARD UPRISE AND 5/4 SALTO FWD STRADDLED TO HANG ON PARALLEL BARS

Iliya Yanev & Emil Stoimenov
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
The technique of gymnastics elements is an important factor for the development in gymnastics. Parallel bars is one of the six apparatuses in men's artistic gymnastics all-around. Each gymnastic combination should include elements from four structural groups, which are: Elements in support or through support on 2 bars, elements starting in upper arm position, long swings in hang on 1 or 2 bars, and underwings and dismounts. Gymnasts strive to increase the difficulty of the performed combination over time by including elements with higher difficulty in the 10 (8 for juniors) elements included in the difficulty score. Due to its complexity and the specificity of the starting position, the elements from second structural group on parallel bars appear to be a crucial factor in the formation of difficulty score in the competitive exercises. A new element in group two is backward uprise and 5/4 salto fwd straddled to hang on parallel bars. The purpose of this study was to explain the mechanics of the Backward uprise and 5/4 salto fwd straddled to hang on Parallel Bars, and to identify how the release conditions were created. 2D video-based data was used to analyze the new element recorded at NSA Sofia. APAS was used for digitizing and DLT techniques were used (APAS-Edition 2020, version 14.3.7). The space was calibrated with 8 points with previously known coordinates, and the movement digitized with 7 points of the main joints and the head. Hip action was characterized by a double large input which peaked close to the horizontal on the downswing and after the down vertical due to the active swing action, followed by a smaller positive arms power contribution as the release was approached. Because of swing action, the ankles velocity peaked close after the down vertical. The dominant role of positive hip extension, swing and arms pushing action was highlighted as a major factor contributing to the creation of the final body orientation and desirable release conditions.

Keywords: *gymnastics, technique, parallel bars.*

INTRODUCTION

The technique of gymnastics elements is an important factor for the development of artistic gymnastics. Parallel bars are one of the six apparatuses in men's artistic gymnastics all-around competition. Research on the kinematic analysis of a certain kind of movement is becoming more and more frequent in artistic gymnastics, particularly as the information obtained enables more rational and economical instruction and acquisition of the analyzed movement (Heng, 2007; Hiley & Yeadon, 2007; Takei, 1998; Brüeggmann et al., 1994).

Each gymnastic combination should include elements from four structural groups, which on parallel bars are: Elements in support or through support on 2 bars, elements starting in upper arm position, long swings in hang on 1 or 2 bars, and underswings and dismounts. Very few research papers have dealt with the kinematic analysis of the parallel bars elements. Linge et al. (2006) dealt with the modeling of the parallel bars in Men's Artistic Gymnastics. Prassas, Ariel (2005); Prassas (1994); Tsuchiya et al. (2004); Prassas et al. (2004) dealt with the kinematics of giant swings and back toss on the parallel bars. The double back salto dismount from the parallel bars was the research topic of Gervais, Dunn (2003). Additionally, there were many research papers which deal with the comparative study of two similar elements. Kolar et al., (2002) conducted comparative analyses of selected biomechanics characteristics between a support backward swing and support swing for the 1 1/4 straddle piked forward salto on the parallel bars.

Gymnasts strive to increase the difficulty of the performed combination over time by including elements with higher difficulty in the ten (eight for juniors) elements included into the difficulty score. Due to its complexity and the specificity of the starting position, the elements from second structural group on parallel bars appear to be a crucial factor in the formation of difficulty score in the competitive exercises. A new element in group two is backward uprise and 5/4 salto fwd straddled to hang on parallel bars, performed suc-

cessfully for value in competition during the 2020 Challenge Cup, Szombathely (HUN) and was approve as F Value (EG II) #54 – Figure 1.

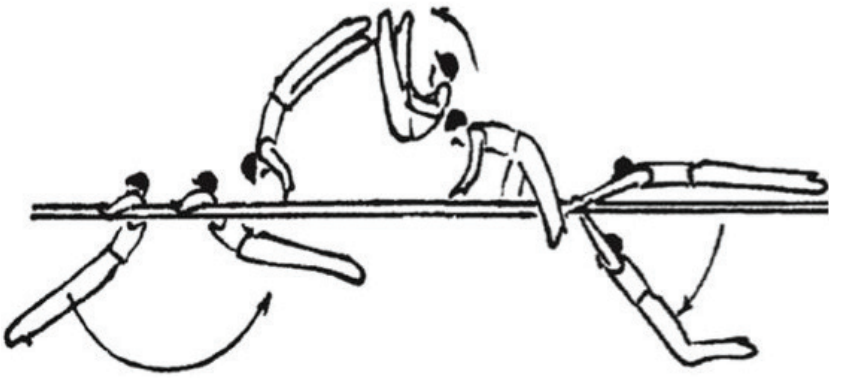


Figure 1. *Backward uprise and 5/4 salto fwd straddled to hang on parallel bars.*

The purpose of this study was to explain the mechanics of the backward uprise and 5/4 salto fwd straddled to hang on parallel bars and to identify how the release conditions were created. 2D video-based data was used to analyze the new element recorded at training conditions in the Bulgarian National Sports Academy training center.

METHODS

We choose to investigate the new element - backward uprise and 5/4 salto fwd straddled to hang. The studied performance is shot with a fixed video camera SAMSUNG with a shot frequency 30 fps, positioned perpendicularly to the side axis of the gymnast at the level of the swing, according to all the requirements of biomechanical analysis. 2D video-based data was used to analyze the new element recorded at training conditions in the Bulgarian National Sports Academy training center. Ariel Performance Analysis System was used for digitizing and DLT techniques were used (APAS-Edition 2020, version 14.3.7). The space was calibrated with 8 points with previously known coordinates – Figure 2, and the movement digitized with 7 points of the main joints and the head. (ankle, knee, pelvis, shoulder, elbow, wrist, and head) – Figure 3.

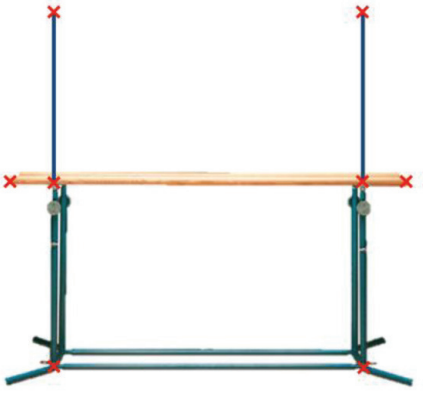


Figure 2. *The space calibration with 8 points*

Figure 3. *Digitized with 7 points of the main joints and the head. (ankle, knee, pelvis, shoulder, elbow, wrist, and head)*

RESULTS

Through video recording and pedagogical supervision, we determined the best performance to subject to kinematic analysis – Figure 4.

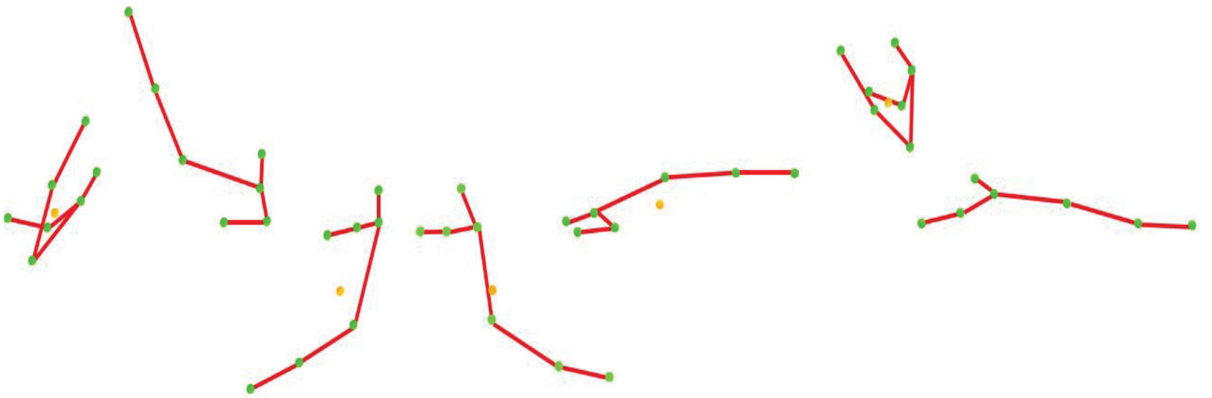


Figure 4. *A sequence of images with mechanical axes and the CG of the backward uprise and 5/4 salto fwd straddled to hang on parallel bars.*

The duration of the element is 2,1 sec. The foothold period, during which the preparatory actions for the exercise are performed is 1,2 sec. The swing is performed for 0,63 sec and repeated hold of the apparatus follows. The starting position is picked upper arm support. The exercise starts with active forward and upward unfolding of the body in the pelvis joints and moves the shoulders closer to the wrists. Configuration of the gymnast remains closed until passing the vertical where the swing is performed and the body stretches. The swing amplitude is 93° in the pelvis joints – Figure 6. The gymnast remains in open configuration until the end support. The angle between the pelvis joints is respectively 222°- Figure 5.

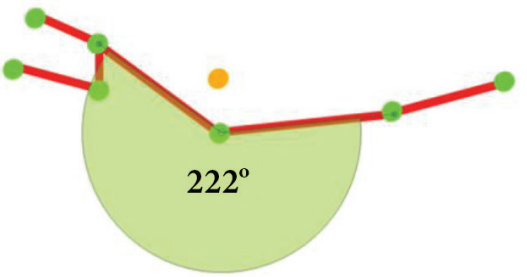


Figure 5. *Release body configuration during backward uprise and 5/4 salto fwd straddled to hang.*

After releasing the bars, the gymnast begins active hip folding action until reaching the highest position of the CG. This is the most piked position of the body. The angle between the torso and the tights is 50°. The angular velocity of the torso is 12,33 rad/s. Combined with folding, arms move from up to down through the sides of the body. After the highest position of CG, the gymnast starts body extension, angular velocity decreases, and the gymnast has better regrouping conditions. Body configuration during regrasp is close. The angle, between the torso and horizontal, is 6°- Figure 2.

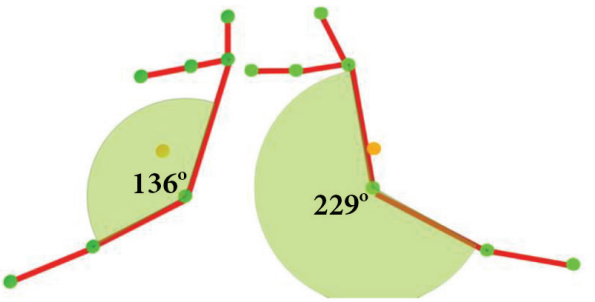


Figure 6. *Swing actions backward uprise and 5/4 salto fwd straddled to hang*

Figure 7. *Regrasp body configuration during backward uprise and 5/4 salto fwd straddled to hang*

DISCUSSION

As we have already specified the purpose of this study was to explain the mechanics of the backward uprise and 5/4 salto fwd straddled to hang on Parallel Bars, and to identify how the release conditions were created.

Kinematic analysis of the technical actions showed, that the trajectory of the centrum of gravity of the gymnast's body (CG) shifts in a backward direction in the non-support part of the element. CG backward movement shows that if the release time is later, the amplitude of the non-support part of the element will be higher. In connection with this, we recommend later and extended swinging actions as well as later release and transition from support to un-support part of the element. Thus, the direction of takeoff will be upwards instead of back and upwards. After hip folding and legs apart torso angular velocity increases – Figure 8.

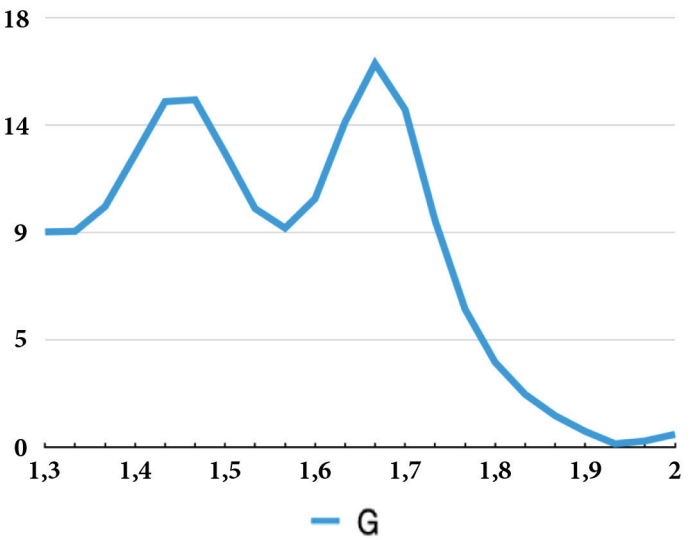


Figure 8. *Torso angular velocity (rad/s) during the non-support phase*

CONCLUSION

Researching of new skills in artistic gymnastics is a process linked to technical knowledge of gymnastics technique, theoretical knowledge, and the creativity of everyone involved in the process. A result of such a process is a new knowledge of gymnastics skills that has successfully performed in an official FIG competition, but it is still relatively unknown in the gymnastic world. The article used a method of kinematic analysis of movement in order to present a new gymnastics element backward uprise and 5/4 salto fwd straddled to hang on parallel bars. As it has already been mentioned, the gymnast's CG moves back into the non-support part of the element. Recommendations for later and extended swing actions were made to the coach and gymnast.

Based on the presented study, we started new research where through a mathematical model, opportunities will be established to improve the amplitude of the un-support part of backward uprise and 5/4 salto fwd straddled to hang on parallel bars.

REFERENCES

Brüeggmann, G.P., Cheetham, P., Alp, Y., & Arampatzis, D. (1994). Olympic Scientific Projects: Approach to a Biomechanical Profile of Dismounts and Release-Regrasp Skills of the High Bar. *Journal of Applied Biomechanics*, 10 (3), 291-312.

FIG. (July 2022). 2022 – 2024 Code of points - Men's Artistic gymnastics. Retrieved October 1, 2022, from https://www.gymnastics.sport/publicdir/rules/files/en_TRA%20CoP%202022-2024.pdf

Gervais, P. & Dunn, J. (2003). The double back salto dismount from the parallel bars. Sports *Biomechanics*, 2 (1), 85-101.

Heng, T. (2007). Kinematical descriptors of circles of short pommel horse in men's artistic gymnastics. *Journal of Biomechanics*, 40, S741.

Hiley, M. & Yeadon, M.R. (2007). Optimization of Backward Giant Circle Technique on the Asymmetric Bars. *Journal of Applied Biomechanics*, 23 (4), 300-308.

Kolar, E., Andlovic-Kolar, K. & Štuhec, S. (2002). Comparative analysis of selected Biomechanic characteristics between a support backward swing and support swing for the 1 - 1/4 straddle-piked forward salto on the parallel bars. *Sports Biomechanics*, 1 (1), 69-78.

Linge, S., Hallingstad, O. & Solberg, F. (2006). Modelling the parallel bars in men's artistic gymnastics. *Human Movement Science*, 25, 221-237.

Prassas, S. Ostarello, J. & Inouye, C. (2004). Giant swings on the parallel bars: a case study. *Proceedings the XXII International Society of Biomechanics in Sports*, 133

Prassas, S. (1994). Technique analysis of the back toss on the parallel bars performed by elite gymnasts. *12 International Symposium on Biomechanics in Sports*, 249-251.

Prassas, S. & Ariel, G. (2005). Kinematics of giant swings on the parallel bars. In Wang Q. (Eds.). *23 International Symposium on Biomechanics in Sports*, 953-955.

Takei, Y. (1998). Three-Dimensional Analysis of Handspring with Full Turn Vault: Deterministic Model, Coaches' Beliefs, and Judges' Scores. *Journal of Applied Biomechanics*, 14 (2), 190-210.

Tsuchiya, J., Murata, K. & Fukunaga, T. (2004). Kinetic analysis of backward giant swing on parallel bars. International Journal of Sport and Health Science, 2 (1), 211-221.

Corresponding author:
Iliya Yanev
Department gymnastics
National Sports Academy "Vassil Levski"
Sofia, Bulgaria,
Email: iliyanev@nsa.bg

BIOMECHANICAL JUMP CHARACTERISTICS OF CHILDREN (9 - 12 YEARS) BASEBALL PLAYERS AFTER STRETCHING PROGRAM

Ivan Ivanov[1], Lyudmil Trenev[1], Zdravko Stefanov[1], Galina Rusimova[1], Dimitar Zagorski[1], Ivan Janakiev[1], Ognian Tishinov[1] , Danail Trenev[2] & Antonio Antonov[1]

[1]National Sports Academy "Vassil Levski", Sofia, Bulgaria

[2]119 SOU "Acad. Mihail Arnaudov", Sofia, Bulgaria

ABSTRACT

The correlation of lower extremity technique with upper extremity performance of adolescent baseball players is essential for the overall sporting achievement. The purpose of this study was to estimate and compare the important biomechanical jump characteristics of children (9-12-year-old) baseball players (n=14) with control children group (n=17) at the same age. Chronojump contact platform, detecting a single jump with one phase of flight, was used to evaluate five important biomechanical jump characteristics – jump height at squat, countermovement and Abalakov jumps, lower limb elasticity index (IE) and use of arms index (AUI). The results obtained showed statistically significant elevation of jump height in the three jumps used at baseball team. Interesting tendencies were received for the other two calculated indices as well. The lack of statistically significant difference for the IE allows us to suggest an increase of the duration, frequency, and number of stretching exercises in the athletes training program. This would increase the lower limbs elasticity index and will improve force increment due to the elastic energy accumulated during the shortening-stretching cycle. The trend for AUI index is elevated in the control group relative to the team. In addition, the presented data draw attention to improving coordination between the lower and upper body, emphasizing the individual characteristics of each athlete. From the presented relations it is clear that the excellent sports achievement is a result from the complete set of all factors that determine it. However, a more comprehensive analysis, using similar biomechanical methods, is needed for a complete comparison.

Keywords: *jump height, lower extremity elasticity index, use of arms index*

INTRODUCTION

Elucidating the complex processes that determine the ability of the human body to adapt to specific intense training programs is critical to improving athletic performance in all sportsmen. Physical exercise has enormous potential in combating the global "epidemic" of chronic metabolic and inflammatory diseases, such as obesity, metabolic syndrome, type 2 diabetes mellitus, and others (Ivanov, 2022). Physiological reactions of the body under the influence of physical exercise are complex, insufficiently studied, and analyzed, in view of the wide spectrum of hemorheological, metabolic, immunological, and hormonal changes (Schild et al., 2016; Walsh et al., 2011). It is known that the immediate systemic physiological response to intense exercise is highly dependent on the type, duration, intensity, cyclicity, and duration of physical activity. The individual level of training (training status) of athletes also affects the body's adaptive response to long-term changes in response to repeated physical exertion (Ivanov, 2022).

Extensive contemporary research has been published analyzing specific bodily answers in response to various training regimens and their relationship to the age, sex, training level, and health status of athletes (Lara Fernandes et al., 2011; Gokhale et al., 2007; Huffman et al., 2008; Zvetkova et al., 2010).

In recent years in Bulgaria, as well as in many other countries, the problem of obesity among children and adolescents is deepening. The way of life, the lack of movement, the remote form of learning at school (Corona Virus 19), spending time in front of the computer are factors that cause, maintain, and deepen this problem. The efforts of parents and teachers should be aimed at introducing children to a physically active lifestyle. Including them in training programs of various sports is a good step to improve their mental and physical health and the full formation o f their personality.

Vertical jump performance has been well-studied in the past (Mackala, et al., 2013; Gadev et al., 2020). An important aspect of vertical jump performance

is the contribution of upper limb segments to force production during jump takeoff (Fukashiro, et al., 2005; Linthorne, 2001).

According to Rodano et al., 1996, the vertical jump can be defined as a complex series of ballistic multi-joint actions where the muscle around the ankle, knee, and hip joint collectively operate to produce patterns of movement (Rodano et al., 1996). The correlation of lower extremity technique with upper extremity performance of childrens baseball players is essential for the overall sporting achievement.

The purpose of the present study was to verify the effectiveness of the applied training program for the preparation of members of the "Lions" Club at National Sports Academy "Vassil Levski", Sofia, Bulgaria. Eight children from this club are part of the children's national baseball team of Bulgaria.

METHODS

In the study, 14 children baseball players from the "Lions" club of the NSA "Vassil Levski", Sofia, Bulgaria, aged from 9 to 12 years, were tested. As a control group was 17 children, in the same age group, without any specialized physical activity, not practicing any kind of sport, from 119 Middle School, Sofia, "Acad. Mihail Arnaudov".

Prior to the experiment parents signed informed consent. The work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki, World Medical Association, 2008).

In the preparation of children's baseball teams, in addition to technical and physical training, stretching exercises were involved. These are extremely important, and improve the elasticity of the skeletal muscles, increase the joint range of motion and have a positive effect on the age growth of the children.

The team of "Lions", NSA in the age group of 9-12 years (n=14) is mainly made up of children who regularly participate in the learning and training process of the club under the guidance of two coaches and in 2022 eight of them, after their good performance, took part in the national team of Bulgaria.

The training methodology for the preparation of the athletes from the "Lions" club includes three modules, the first and last of which are based on dynamic and static stretching, respectively:

A. Dynamic stretching for agility and coordination - 5 exercises, 3 repetitions;
B. Tactical and technical exercises - 10 exercises;
C. Static stretching for relax – 5 exercises, 3 repetitions.

Module A. The use of dynamic stretching in the preparatory part of the training has an excellent effect on the children's concentration towards the training process, and the coaches' approach also creates a positive attitude towards the upcoming activities. It influences the development of qualities such as agility, flexibility, speed of reaction, as well as improves coordination in young baseball players.

The training methodology included the obligatory use of five exercises three times a week through dynamic stretching. The exercises were performed without requiring speed, and the focus was placed on correct execution technique and maximum concentration. Each participant performed 3 times of each exercise by walking the entire ladder.

Exercise A.1. From a basic stance, a jump is made with both feet to the sides and a subsequent jump inward to the next square of the ladder.

Figure 1. *Exercise A.1.*

Exercise A.2. Running with the knee raised high, with the performer trying not to step on the ladder.

Figure 2. *Exercise A.2.*

Exercise A.3. The performer brings one leg out to the right and performs an exercise to catch the ball with the hands, then repeats to the left.

Figure 3. *Exercise A.3.*

Exercise A.4. The performer rapidly alternately steps forward first with one and then the other foot forward into the square of the ladder and a subsequent movement back.

Figure 4. *Exercise A.4.*

Exercise A.5. The exercise is performed as exercise 4, using a cross step.

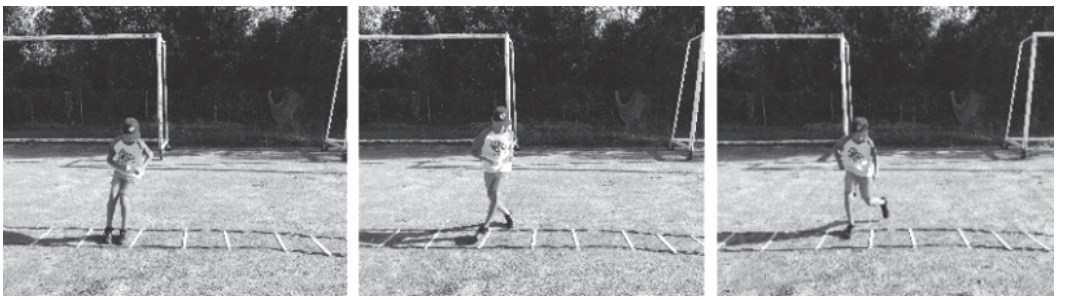


Figure 5. *Exercise A.5.*

Module B. The second module contains 10 tactical and technical exercises, the same for all performers.

Module C. From the beginning of the sports-competitive year 2022, static stretching exercises were applied in the training process with the aim of improving physical qualities and their positive influence on the technical skills of the athletes used in the baseball game.

The training methodology includes the obligatory use of five stretching exercises three times a week through static stretching. Two weeks before the athletes were tested using the Chronojump platform, the stretching module (module C) was introduced, with the exercises performed without requiring maximal effort for 15 seconds in the final part of the training session. The exercises are demonstrated by the trainers, who monitor their correct execution during the studied period.

Exercise C.1. From a basic stance, bend one leg back, then the other. The performer aims to balance on one leg for 15 seconds with each leg.

Figure 6. *Exercise C.1*

Exercise C.2. From a basic stance, the performer aims to bring one leg forward to the chest, maintaining a balanced position on the supporting leg for 15 seconds. Next is a change of legs.

Exercise C.3. From a basic stance, the performer leans forward and tries to bring one bent leg back as far as possible, holding it with one hand for 15 seconds, and touching the ground with the other hand.

Figure 7. *Exercise C.2*

Figure 8. *Exercise C.3.*

Exercise C.4. Stretching pushed forward, alternating right and left leg.

Figure 9. *Exercise C.4*

Figure 10. *Exercise C.5*

Exercise C.5. Stretching pushed to the side, alternating to the right and left.

Chronojump DIN-A1 contact platform (Spain), detecting a single jump with one phase of flight, was used to evaluate five important biomechanical jump characteristics for two compared groups – jump height at squat jump (SJ), countermovement jump (CMJ) and Abalakov jump (ABK) (Figure 11), lower limb elasticity index (IE) and arms use index (AUI)(IUB in Chronojump manual and software).

Elasticity index represent force increment due to the elastic energy acumulated during the shortening-stretching cycle. Elasticity index formula between SJ and CMJ jumps (chronojump_manual_en.pdf) is defined as:

$$IE = \frac{(CMJ-SJ)}{SJ} * 100 \quad (1)$$

Arms use index (AUI) represent force increment due to the arms using (chronojump_manual_en.pdf):

$$AUI = \frac{(ABK-CMJ)}{CMJ} * 100 \quad (2)$$

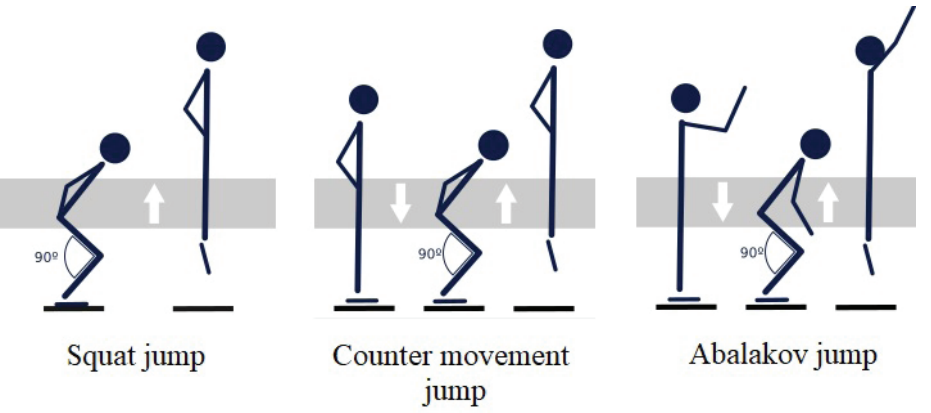


Figure 11. *Protocols for SJ, CMJ and ABK.*

Means and standard deviations, as well as graphical comparisons for all participants of two groups were obtained by Chronojump software. Statistical analysis for unpaired t-test simultaneously with Normality data distributions were done with Sigma Plot 10.

RESULTS

The data obtained for jump height CMJ comparison between baseball players and controls were presented on Figure 12.

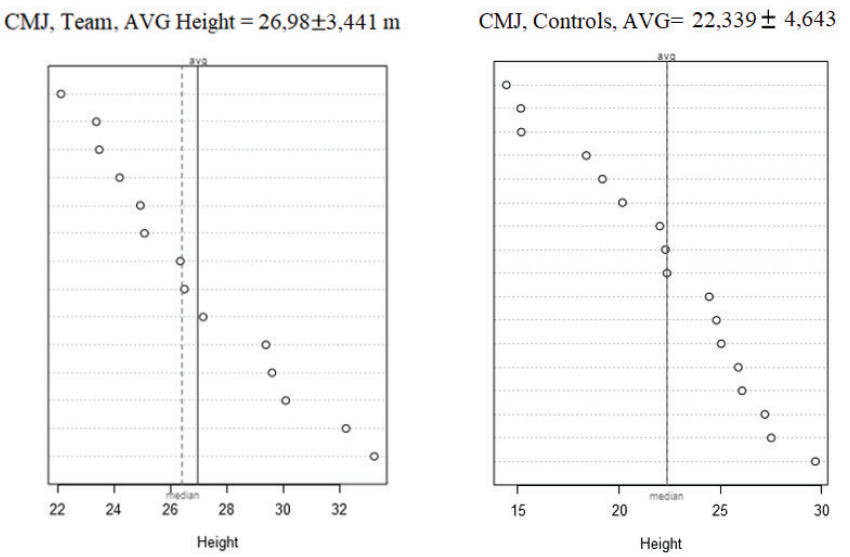


Figure 12. *Jump height CMJ comparison between baseball players and controls.*

A statistically significant increase ($p \leq .005$, Table 1) was obtained in the CMJ jump height of team members compared to controls.

The data obtained for jump height SJ comparison between baseball players and controls were presented on Figure 13. A statistically significant increase ($p \leq .05$, Table 1) was obtained in the SJ jump height of team members compared to controls.

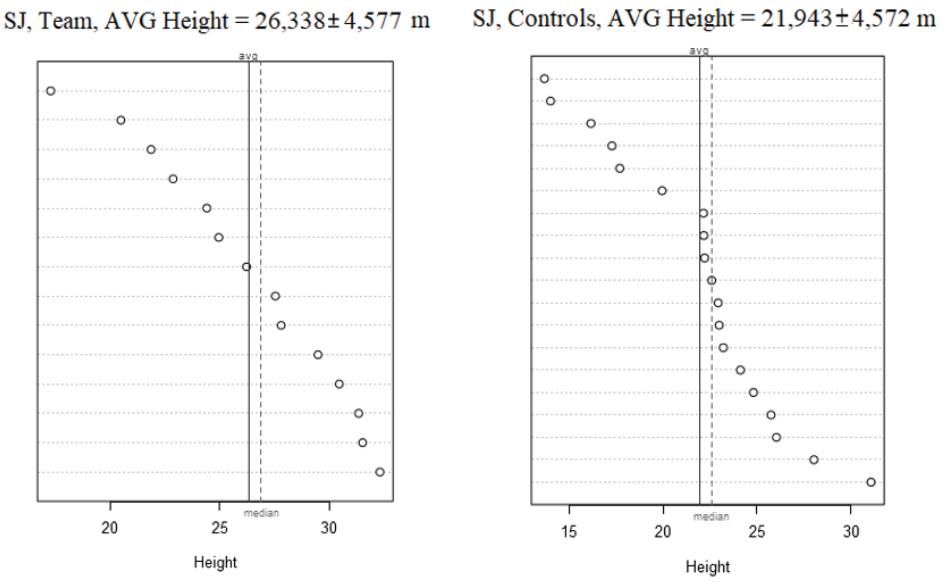


Figure 13. *Jump height SJ comparison between baseball players and controls.*

The data obtained for jump height ABK comparison between baseball players and controls were presented on Figure 14. A trend for a statistically significant increase ($p = .052$, Table 1) was obtained in the ABK jump height of team members relative to controls.

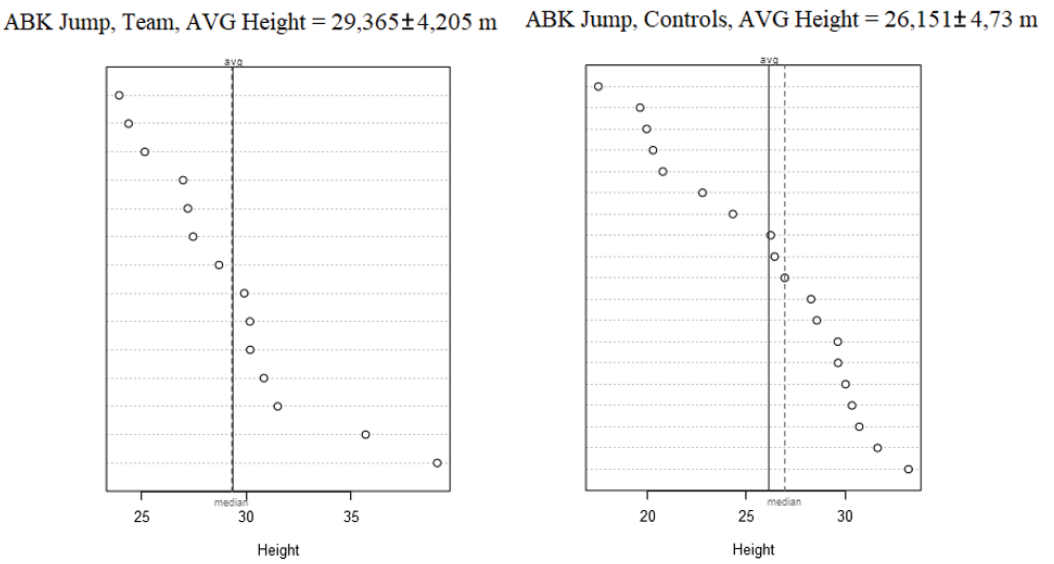


Figure 14. *Jump height ABK comparison between baseball players and controls.*

The data obtained for jump AUI index comparison between baseball players and controls were presented on Figure 15. The trend for this index is for it to increase in the control group relative to the team. This is an interesting result that warrants attention.

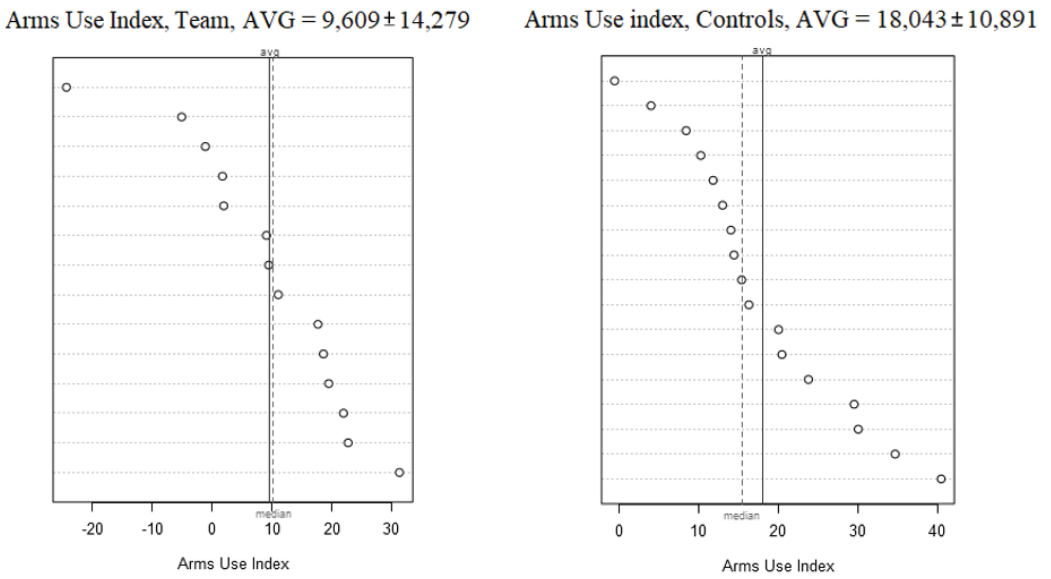


Figure 15. *AUI index comparison between baseball players and controls*

The data obtained for jump IE index comparison between baseball players and controls were presented on Figure 16. No statistically significant difference (p = .86) was obtained for this index.

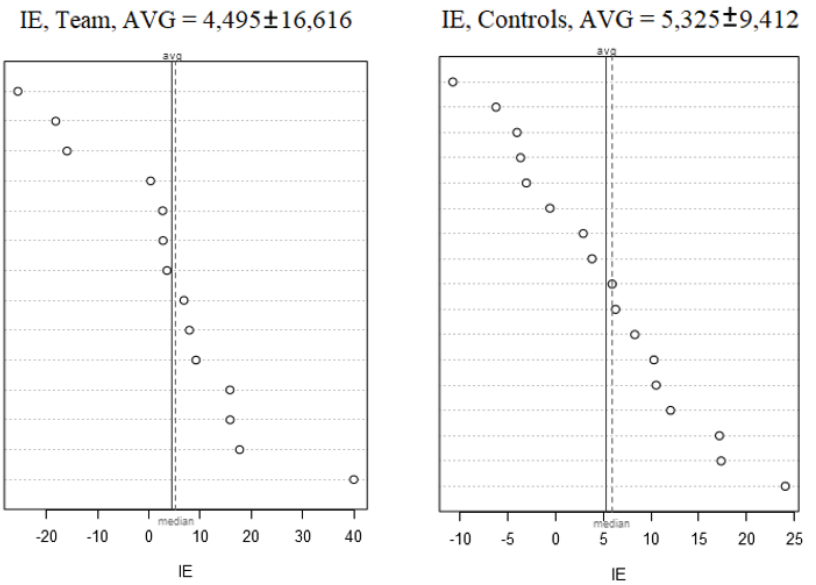


Figure 16. *IE index comparison between baseball players and controls.*

Table 1. *T-test statistical significance for comparisons.*

	SJ	CMJ	ABK	IE	AUI
P value	0.01039969 *	0.00427784**	0.0521189822	0.8626679267	0.0721959711
T value	2.7279628	3.1000316875	2.0198046945	-0.174522021	-1.865926047
DF	31	29	31	29	29

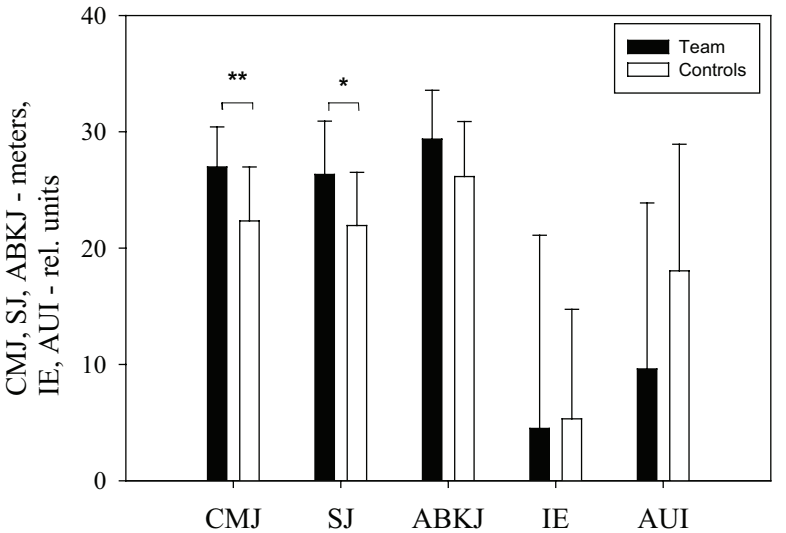


Figure 17. *Comparison between team and controls for obtained parameters*

DISCUSSION

Statistical significant jump height elevation for players group in comparison with controls was obtained for SJ and CMJ (Table 1, Figure 17). For ABK the result is almost statistical significant ($p = .05212$), very close to statistical significance ($p \leq .05$). These results undoubtedly prove the effectiveness of the training methodology used.

Interesting tendencies were received for the other two calculated indices as well. The data obtained for jumps AUI index comparison between baseball players and controls showed tendency for team elevation in comparison with controls. This result proves that the applied training methodology probably increases the coordination between arms and lower limb movement (Miladinov, Velin, 2018).

The obtained t-test statistics of the measurement parameters between the two participant groups noted that lower extremity control and performance are strongly related with the location and motion of trunk and upper limbs. In addition, the presented data draw attention to improving coordination between the lower and upper body, emphasizing the individual characteristics of each athlete.

The lack of statistically significant difference for the elasticity index (IE) allows us to suggest an increase of the duration, frequency and number of stretching exercises in the athletes training program. This would increase the lower limbs elasticity index and will improve force increment due to the elastic energy accumulated during the shortening-stretching cycle (Ranchev et al., 2020).

In addition from the presented relations, it is clear that the excellent sports achievement is a result from the complete set of all factors that determine it. However, a more comprehensive analysis, using similar biomechanical methods, is needed for a complete comparison.

Acknowledgments: This work was financially supported by Grant No. КП-06-Н57/18 from 16.11.2021 by the Bulgarian National Science Fund.

REFERENCES

Ivanov, I. (2022). *Sport i hemoreologia*. Monografia, NSA Press, Sofia, str. 7.

Fukashiro, S, Besier, TF, Barrett, R, Cochrane, J, Nagano, A, and Lloyd, DG. (2005). Direction control in standing horizontal and vertical jumps. *Int J Sport Health Sci* 3: 272–279.

Gadev, M., Peev, P., & Hristov, O. (2020). Agreement Between Measurement Of Jump Height In Different Vertical Jump Tests Executed By Young Football Players. *Journal of Applied Sports Sciences*, (2), 40-52.

Gokhale, R., Chandrashekara, S., & Vasanthakumar, K. C. (2007). Cytokine response to strenuous exercise in athletes and non-athletes—an adaptive response. *Cytokine*, *40*(2), 123-127.

Huffman, K. M., Slentz, C. A., Bales, C. W., Houmard, J. A., & Kraus, W. E. (2008). Relationships between adipose tissue and cytokine responses to a randomized controlled exercise training intervention. *Metabolism*, *57*(4), 577-583.

Lara Fernandes, J., Serrano, C. V., Toledo, F., Hunziker, M. F., Zamperini, A., Teo, F. H., ... & Negrão, C. E. (2011). Acute and chronic effects of exercise on inflammatory markers and B-type natriuretic peptide in patients with coronary artery disease. *Clinical research in cardiology*, *100*(1), 77-84.

Linthorne, N. P. (2001). Analysis of standing vertical jumps using a force platform. *Am J Phys* 69: 1198–1204.

Mackala, K., Stodólka, J., Siemienski, A., & Coh, M. (2013). Biomechanical analysis of squat jump and countermovement jump from varying starting positions. *The Journal of Strength & Conditioning Research*, 27(10), 2650-2661.

Miladinov, O., & Velin, V. (2018). Kinematic-Dynamic Interrelations Between The Drop Jump On Inclined Platform And The Take-Off In The Horizontal Athletics Jumps. *Journal of Applied Sports Sciences*, (1), 3-13.

Milewski, M. D., Õunpuu, S., Solomito, M., Westwell, M., & Nissen, C. W. (2012). Adolescent baseball pitching technique: lower extremity biomechanical analysis. *Journal of Applied Biomechanics*, *28*(5), 491-501.

Ranchev, S., Ivanov, I. M., Yotov, I., & Stoytchev, S. (2020). Studies On A Paradox In The Work Of The Musculoskeletal System In Isometric Stretching. *Journal of Applied Sports Sciences*, (2), 80-90.

Rodano, R, Squadrone, R, and Mingrino, A., (1996). Gender differences in joint moment and power measurements during vertical jump exercises. *In: Proceedings of the XIV ISBS Symposium.* Funchal-Madera, Portugal, Abrantes J.M.C.S., pp. 308–310.

Schild, M., Eichner, G., Beiter, T., Zügel, M., Krumholz-Wagner, I., Hudemann, J., ... & Mooren, F. C. (2016). Effects of acute endurance exercise on plasma protein profiles of endurance-trained and untrained individuals over time. *Mediators of inflammation*.

Walsh, N. P., Gleeson, M., Shephard, R. J., Gleeson, M., Woods, J. A., Bishop, N., ... & Simon, P. (2011). Position statement part one: immune function and exercise.

World Medical Association, (2008). Declaration of Helsinski – Ethical Principles for Medical Research Involving Human Subjects. – *WMJ*, 54(4), 122 -125.

Zvetkova, E., Antonova, N., Ivanov, I., Savov, Y. & Gluhcheva, Y., (2010). Main hemorheological problems in disorders of social significance. *Series on Biomechanics*, Vol. 25, No. 1-2, 2010, 61- 67.

Corresponding author:
Ivan Ivanov, PhD
Department of Anatomy and Biomechanics
National Sports Academy "Vassil Levski"
21, Acad. Stefan Mladenov, str.
Sofia, Bulgaria
E-mail: ivanmirchev@abv.bg

INFLUENCE OF A BALANCED DIET ON MUSCLE MASS IN MEN

Veronika L. Georgieva
South-Western University "Neofit Rilski", Blagoevgrad, Bulgaria

ABSTRACT
Following a balanced diet is essential, not only for maintaining a good body shape, but it is also crucial for our health. By controlling our nutrition, we can reduce the symptoms and also the progression of many diseases such as diabetes, anemia, cardiovascular disease, movement disorders, and more. Of particular importance is the right proportion of the main energy sources - carbohydrates, proteins, and fats, which aim to reduce excess body fat and increase muscle mass. In search of an answer to whether a balanced diet is enough, we studied 20 volunteers to build a harmonious body. The present study focuses on the diagnosis and control of the main physical indicators of managed 20 to 30 years and how they are affected by 50 days balanced diet combined with and without strength training, divided into two groups - basic and experimental. Anthropometric parameters were measured using a body composition analyzer from the Japanese company TANITA. Based on the indicators of daily caloric intake and kilograms of muscle mass, the required daily intake of proteins, carbohydrates, and fats is calculated. In the main group, after 50 days, a decrease in body weight was reported on average by 5.87% (6.07 kg). What is concerning is the fact that body fat was reduced by only 1.8%, while muscle loss was 4.83% (3.73 kg). In the experimental group, which was on the same diet, but included strength training, the muscle mass was increased by 4.14% (3 kg) and a decrease in total fat by 3.05%. No significant differences are observed in total body weight - 0.89% (0.68 kg), due to the increase in muscle mass. After the research, we concluded that following a diet is not enough to build a harmonious body. This should be used in combination with a training process aimed at increasing muscle mass and lower in total body fat.

Keywords*: balanced diet, muscle mass*

INTRODUCTION

Obesity is a major global problem. Despite society's attempts to impose a healthier existence - sport, exercise, healthy food - the number of overweight people is steadily increasing. According to the latest World Health Organization data, over 1.9 trillion (39%) adults are overweight of which 650 million (13%) have been diagnosed with obesity (World Health Organization Obesity and Overweight). For obesity control, physical activity of 150 to 250 minutes per week or up to 60 minutes per day is advised. (Donnelly et al., 2009) Most alarmingly, obesity begins to be seen in early childhood. There were 39 million children under the age of 5 registered in 2000 (World Health Organization Obesity and Overweight). These findings lead us to the conclusion that young parents should be better informed about their children's nutritional needs, which could be included as courses from maternity homes, nurseries, kindergartens, and schools.

Excessive amounts of visceral adipose tissue and ectopic fat largely determine the risk of cardiovascular disease, overweight and moderate obesity. Severe obesity is characterized by specific additional cardiovascular health problems that must be addressed. The link between obesity and type 2 diabetes has long been recognized and clearly explains the high prevalence in different countries. It is also a major risk factor for cardiovascular disease (Piché, 2020).

One of the main causes of obesity is energy intake that exceeds the body's daily needs. The first approach to controlling excess fat and preventing obesity is to implement a diet combined with increased physical activity. In the early 1980s, two pioneers, Ahmed Kisebach in the United States and Per Bjornthorpe in Sweden, reported almost simultaneously that a high proportion of upper body (or abdominal) fat as assessed by the ratio of waist to hip circumferences predicted an increased risk of detecting glucose intolerance, evidence of insulin resistance, hypertension, and hypertriglyceridemia. (Kalkhoff et al., 1983; Kissebah et al., 1982; Krotkiewski, 1982).

METHODOLOGY

Using a scale determining the body composition of the Japanese company TANITA we count the daily caloric intake and kilograms of muscle mass. According to the data, we prepared a balanced diet with low glycemic index carbohydrates, aiming for a stable blood sugar level throughout the day. Daily calorie in-

take was reduced by 20% for the first twenty days of compliance. Protein is based on muscle mass in kg. multiplied by 2.2 and is obtained from meat, eggs, and whey protein powder. In the experimental group, the men have a mandatory intake of a dose of protein with fruit after exercise to replenish the glycogen stores in the muscles and restore muscle tissue from exercise-related damage. The required fat is 20% of the reduced calorie intake. They are supplied by the fat found in food, olive oil, olives, and avocados. (Hall et al., 2017) who reviewed 32 controlled trials, concluded that the reduction in total body fat was greater on lower fat diets compared to isocaloric diets.

Carbohydrates were distributed in equal portions throughout the day on the first twenty days of the diet, while on the next thirty days, after reducing carbohydrates by a further 20%, they were distributed decreasingly from morning to evening. The last meal excludes carbohydrates in both variants and emphasizes protein and healthy fats. After the measurement on day 20, muscle mass gives a change in weight, which necessitates a change in protein intake. Meals for the day are 5 every three to three and a half hours. The first begins immediately after rising, and the last is up to 2 hours before bedtime.

The first 20 days of following the diet are necessary for the body to adjust to the change in eating habits. By having a meal directly after waking up, the aim is to speed up the metabolism. By eating every 3 hours, we intend for the body to have a steady intake of calories, so it will stop stocking up.

In the main group, compliance with the prepared diet is monitored. Exercise habits do not change. In addition to the balanced diet, the experimental group has three strength training sessions per week - two for the upper part and one for the lower part. The workouts are moderate in heart rate - an aerobic work mode is aimed for. Informed consent was obtained from all subjects.

Participants

The study involved 20 men aged 20 to 30 years with overweight and low physical activity from Blagoevgrad. They were divided into two groups - baseline and experimental. The study was performed in the period November 2021 - March 2022.

RESULTS AND DISCUSSION

The results in the main group indicated a loss of 2.44 kg on average, of which 2.11 kg was muscle mass, indicating that the diet aided in losing weight but at the expense of muscle. The fat was approximately the same, even slightly increased by 0,15%, and the physique did not change its shape. In the experimental group, where strength training was included, an average of 2.3 kg was lost. Total fat was also significantly reduced - by 3.05%, while muscle mass increased its volume by 1.17 kg in 20 days. The physique has started to reduce waist and hip circumference and visibly has a result.

Table 1. *Results for 20 days*

Participants	Kg. for 20 days	Fat for 20 days	Muscle mass for 20 days
Main Group	- 2.44%	+0.15%	-2.1%
Experimental group	- 2.26%	-3.05%	+1.26%

While diet is more effective for reducing overall body weight loss, exercise combined with diet is better for reducing visceral body fat. Moderate to vigorous regular exercise for 4 to 6 months combined with a balanced, healthy diet has been shown to result in 5% to 10% of weight loss and can be achieved with a reasonable reduction in caloric intake with or without exercise (Atakan et al. 2021). The metabolic effects of reduced muscle mass lead to a high prevalence of obesity, insulin resistance, and T2D (Braith et al., 2006, Baumgartner et al., 1998). Therefore, exercise and subsequent increases in muscle mass are likely to reduce risk factors for metabolic diseases (Braith et al., 2006). Although aerobic exercise has traditionally been recommended for the prevention and management of obesity and associated metabolic risk factors (Pollock et al., 2000, Clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults-the evidence report 1998), it has also recently been suggested that exercise training is a feasible and effective alternative to aerobic exercise for weight control due to its multiple therapeutic effects (Braith et al., 2006; Pollock et al., 2000).

Following strength training, dietary fat stored in adipose tissue decreases as a result of fatty acid mobilization stimulated by β-adrenergic activation from adipose tissue to other tissues, such as skeletal muscle. In addition, regular exercise/training is known to alter adipose tissue physiology, leading to increased fat mobilization during heavy exercise. However, it is not fully understood whether structural changes in adipose tissue are induced by exercise training or negative energy balance (Thompson et al., 2012).

Total carbs in the regimen are reduced by 20% after day 20. The organism is accustomed to the intake of certain calories, and after their reduction, it will experience deficiency. Carbohydrate intake is also reduced with each subsequent meal.

We discovered after the research that the body draws energy from its muscles without exercise. After measuring on day 50, the main group had reduced their body weight by 6.07 kg (5.87%), of which they had lost 3.73 kg (4.83%) of muscle mass. Our goal to reduce weight from total body fat for a more harmonious body was crowned with failure. Only 1.08% of total fat was lost, and the weight-fat-muscle mass ratio was unacceptable. Thoma and colleagues performed a systematic review of the literature for diet-only interventions. The authors uncovered 10 studies in which 11 groups of 322 participants have prescribed a hypocaloric diet with varying composition and negative energy balance. The duration of the diet interventions ranged from one to six months. The average weight loss in the studies ranged from 4% to 14% (Ross et al., 2020). No reference is made to how much of the weight lost is fat and how much muscle mass is.

In the experimental group, we marked our success by losing 3.97% of total fat in 50 days. Muscle mass also marked its gain by 3 kg (4,14%). There was almost no difference in weight - only 0.68 kg (0.89%), but visually the men in the experimental group were leaner, put together, with shaped muscles.

Table 2. *Results for 50 days*

Participants	Kg. for 50 days	Fat for 50 days	Muscle mass for 50 days
Main Group	- 5.87%	-4.83%	-3.73%
Experimental group	- 0.89%	-3.97%	+4.14%

Lee et al., (2005) further discovered that without changes in total body weight, 13 weeks of moderate-intensity exercise (5 sessions/week, 60 min/session, -60% peak oxygen uptake (VO2peak) resulted in significant reductions in total subcutaneous fat and visceral fat in obese men with and without type 2 diabetes. Muscle mass was not measured, however, based on the data, we can conclude that they significantly increased their mass.

To support our study, different authors confirm our results that a diet combined with strength training has a better result in reducing overall fat and therefore building a harmonious body. In an 18-month diet and exercise-based intervention among 278 sedentary adults with abdominal obesity, Gepner et al., (2018) reported that diet combined with exercise resulted in greater reductions in visceral fat than diet alone. Wilmore et al. (1999) determined the extent of changes in total and visceral fat in overweight subjects after 20 weeks of chronic training (3 sessions/week, at 50-75% VO2max for 30-50 min). Findings suggested that men had a greater loss of total and visceral fat than women. Hunter et al. studied that 25 weeks of strength training resulted in improvements in fat-free mass and reductions in total fat in men (Hunter, 2002). Kheniser et al. state that two years of lifestyle interventions can facilitate weight loss by 5% and that, although weight regain occurs, both diet and exercise have significant effects on obesity-related comorbidities and adipose tissue remodeling. Moreover, both regular aerobic exercise and consumption of a hypocaloric diet were associated with significant reductions in visceral and liver fat, regardless of age, biological gender, or ethnicity (Atakan et al., 2021).

CONCLUSION

A balanced nutritional diet is suitable for people of all ages. It includes all the nutrients that the body requires. It leads to a reduction in total fat and an increase in muscle mass combined with moderate to intense strength training. It is also beneficial for body shaping and muscle building. Regulating cal-

orie intake with a balanced regimen for a period of two to six months can completely change eating habits and help with permanent weight loss, and lower blood pressure, cholesterol, and triglycerides. Following a balanced diet is not only aimed at temporarily restricting certain foods, the goal is to completely change eating habits for a better and healthier society.

REFERENCES

Atakan, M. M., Koşar, Ş. N., Güzel, Y., Tin, H. T., Yan, X. (2021). The Role of exercise, diet, and cytokines in preventing obesity and improving adipose tissue nutrients. *Daily news* 13 May, 5. Published online 2021 Apr 25.

Baumgartner, R.N., Koehler, K.M., Gallagher, D., Romero, L., Heymsfield, S.B., Ross, R.R., Garry, P.J., Lindeman, R.D. (1998). Epidemiology of sarcopenia among the elderly in New Mexico, *Am. J. Epidemiol.* 147, 755–763.

Braith, R.W., Stewart, K.J. (2006). Resistance exercise training: Its role in the prevention of cardiovascular disease. *Circulation*. 113, 2642–2650.

Donnelly, J.E., Blair, S.N., Jakicic, J.M., Manore, M.M., Rankin, J.W., Smith, B.K. (2009). American College of Sports Medicine Position Stand. Appropriate physical activity intervention strategies for weight loss and prevention of weight regain for adults. *Med. Sci. Sports Exerc.* 41, 459–471.

Gepner, Y., Shelef, I., Schwarzfuchs, D., Zelicha, H., Tene, L., Yaskolka Meir, A., Tsaban, G., Cohen, N., Bril, N., Rein, M. (2018). Effect of Distinct Lifestyle Interventions on Mobilization of Fat Storage Pools: Central Magnetic Resonance Imaging Randomized Controlled Trial. *Circulation*. 137, 1143–1157.

Hall, K.D., Guo, J. (2017). Obesity Energetics: Body Weight Regulation and the Effects of Diet Composition. *Gastroenterology*. 152, 1718–1727.

Hunter, G.R., Bryan, D.R., Wetzstein, C.J., Zuckerman, P.A., Bamman, M.M. (2002). Resistance training and intra-abdominal adipose tissue in older men and women. *Med. Sci. Sports Exerc*. 34, 1023–1028.

Kalkhoff, R.K, Hartz, AH, Rupley, D., Kissebah, A.H., Kelbe,r S. (1983). Relationship of body fat distribution to blood pressure, carbohydrate tolerance, and plasma lipids in healthy obese women. *J Lab Clin Med*. 102, 621–627.

Kissebah, A.H., Vydelingum, N., Murray, R., Evans, D.J., Hartz, A.J., Kalkhoff, R.K., Adams, P.W. (1982). Relation of body fat distribution to metabolic complications of obesity. *J Clin Endocrinol Metab.* 54, 254–260.

Krotkiewski, M., Björntorp, P., Sjöström, L., Smith, U. (1983). Impact of obesity on metabolism in men and women. Importance of regional adipose tissue distribution. *J Clin Invest.* 72, 1150–1162.

Lee, S., Kuk, J.L., Davidson, L.E., Hudson, R., Kilpatrick, K., Graham, T.E., Ross, R. (2005). Exercise without weight loss is an effective strategy for obesity reduction in obese individuals with and without Type 2 diabetes. *J. Appl. Physiol.* 99, 1220–1225.

National Institutes of Health (1998). *Clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults—the evidence report*. 6, 51–179.

Piché, M.E., Tchernof, A., Després, J.P. (2020). Obesity phenotypes, diabetes, and cardiovascular Diseases. *Circ. Res* 126, 1477–1500.

Pollock, M.L., Franklin, B.A., Balady, G.J., Chaitman, B.L., Fleg, J.L., Fletcher, B., Limacher, M., Piña, I.L., Stein, R.A., Williams, M. (2000). Resistance exercise in individuals with and without cardiovascular disease: Benefits, rationale, safety, and prescription: An advisory from the Committee on Exercise, Rehabilitation, and Prevention, Council on Clinical Cardiology, American Heart Association; Position paper endorsed by the American College of Sports Medicine. *Circulation*. 101, 828–833.

Ross, R., Soni, S., Houle, S.A. (2020). Negative Energy Balance Induced by Exercise or Diet: Effects on Visceral Adipose Tissue and Liver Fat. *Nutrients*. 12, 891.

Thompson, D., Karpe, F., Lafontan, M., Frayn, K. (2012). Physical activity and exercise in the regulation of human adipose tissue physiology. *Physiol*. 92, 157–191.

Wilmore, J.H., Despres, J.P., Stanforth, P.R., Mandel, S., Rice, T., Gagnon, J., Leon, A.S., Rao, D., Skinner, J.S., Bouchard, C. (1999). Alterations in body weight and composition consequent to 20 wk of endurance training: The HERITAGE. *Family Study*. 70, 346–352.

World Health Organization Obesity and Overweight. Fact Sheet.: https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight (accessed 29 August 2022).

Corresponding author:
Veronika Georgieva, PhD
Department "Theory and methodology of physical education"
South-Western University "Neofit Rilski",
Blagoevgrad 2700, Bulgaria
E-mail: vdimanachka@abv.bg

 DOI: 10.37393/ICASS2022/91 110 - 114

STUDY ON THE EFFECT OF SWAMI DEV MURTI'S YOGA PRACTICE "CROCODILE EXERCISES"

Petia Milanova
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
Yoga is a combination of physical, mental, and spiritual practices. It is an ideal stress reliever and a powerful therapy for mental and physical disorders. Since they were created, Swami Dev Murti's "Crocodile Exercises" have significantly contributed to the yoga practice. Swami Dev Murti invented them after a thorough study of ancient yoga practices. These exercises are considered the most original and effective practice for dealing with spinal, lower back, and pectoral (shoulder) girdle issues.
The survey aimed at monitoring the changes occurring in a human's body after practicing "Crocodile Exercises" for 30 days. The research was conducted with 37 people of different ages with experience in yoga. A questionnaire survey, pedagogical experiment, and maths-statistical methods were used for the research to be carried out. The questionnaire card was used to determine the popularity of Swami Dev Murthy's "Crocodile Exercises". The pedagogical experiment involved performing the recommended yoga practice „Crocodile Exercises" for 30 days. Test 1 (flexibility in the lower part of the spine) and Test 2 (shoulder girdle) were used to establish the level of spinal flexibility. The results were processed with the Microsoft Pack software package, particularly Microsoft Excel.
After analyzing the results from the measurement of the flexibility in the lower part of the spine, it was found that the positive effect of the yoga practice "Crocodile Exercises" was much greater on women. The results from the measurement of the flexibility in the upper part of the spine showed a significant improvement in both sexes. All participants noted unequivocally, without exception, the positive effect of these exercises on their bodies. The results from the experiment revealed that the yoga practice "Crocodile Exercises" had a beneficial impact on the overall improvement in subjects' physical, mental, and emotional states.

Keywords: *yoga, physical exercise, spinal flexibility*

INTRODUCTION

Yoga is a combination of physical, mental, and spiritual practices. It is an ideal stress reliever and a powerful therapy for mental and physical disorders. Any activity in life, done properly and with discipline, can be yoga. This leads to physical and mental health recovery. Four major pillars should be followed in yoga life: proper diet, proper exercises, proper actions during the day, and proper sleep (Evtimov, 1992).

'Crocodile Exercises' are considered the most original and effective practice in Swami Dev Murti's system of exercises. He invented them after a thorough study of ancient yoga practices and after observing and studying wild animals' behavior for twenty-five years. He noticed that due to the horizontal position of animals' spines while walking, they bent it to one side and the other, and that made them strong and resilient. However, most animals, like crocodiles, horses, dogs, cats, and others, often turned on their backs and stretched their spines by twisting their legs to one side and their head to the other. That's how Swami Dev Murti came up with the idea of the „Crocodile exercises", which are his significant contribution to the yoga system.

These exercises are designed for the spine and to activate blood circulation. They can be done for a few minutes a day because the spine is essential for human health. All the important nerve plexuses /plexūs/ pass through the spinal column. The health of the whole organism depends on it. Spinal curvature disorders can also cause pressure on the internal organs and can lead to diseases and problems in the internal organs. This is the reason why Swami Dev Murti's exercises are suitable for everyone (Atanasov, 2017).

Swami Dev Murti has created various types of „Crocodile exercises". Depending on the starting basic position – prone, supine, sideways, half-bridge - he divided them into eight courses. Later, he added a ninth course – "Crocodile exercises" in

a sitting position. The most important, easy, and effective courses are the first and the second one – from a prone and supine body position and the new course – from a sitting position.

The survey aimed at monitoring the changes occurring in a human's body after practicing „Crocodile Exercises" for 30 days.

To achieve our goal, we set the following tasks to solve:

1. To determine the popularity of „Crocodile exercises" among people.
2. To determine the impact of the experiment conducted with the yoga practice "Crocodile exercises" on the spine's flexibility and blood pressure.

METHODOLOGY

To implement the set tasks, we used the following methods:

1. A questionnaire survey – a questionnaire card was developed to determine the popularity of Swami Dev Murti's "Crocodile exercises".
2. Pedagogical experiment – performing the recommended yoga practice, "Crocodile Exercises" for 30 days.
3. Testing – Test 1 (flexibility in the lower part of the spine) and Test 2 (shoulder girdle) were used to establish the level of spinal flexibility.
4. Maths-statistical methods – spectral analysis and mean blood pressure values and spinal flexibility.

The results were processed with the Microsoft Pack software package, particularly Microsoft Excel.

The experiment was conducted in January 2022. Before starting the practice, the participants filled out the questionnaire. After completing the 30-day performance of the 'Crocodile exercises', they filled out the questionnaire again with self-assessment questions.

The subject of the study is the change occurring in the bodies of the examined people.

The main signs of the functional state and physical development (occurring changes in blood pressure and flexibility of the spine) are the objects of the research.

Thirty-seven people (15 men and 22 women), with an average age of 38.2 years, participated in the study. The participants in the experiment performed two basic courses of 'Crocodile exercises' (from a prone and supine position of the body) every day for 30 days. For optimal results, they were advised to perform the exercises before their main program if they practiced yoga, and if not, to perform them as such. Since the 'Crocodile exercises' tone the internal organs, participants were advised to drink enough water before starting their daily practice.

For the participants' greater convenience, especially for those who were unfamiliar with the practice, we organized three preliminary classes during which the exercises were thought to and learned by them following the pictures that had been sent to each participant in advance. In this way, their thoughts would be concentrated on the very performance of the poses, and their mind would not be engaged in following the sequence of the given exercises.

The participants' blood pressure and spinal flexibility were measured before and after completing the "Crocodile exercises" practice.

Two tests were used to determine the level of spinal flexibility in the participants: Test 1 (flexibility in the lower part of the spine) and Test 2 (shoulder girdle) (Yochev, 2021). Test 1 is a version of the so-called 'The Canadian Trunk Forward Flexion test' (American College of Sports Medicine, 2010).

A ruler or a tailor's tape was used to measure flexibility. Results are in centimeters, the nearest 1 cm.
A standard blood pressure monitor was used to measure participants' blood pressure.

RESULTS ANALYSIS

The questions in the questionnaire cards for determining the popularity of Swami Dev Murti's "Crocodile exercises" practice aimed at establishing the respondents' awareness of these exercises, how often they practiced them, and whether they had shown them to someone else. Before completing the survey, none of the participants knew who Swami Dev Murti was.

Eight of the researched people had heard about the "Crocodile exercises" and tried to do them, but none had been seriously engaged in their systematic practice (Figure 1).

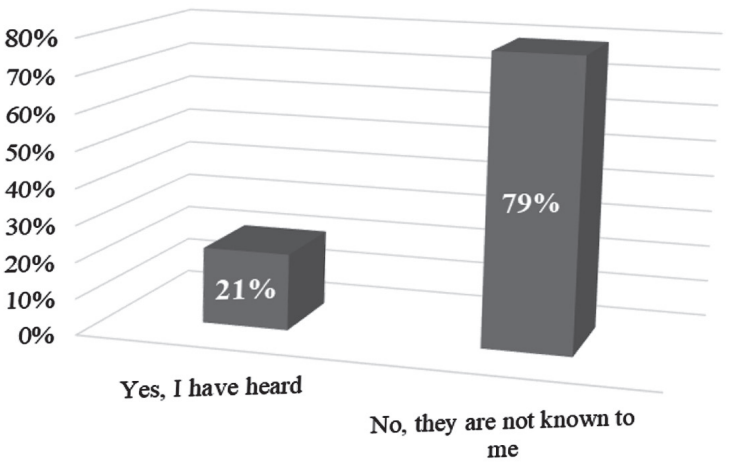


Figure 1. *Answers to the question: 'Have you heard about Swami Dev Murti's 'Crocodile exercises'?'*

Figure 2 shows the results from the measurements of flexibility in the lower part of the spine – Test 1 (flexibility in the lower part of the spine) after 30 days of practicing the "Crocodile exercises". 60% of the men did not show much improvement. Only 5 of them (40 %) had improved their spinal flexibility. The positive impact of the "Crocodile exercises" yoga practice was much greater on women. Only 14% of the researched participants did not experience any improvement in flexibility in the lower part of the spine.

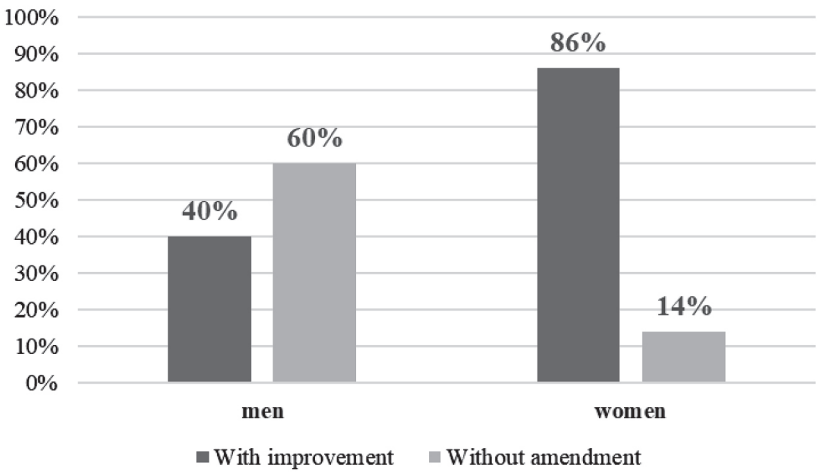


Figure 2. *Distribution of the results from Test 1 (flexibility in the lower part of the spine) by percent*

Figure 3 shows the results from the measurements of flexibility in the upper part of the spine – Test 2 (shoulder girdle) after 30 days of practicing the "Crocodile exercises".

In contrast to the results from Test 1 (flexibility in the lower part of the spine), those from Test 2 (shoulder girdle) showed a significant improvement in both sexes: men – 87% and women – 82%. Only two men (13%) and four women (18%) had no change in flexibility in the upper spine.

We believe these results are due to the positive impact of Swami Dev Murti's "Crocodile exercises" practice.

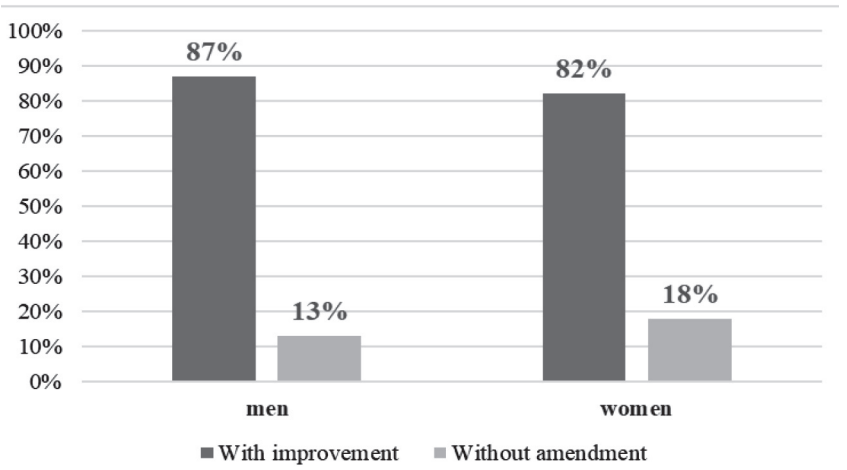


Figure 3. *Distribution of the results from Test 2 (shoulder girdle) by percent*

A standard blood pressure monitor was used to measure the participants' blood pressure levels. Figure 4 shows the results after the 30-day experiment.

Among men, the highest percentage of the examined – 47% kept their normal blood pressure. The rest of them – 53% normalized it over the period of the experiment (33% – from high to normal and 20% – from low to normal blood pressure)

Among women, the highest percentage of the examined – 36% normalized their blood pressure levels (from low to normal). 27% of them kept the levels of their blood pressure, and 5% of them showed no change in their blood pressure levels after the experiment. Blood pressure levels normalized (from high to normal) in 7 examined women (32%).

Both sexes did not show any deterioration in their blood pressure levels.

The results from the blood pressure measurements after a 30-day yoga practice of Swami Dev Murti's "Crocodile exercises" proved its positive effect on the participants' blood pressure levels.

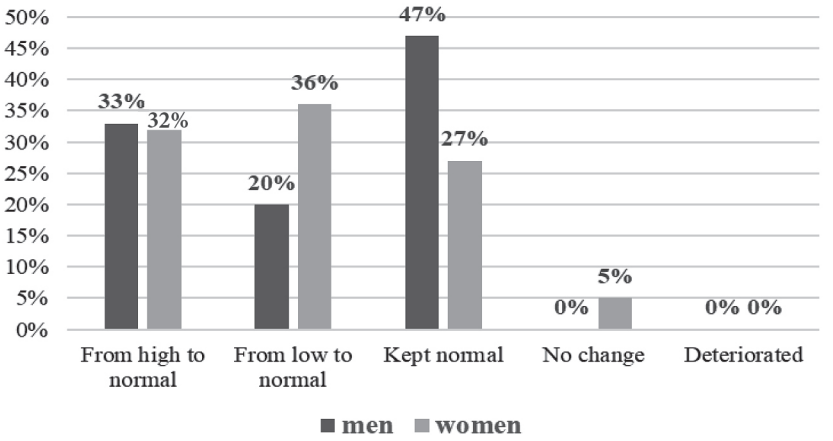


Figure 4. *Distribution of the results from the blood pressure measurement by percent*

DISCUSSION

Questions about sleep quality, self-esteem, willpower, motivation, energy level, stress level, and Yoga experience are based on self-assessment. As such, of course, they carry a certain degree of subjectivity.

The evaluation of the parameters "Do you feel pain in your lower back?", "Do you feel pain in your back?", "Do you feel pain in your neck?", "Do you have trouble sleeping?", "Are you satisfied with your concentration and memory?", "Are you self-confident?", "Do you have energy throughout the day?",

"Do you perform the practice willingly?", etc., is also subjective.

All participants, without exception, clearly noted the positive impact of practicing the exercises on their bodies.

At the same time, we are perfectly aware that a 30-day period – the duration of the experiment – is not such a long period to register more substantial changes, especially when a person has not practiced this kind of exercises before.

This is why some of the study participants gave the same answer, before and after the experiment, to the question 'Do you feel pain in your lower back?' and it was "Yes, I do". But to the clarifying question: 'Compare them!' they answered that the pain decreased or that it was not as sharp or as frequent, which for the purposes of our research is a positive answer to the question "Do the practiced exercises have an effect?".

The participants in the study have different professions and marital status, good physical activity, and health. The factors determining the participants' perseverance in performing the 'Crocodile exercises' yoga practice are the will and motivation to improve their health and physical and mental condition.

CONCLUSION

The results from the questionnaire show a low awareness of the suggested yoga practice, "Crocodile exercises".

After analyzing the results from the measurement of the flexibility in the lower part of the spine, it was found that the positive effect of the yoga practice 'Crocodile exercises' was much greater on women. The results from the measurement of the flexibility in the upper part of the spine showed a significant improvement in both sexes. As a result of these exercises, the participants' blood pressure levels normalized. All participants noted unequivocally, without exception, the positive effect of these exercises on their bodies.

The results from the experiment revealed that the yoga practice 'Crocodile exercises' had a beneficial impact on the overall improvement in subjects' physical, mental, and emotional states.

We believe that more extensive research over a more extended period and with a larger number of participants would prove the positive effect of the 'Crocodile exercises' yoga practice on certain physiological conditions – headache, neck pain, pain in the lower back, and the back, etc.

REFERENCES

Atanasov, N. (2017). *Himalayan teacher Swami Dev Murti. Life, teachings, yoga practices, recipes*. 3rd revised and supp. ed. Biana Ltd. Sofia. ISBN 978-954-91509-9-5.

Evtimov, V. (1992). *Yoga.* „Om". Sofia. ISBN 954-8080-01-X.

American College of Sports Medicine (ACSM). (2010). *ACSM's Guidelines for Exercise Testing and Prescription* 8th ed. Wolters Kluwer Health | Lippincott Williams & Wilkins, Philadelphia, PA 19106. ISBN 978-0-7817-6903-7.

Yochev, K. (2021). Easy flexibility tests in advanced age, available at: https://sport.framar.bg/tests-for-good-posture-flexibility-and-joint-mobility-in-sports. (accessed 10 August, 2022)

Yoga Center Svami Dev Murti (n.d.). http://swamidevmurti.com/ (accessed 10 August 2022)

Corresponding author:
Petia Milanova, PhD
Department Heavy athletics, boxing, fencing and sport for all
National Sports Academy "Vassil Levski"
Studentski grad, 21, Acad. Stefan Mladenov str.
Sofia 1700, Bulgaria
E-mail: petiamilanova@gmail.com

 DOI: 10.37393/ICASS2022/92 115 - 121

NATURAL HERITAGE AND HEALING PRACTICES FOR WELLNESS LIFESTYLE

Bistra Dimitrova, Gergana Dincheva
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
Introduction: Natural heritage is becoming an increasingly important focus in international and national policies. Bulgaria has a large diversity of natural resources with protected areas. Natural resources are the main product in wellness tourism, which will grow in 2022 with an impressive 7.5% growth per year. According to the Global Wellness Institute Report, this is a higher percentage than the total revenue of the whole world tourism (6.4%). Methods: We systematically develop and analyze innovative wellness programs for people of all ages. We are making the first attempt to create some simulated products (in blocking mode) with augmented virtual reality. Results: Immune system health will remain an important social issue in 2022. The focus will stay on the individual consumer and the new health strategies. Scientific evidence is accumulating about holistic approaches, health from contact with nature, a balanced diet, and microbiome, which are key to achieving a wellness lifestyle. Programs to strengthen the immune and metabolic health and individual psycho-relaxation practices in and from the natural heritage will be increasingly important. Discussion: Effective wellness practices in forests and sea are slow modeling strategies that prove their effectiveness and positive influences but require regular practice. Conclusion: The Wellness lifestyle requires communicating regularly with nature. It is globally important to preserve natural heritage, eat a balanced diet, and invest in personal health to achieve a Well-being.

Keywords: *Forest medicine, forest art therapy, wellness program, monetarization of the nature heritage*

INTRODUCTION

Conservation of natural heritage is evolving into an increasingly important topic in international and national policies (Ellis, 2013). Bulgaria has a large spectrum of natural heritage areas which are protected (Dimitrova et al. 2021). Natural resources are the main product in wellness tourism, which will grow in 2022 with an impressive 7.5% annual growth (Dimitrova et al. 2018). According to the report of the Global Wellness Institute (2021), this is a higher percentage than the total growth of the entire world tourism (6.4%). Health affects every citizen personally. It also affects their working capacity by making them better or weaker professionals (Ilinova, 2014; Donev et al., 2019; Ignatova, Iliev, 2020; Tomova, 2021). These two reasons are fundamental to the knowledge-based economy and do not require arguments other than statistical information. Within the EU alone, there are more than 200 million people of all ages and practices which focus on Wellness & Forest practices, aqua programs, or Eastern relaxation techniques for health prevention and recreational activities (Ivanova, 2019; Nesheva, 2019; Angelcheva, Petkova, 2019; Ilinova, Toteva, 2019). The number of vacations connected with traveling to a destination (offering health and wellness packages) has increased drastically through the period of 2017-2019. Based on scientific data of the global wellness institute, the impressive 21% annual growth rate projected for wellness tourism through 2025 reflects the new traveler's values (a quest for nature, sustainability, and mental wellness) as well as a period of rapid recovery from pent-up demand in 2021 and 2022 (GWI, 2021). From 2007 to 2019, Bulgaria has turned into the Wellness European scientific and educational leader by successfully accrediting and integrating six new specialized (in Niche tourism) programs in two professional categories – Healthcare and Sport (Dimitrova et al. 2021; Veselinov, 2021). A new European profession - wellness instructor was developed through funding under the Erasmus + KA2 program (Dimitrova et al. 2018). A new scientific project with the scope to build and develop a center of Excellence "Heritage BG" was started in February of 2018. The prioritizing field was "Creative and Recreational industries" under the operational program "science and education for intellectual growth", co-financed by the European structural and investment funds for the program period 2014-2020 (Harizanova, 2019). Bulgaria is the first country that has accredited educational and R&D programs from bachelor's degree to Doctoral level (for wellness, spa, and Thalasso culture) at the National Sports Academy "V. Levski" in Sofia (Dimitrova et al., 2021). At the same time, Bulgaria has the highest level of scientific infrastructure in Europe – the Bulgarian Center for Excellence in Creative and Recreational industry (Heritage BG) and a specialized scientific body inside

of it for "Social innovations, Recreational human design, and Niche tourism".

METHODOLOGY

Purpose of the study

The aim of this case study was to develop and verify a method of Wellness index for evaluation and control of forest medicine & therapies special efficiency. The specific purpose of the study was to compare the effectiveness of three forest therapies as a methodological approach to evaluate the psychological balance and heart rate (HR) level and function after the treatment with the forest medicine.

Participants

This project and the procedures within were approved by the Centre of Excellence "Heritage BG". Participants (N = 121 in 3 groups) were recruited via flyers placed in the student wellness center of a university in the southwestern Bulgaria. Participants were also recruited by verbal announcements made in project partners Universities and the Facebook project page. Participants consisted of healthy and injury-free males (N = 44) and females (N = 77) between the ages of 15 and 55+, divided into 2 groups of 40 and 1 by 41 participants in 3 forest therapies, respectively: Art, Air Bath, and Elephant eye treatments. Each participant's ability to participate in the forest medicine activities was verified. A reviewed and signed consent document was required for participation in the experiment. All participants were recreationally trained, which was operationally defined as participation in an average of 2 forest sessions per week in the last 4-5 months. Participant characteristics are listed in Table1.

Table 1. *Descriptive Statistics of Study Population*

Description of the Study population	Value
Total number of participants included	121 (100%)
Number of young people	77 (62%)
Number of 55+	14 (12%)
Others	30 (26%)
Age	15 and 55+ years
Training Age	7.51 ± 3.73 years
Average period of practicing forest therapies	123.81 ± 29.60 days

In order to fulfill the aim of the research, we set the following tasks: To develop a model of Wellness index for control and evaluation of specific efficiency in forest medicine activities. To verify the model through supposition of its values obtained in terrain application. The sample is not representative and refers only to the subjects.

Research procedure

Modern sports watches with GPS and heart rate (Samsung) meter provide the opportunity for recording the data measured during a certain session, over different periods of time. Thus, the HR can be registered and traced in dynamics during the therapy session. Furthermore, the forest therapies' effectiveness is measured by manually assessing the heart rate for 10 seconds to measure radial pulses (when watches with GPS are not present). The pulse is one universal internal indicator in synchronization with the heart activity. We determined the standard upper limit according to Euro fit PVC-170 norms. This means that each participant is informed to have an effective pulse rate of 11-14 beats in 10 seconds, and the maximum upper limit is 16 beats, i.e., during forest activity, the heart pulse rate (HR) should not exceed 150-160 beats/min. The participants in the research were subjected to two before and after registrations of the HR and their subjective Selfness feelings, each one in his preferred group. We recorded the mean values of the heart rate frequency and they completed the author's Selfness-Scale.

Equipment and conditions

The terrain therapies were carried out in relatively equal atmospheric conditions – air temperature between 13 and 27 degrees Celsius, and air humidity up to 30-35%. The preliminary analysis of the measured values of the therapies' influence to the participants showed the existence of a normal distribution, according to the applied tests of Shapiro-Wilk and Kolmogorov-Smirnov.

RESULTS

Content & scope of the applied forest therapies: We explored what nature can do for people supporting their status health by reducing stress level. Countries worldwide are uncovering scientific proof about the healing effects of connecting with nature. With overloaded minds and overworked bodies, returning to nature can yield surprising results as scientifically proven in Japan and South Korea. Both countries have even developed various healing practices, such as nature walks and forest Air bathing. Our partners from the Wellness Institutes of Serbia, Montenegro, Kauaï, and Bulgaria organize regular Forest practices. Furthermore, together, we share data, exchange ideas, and promote the Forest medicine & therapies (Figure 1).

The Forest Art therapy

This therapy is part of the concept "Health from Nature".

Figure 1. *Final individual works of art therapy (in Bulgaria, Serbia, Kauaï, and Montenegro).*

The practitioner uses all types of natural products (in place inside the forest) to build his unique & personal Art construction. During the process, the mind becomes free of stress using the focus on the materials choices and the motivation to create one personal art installation. The art creator returns the psychological balance which relaxing all the body. Participant forgets his social problems and starts to feel one personal Selfness. Additionally, the positive feelings calm the HR, and the body enjoys its relaxation by communicating with the forest energy, which activates the internal auto-healing body systems (immune system, internal gland secretions, blood velocity, oxygen enrichment, and others).

The Forest Air Bath therapy

Globally, it is one of the most widespread forest practices. In many countries, the tradition is hundreds of years old. Forest Air Bath Therapy takes part in the concept of "Health from Nature". The practitioner uses different natural forest benefits such as oxygen, sun rises, freshness, and humidity to strengthen his immune system and clean his mind (Figure 2).

Figure 2. *Oxygen Air Bath therapy offered by Vitocha mountain (Sofia in July 2022).*

Recreational effects are created deep within the forest, by the rhythmic blood circulation, and high oxygen quantities are transported to the organs.

For example, after 5-7 minutes after the Forest Air bath therapy, the heart rate at rest slows down. The higher oxygen level cleans the mind and restores

psychological balance, eliminating social stress. The practitioner starts to feel the Selfness balance.

The Forest Hammam therapy

The concept behind this therapy is "Health from Mountain Water". As a natural Spa procedure, the practitioner uses the difference in temperature between his warm body and the fresh water to boost his immune system, strength, and anti-stress abilities (Figure 3).

Figure 3. *Natural forest hammam therapy - Spring (left), Autumn (right) by free internet sources.*

Within fresh / spring mountain water, the forest hammam therapy promotes rapid blood circulation in order to counteract the large temperature contrast. This ensures abundant oxygen transportation to the organs, cleans the cervical cells and eliminates social stress. The practitioner feels a sense of Selfness balance.

The Elephant Eye therapy

This therapy is based on the concept "Health from Natural green & sunshine". The practitioner uses those natural products to build his spiritual emotions of uniqueness (Figure 4).

Figure 4. *Elephant eyes therapy offered by Vitocha mountain (near Sofia in August 2022).*

People need calm mind, body, and life to have good health. As humans, we have evolved in Nature. Nature is what makes us feel complete. The healing powers of Nature have been the subject of numerous studies. These studies have shown that they have a variety of benefits for our physical, mental, and social health. It provides an easy and effective way of avoiding stress, anxiety, burnout, and depression, as well as reducing their ill effects. Connecting with Nature boosts our body's immunity, energy levels, and healing ability. It can improve our mood, sleep, memory, and focus. Nature also has a soothing influence on our relationships and emotional well-being. Hunting, gathering, and surviving in the wilderness were our ancestors' daily activities for thousands of years. We called home a place with endless grasslands, dense forests, and vast stretches of green. Modern cities, crowded places, and polluted environments have replaced green spaces. Our bodies and minds are under pressure as a result of this rapid change. A rise in chronic illnesses, stress, depression, anxiety, burnout, and other ailments is a consequence of these urban changes. In addition, apathy, anger, addictions, intolerance, and loneliness are on the rise within the society of the 21st century. Below is the Author's scale self-report rating, graphically showcasing with score and percentages superimposed on the continuum of presence of Anxiety and Fear relief (Figure 5).

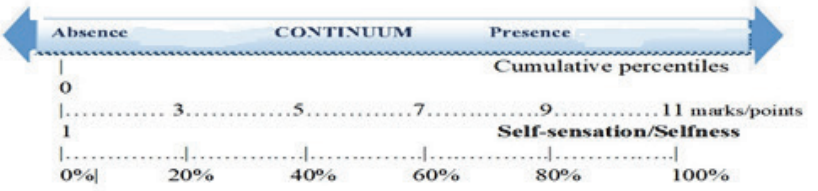


Figure 5. *Anxiety and fear relief continuum*

We have shown that after practicing the Forest therapies in our Wellness program in a Forest Art (FA), 43% of the participants reported Anxiety relief, 30% self-perceived fear relief of - 3 points; 25% reported 1-3 points; and 2% insignificant fear relief.

Forest Medicine and therapies are a part of the LIFE Forest program associated with the wellness lifestyle. At the same time, it is one of the key contributors to the European Green Deal which aims to transform the EU into a fair and prosperous society, with a modern, resource-efficient, and competitive economy where there are no net emissions in 2050. With this advanced strategy, economic growth will be decoupled from resource use, protection, and conservation, which enhances the EU's natural capital and Nature heritage for future generations. Vice versa, the power of Nature will protect the citizen's health and offer well-being from environmental and climate-related risks and impacts. The effectiveness of the forest therapies we approved by measuring two indicators: psychological and physiological. The first is the sense of Selfness by the author's assessment scale and the second by the changes in HR and the psychological balance of all participants. The pulse is one universal internal indicator and represents the rhythmic oscillations of the elastic arterial walls in synchronization with the heart activity (Table 2).

Table 2. *Significantly different HR results before and after the influence of forest therapies*

	Forest Air bath therapy		Forest Art therapy		Forest Elephant Eyes	
	Mean	***SD***	***Mean***	***SD***	***Mean***	***SD***
Pre HR	102.76**	13.56	105.05**	14.08	107.05**	15.01
Post HR	74.67**	11.43	69.14	10.57	70.21	11.05
Reps	39.33	13.33	40.76	14.65	41.37	15.44

**Significantly different from both forest therapies influences to the participant's psychological balance.*
***Significantly different from pre-therapies HR*

Post HR was significantly different between the forest treatment conditions a mean difference of 5.524 (95%). As would be expected there was a significant difference between Forest Art therapy HR (M = 69.14, SD = 10.57) and post HR of Forest Air bath therapy (M = 74.67, SD = 11.63), Forest elephant eyes therapy (M = 70.21, SD = 11.05), $p < .001$, in the condition as well as the pre-therapy HR. FA (M = 105.05, SD = 15.08) HR. FAB (M = 102.76, SD = 13.66) and HR. FEE (M = 107.05, SD = 15.01), $p < .001$.

Limiting conditions of the experiment: Even though all efforts were channeled to ensure a high degree of internal validity, the drive to implement forest therapies in practice placed limitations on the present study. A direct relationship exists between activities that support vasodilation and lowering blood pressure, as demonstrated in clinical and field studies.

DISCUSSION

This paper was the first known study to assess the usefulness of forest medicine activities in improving single-set, body-mind relaxation in contact with Nature. The specific mix of components in Forest Art therapy, Forest Elephant eyes or Air bathing we do not find to be scientifically studied. Researchers hypothesized that forest medicine activities would increase the wellness lifestyle of different age groups. Our partners from Montenegro and Serbia work in the field of dissemination of Forest practices. Based on our previous research using only the subjective emotional assessment on the feeling returning to the sense of Selfness, we upgraded the actual research. By studying the effects of forest therapies (Forest Art, Forest Elephant eyes and Forest Air Bathing) to eliminate post-COVID19 adverse effects of the global lockdown, this study aims to assess the effectiveness of an al-

most 4-month-long practice as a treatment (123.81 ±29.60 days). We investigated the positive impact on human health of the launched concept "Health from nature through forest medicine". In the specialized literature, there were no studies describing or evaluating the benefits of forest medicine and therapies, or even mentioning conservation of natural heritage. A large sample of people using different forest therapies makes our study unique. Forest medicine and therapies will contribute to the EU-green policies & priorities in particular through its three powerful influences: forest art, air bath, hammam, and elephant eyes:

- Boosting and integrating the implementation of the EU's policy objectives for halting and reversing the loss of wildlife habitats and species across all sectors;
- Supporting the transition to a circular economy and protecting and improving the quality of the EU's natural resources, including air, soil, and water among others;
- Supporting implementation of the 2030 energy and climate policy framework, the EU's climate neutrality objective by 2050, and the revised EU strategy on adaptation to climate change.

CONCLUSIONS

Forest medicine and therapies support the commercialization of Nature heritage. At the same time, these practices are very reasonable and non-destructive. The post-pandemic life indicates a lack of psychological balance, low confidence, absence of selflessness, and positive daily motivation all over the globe. These consequences are caused by a variety of social indicators, such as fear of loss, fear of weakness timing, fear of diseases, and fear of job loss. This study has documented that forest therapies as a treatment technique reduce fear, clean the mind, boost spirits, eliminate pain, increase range of motion, and improve outcomes and function in people after forest Med treatment. The use of this technique would appear to be an effective complement to traditional recreational therapies. In a comparative analysis before and after the influence in three study groups, it was found that the Wellness method by Forest Med treatment technique was highly effective for psycho-functional recovery for all participants.

Note:

Financial Disclosure: *The developed analysis is financially supported by the project BG-05M2OP001-1.001-0001 "Building and developing a Centre of Excellence "Heritage BG", funded by the Operational Program" Science and Education for Smart Growth.*

Declarations *of informed consent have been signed regarding the publication of survey data.*

REFERENCES

Angelcheva M., Petkova S. (2019). Effects of combination between relax massage and Bach flover remedies on everyday stress. *International Scientific Congress Applied Sports Sciences,* 15-16 November 2019, NSA, Sofia. Proceedings book, pp.348-352. Available at: www.icass2019.com. (accessed 2022, August 12th).

Dimitrova, B., Polomenov, M., Treneva, V., Nesheva, I., Ivanova, V., Trendafilov, D. (2018). *Sotsialna znachimost na uelnes (wellness) kulturata: sravnitelen analiz po danni ot nauchni izsledvania na Galap internesha-nal.* Izd. Avangard, Sofia, pp. 89-104. [In Bulgarian]. *Социална значимост на уелнес (wellness) културата: сравнителен анализ по данни от научни изследвания на Галъп интернешънъл (Gallup International).*

Dimitrova, B., Izov, N., Alexandrova, V., Iosifov, R., Ignatova, D., Trendafilov, D., Petrov, V., Vasileva, G. (2021). Smart kognitiven instrumentarium. Vŭnshna otsenka na profesionalni kompetentsii za kadri v Nishov turizŭm. NSA Pres, Sofia, pp. 58-60. [In Bulgarian]. *Smart когнитивен инструментариум. Външна оценка на професионални компетенции за кадри в Нишов туризъм.*

Donev, J., Andonov, S., Djobova, S., Donev, D., Hristov, O., Kirilova, I., Bahchevanski, S., Iossifov, R., Aleksandrova, V., Angelov, B., Stoyanova, N. (2019). Comparative study of measuring physical activity among sport students. Original scientific paper. *Conference: International scientific congress "Applied sports sciences. Balkan scientific congress of physical education, sports and health", 15 - 16 November 2019, Sofia, Bulgaria.* Proceeding book, pp. 369-374, NSA press, Sofia.

Ellis, S. (2013) The global wellness tourism economy Report. *Global Wellness Tourism Congress (Delhi, India). Global wellness institute, USA, Miami, pp.9-10.* Available at: https://www.globalwellnessinstitute.org/. (Accessed 2014 &2021, Dec 7th and November 24th).

GWI (2021). *The Global Wellness Economy: Looking Beyond COVID.* Ed. Global wellness Institute, 2021, pp.5-9, 43. Available at: https://globalwellnessinstitute.org/ industry-research/global-wellness-economy-looking-beyond-covid/. (accessed 2022, May 25th).

Harizanova, O. (2019). New scientific infrastructure for innovations on the creative and recreative industries.

Smart innovations in the Recreative & Wellness Industry and Niche Tourism Journal, Vol.1, Iss.1, pp.17-21. Available at: https://scjournal.globalwaterhealth.org, (accessed 2022, June 22nd).

Ignatova, D., Iliev, A. (2020). Motor qualities and their influence on children's development. *Smart Innovations in Recreation, Wellness Industry and Niche Tourism*, Vol. 2, Iss. 1-2, pp.16-44. Available at: https://scjournal.globalwaterhealth.org/, (accessed 2022, August 22nd).

Ilinova, B. (2014). *Zhenata i sporta.* Sofiya: Avangard Prima, pp.22-33. [In Bulgarian]. *Жената и спорта.* София:Авангард Прима.

Ilinova, B., Toteva, M. (2019). Pregnancy and delivery of elite competitive athletes. *International Scientific Congress-Applied Sports Sciences,* Proceeding Book, pp.280-285, NSA 2019. Available at: www.icass2019.

Ivanova, V. (2019). Influence of gymnastic exercises in the water environment. International Scientific Journal: Smart Innovations in Recreational, Wellness Industry and Niche Tourism. Vol 1, Iss. 1, pp. 53-56. Available at: https://scjournal.globalwaterhealth.org/, accessed 2022, September 2nd).

Nesheva, I. (2020). Information system for inclusion of women with normal pregnancy in gymnastics program. "Smart Innovations on the Recreative & Wellness Industries and Niche tourism", Sofia, Vol. 2, Iss. 1, pp. 33-39. Available at: https://scjournal.globalwaterhealth.org/, (accessed 2022, September 12th).

Tomova, T. (2021). Menstrualni raztroĭstva - razpostranenie i proyava. *International Scientific journal Smart Innovations in Recreational, Wellness Industry and Niche Tourism*. Vol.3, Iss. 2, pp.33-38. Available at: https://scjournalbg.globalwaterhealth.org/, (accessed 2022, September 10th). (In Bulgarian) Менструални разтройства - разпостранение и проява.

Veselinov, D. (2021). Диалогът в образованието. *X-Международен форум „Диалогът в образованието – присъствие и перспективи".* [Dialogat v obrazovanieto. *Deseti mezhdunaroden esenen nauchno-obrazovatelen forum. Dialogat v obrazovanieto – prisastvie i perspektivi, Sofia, Bulgaria].* Proceeding book, pp.11-16. [In Bulgarian].

Corresponding author:
Prof. Bistra Dimitrova, D.Sc.
Faculty of Public Health, Health Care and Tourism
National Sports Academy "Vassil Levski",
Sofia, Bulgaria
E-mail: dimitrova.bistra@yahoo.com

CHARACTERISTICS OF INCIDENTS AND INJURIES IN SKI AREA BOROVETS DURING THE 2019/2020 SEASON

Peter Yankov, Deyan Todorov, Svetoslav Simeonov
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
Although in Bulgaria there is a sub-law from the Law of Tourism regulating the security and safety of the users of the ski slopes in Bulgaria, not enough attention is paid to the point of view of reasons for the accidents, feedback, and prevention of injuries in the snow sports. Another argument underlying the relevance of the topic is the more frequent intervention of experts in snow sports from NSA "Vassil Levski", which has been invited as an experts in the preparation of sports-technical expertise for occurred accidents on the slopes.
This study aims to research the type of accidents and traumas in ski zone Borovets for 2019/ 2020 year on various indications – an hour of occurrence of the trauma, slope complexity, type of the trauma, and type of ski or snowboard equipment. The tasks reviewed as determine the type of trauma with ski and snowboarding.
Methods used: frequency analysis, analysis of documents, comparative analysis.
Summary of results: the total number of accidents on the slopes of ski zone Borovets for season 2019/2020 is 455. The skiing accidents are nearly 8 times as many as the snowboarding ones.
We distributed the traumas into four sub-groups: head, body, legs, and arms. It appeared that the biggest number of traumas is the ones of the legs, followed by those of the arms. In slope accidents, the most common trauma is on the knee joints, followed by shoulder and lower leg injuries. From those traumas, we reviewed the most severe traumas – the fractures. The most registered fractures are the ones of the lower leg and the collarbones.
Conclusions: Borovets is in second place in incidents in Bulgaria for the period. The highest percent of the traumas are the ones of the lower limbs, registered in the alpine ski. The incidents occur mainly on blue slopes.

Keywords*: incidents, traumas, security, ski zone Borovets*

INTRODUCTION

The Bulgarian winter resort Borovets offers 58 km of marked ski runs (24 km blue, 29 km red, 5 km black) and the Musala Pathway, which is 12 km long and is classified as a ski road. With its convenient location not far from the capital city and its 10 illuminated slopes for night skiing and snowboarding, the resort is constantly increasing its tourist attendance. As a result, the ski area also shows an increasing trend of sports injury occurrences.

Every country tries to do its utmost for its tourism development and for encouraging local citizen participation in sports. Global snow sports participation increasingly grows in all age groups – and at all ski resorts around the world safety of the slope and users is the top priority. Therefore, there are generally valid safety rules and regulations that apply to both skiers and snowboarders – and are adopted by all winter resorts worldwide.

Whether we use a marked trail or not, safety should also be our first and foremost priority (Zgurovski, Yankov 2007); injury prevention guidelines should be followed everywhere on the mountain. The Bulgarian Tourism Act and the Ordinance-Law on the Determination of Safety Rules in Winter Sports are in line with international standards. However, there is a lack of comprehensive, in-depth research into the risk factors for the most common types of injuries in local winter resorts, and the preventive measures taken by their management. The relevance of the topic is confirmed by the increasing number of cases in which professors from the National Sports Academy are hired as forensic experts to perform analyses and provide expert opinions on winter sports injuries. However, Bulgarian ski facility owners and operators are reluctant to seek help from experts in the field of accident prevention.

Major manufacturers operating in the global winter sports equipment market are constantly striving to introduce innovative snow safety and reporting products, as according to the author Drazhev, D. (1980) the main reasons for obtaining injuries can be classified as:

- use of inappropriate equipment.

- long carrying out of educational classes without paying attention to the signs of already occurred fatigue.

However, we get the impression that safety is an often underestimated issue. Undoubtedly, the implementation of preventive measures must be strictly controlled, as the issue affects the overall quality of the service. We believe that the use of a modern approach to the study of the incidence of injuries would be useful to better understand the cause of the problem and address it at a national level.

We were kindly provided with the trauma data recorded in Borovets by the Bulgarian Red Cross Mountain Rescue Service during the 2019/2020 season. The incident reporting form did not include the number of lift passes purchased for the season, so this analysis does not take into account the user load on the slopes. Collecting this data may allow future studies to further assess injury risk factors.

Aim: To conduct a systematic review of the ski and snowboarding injuries recorded at the Borovets ski area during the 2019/2020 season and compare them in terms of type, frequency, time of occurrence, slope difficulty, and kind of sport.

Tasks:

1. Incident classification according to the slope difficulty and length.
2. Analysis and overview of the incident distribution by age, gender, and severity of injuries.
3. Overview of the incidents in terms of slope difficulty and timeframe of occurrence.

METHODS

A total of 455 incidents on the ski slopes were studied between December 2019 to March 2020 in the Borovets-Bulgaria ski area, in which first aid was provided by the Mountain Rescue Service. In the study, we found that the most common injuries, disabilities and traumas were in recreational skiing and snowboarding recorded in Borovets, and compared them by type, frequency, time of occurrence, difficulty on the ski slope. The analysis identified when and on which ski slopes the most severe injuries, such as fractures, occurred.

Statistical methods: frequency analysis, document analysis, comparative analysis.

RESULTS AND ANALYSIS

According to the local Mountain Rescue Service, 455 injuries were reported at the Borovets ski area during the given season, ranking it second among all Bulgarian winter resorts. Based on this criterion, Bansko ranks first with 3 times as many injuries for the same season, given that the total slope length there is 75 km vs. 58 km in Borovets. The length difference is only 17 km, and the number of injury cases in Bansko is significantly higher.

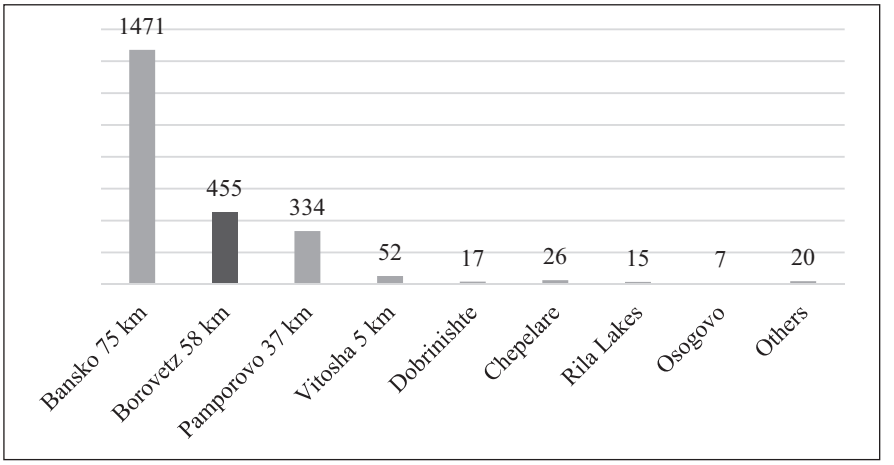


Figure 1. *Total number of the injuries occurred in Bulgarian winter resorts during the 2019/2020 winter season.*

The results show that the number of cases registered in Bansko is much greater than the average for the Bulgarian ski areas. Dividing the total numbers of incidents by the total slope lengths, we obtained the following results:

- Bansko 19.61 cases per km
- Borovets 7.84 cases per km
- Pamporovo 9.02 cases per km
- Vitosha 10.04 cases per km

According to these data, the Borovets ski area had the lowest number of incidents per kilometer of ski slope.

Figure 2 shows the gender distribution of the incidents registered at the ski slopes of Borovets during the season. The injuries were far more common among males.

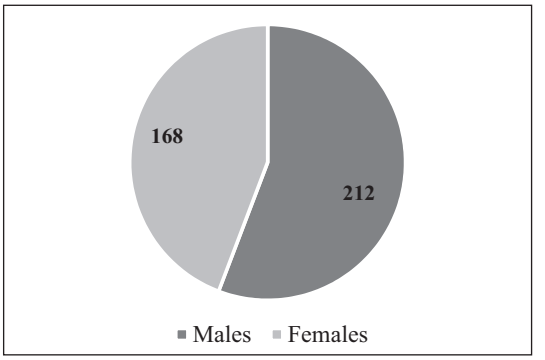


Figure 2. *Distribution of the incidents by gender.*

Figure 3 summarizes the number of injuries sorted by age group. The statistic shows that skiers and snowboarders aged 40–50 and 20–30 were at the highest risk for an injury.

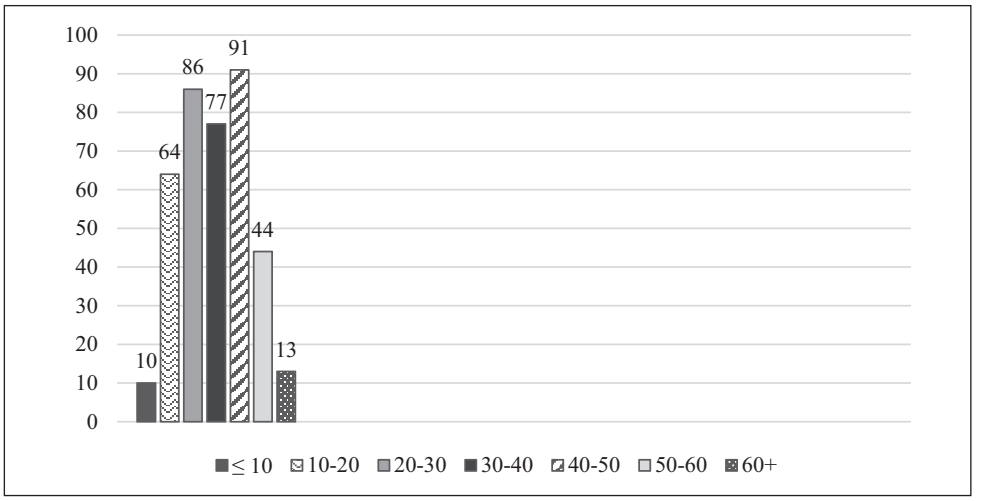


Figure 3. *Number of injury cases per age group.*

Interestingly, the skiers and snowboarders aged 40–50, who are expected to have acquired long-lasting knowledge and skills, accounted for the largest fraction of cases.

Injury incidents occurred most frequently on blue runs, such as Martinovi Baraki 1 (107 cases reported) and Markujik 1 (64 cases reported).

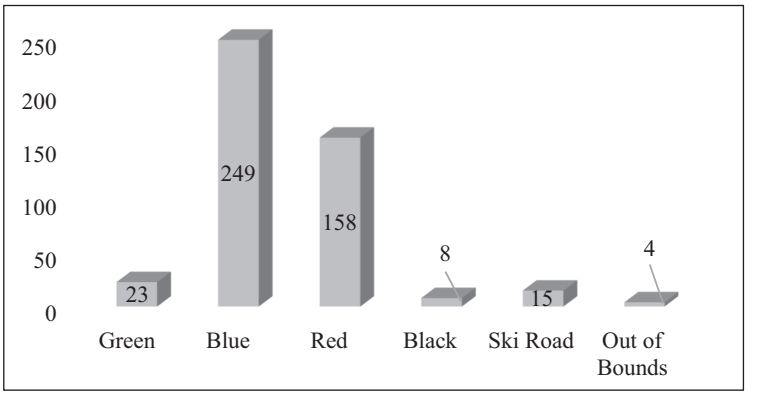


Figure 4. *Distribution of the incidents by slope difficulty.*

Martinovi Baraki 1 starts with a wide-open terrain followed by a narrow middle section, which causes a very high injury risk.

The statistic displaying the percentage distribution of injuries by type can be seen in Figure 5.

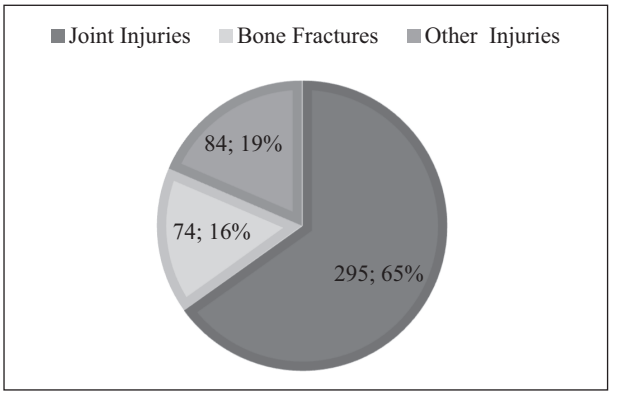


Figure 5. *Types of injury.*

Joint injuries are most common, especially those involving the lower extremities, and particularly the knee. The shoulder comes second, and the third most prevalent site is the wrist (Figure 6).

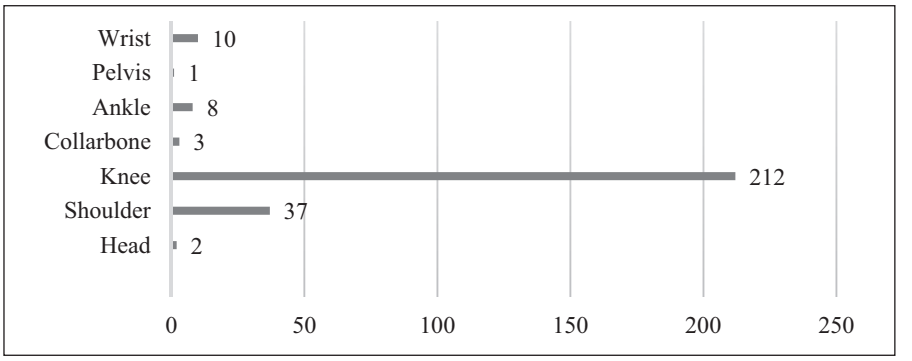


Figure 6. *Distribution of the reported joint injuries by affected body part.*

Other injuries most commonly affect the head or the torso. Their distribution is shown in Figure 7.

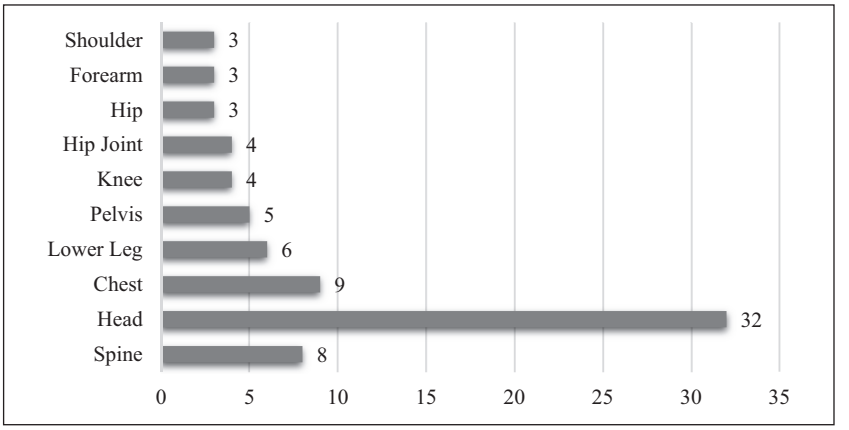


Figure 7. *Distribution of the other injuries by affected body part.*

Concussion represents the majority of head traumas, which is mainly due to the high speed. Riding without a helmet increases the risk of sustaining a serious head injury. Our source did not provide information on whether the head trauma victims were wearing helmets at the time of the incidents.

Bone fractures are very serious injuries with a long recovery time. As noted by (Yankov, Zgurovski,

2008), they are among the most common skiing and snowboarding emergencies, along with muscle and tendon strains and ligament sprains. The frequency distribution of fracture incidents at the Borovets ski area during the 2019/2020 season is shown in Figure 8.

The most common fracture location is the lower leg, with as many as 30 cases – which is due to the *characteristics* of the equipment and, more precisely, the boots, designed to *hold the ankles firmly* in place. Thus, the stress is put on the shins and the knees. Collarbone fractures come second.

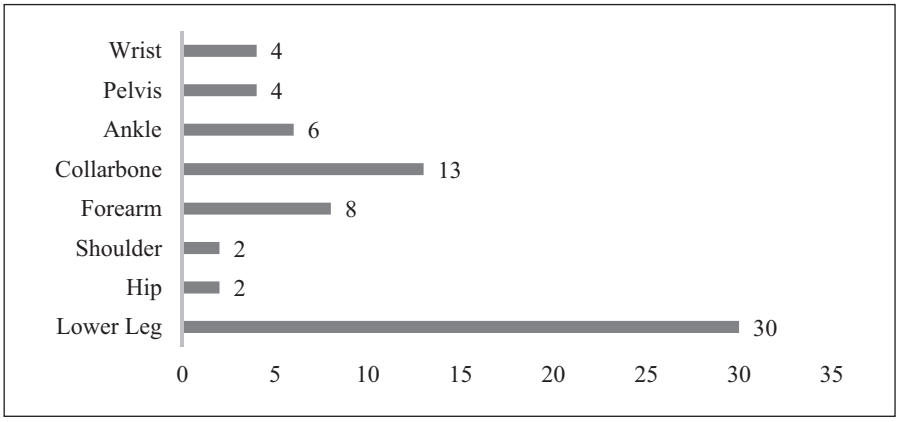


Figure 8. *Sites of fractures.*

The hourly distribution of bone fractures is presented in Figure 9. It is evident from the data that the severe injuries' peak time was the afternoon – which could be partially explained by the worsened ski conditions due to the weather (sun, wind, positive temperatures) and the impact of the other slope users. Another possible cause is the emerging fatigue.

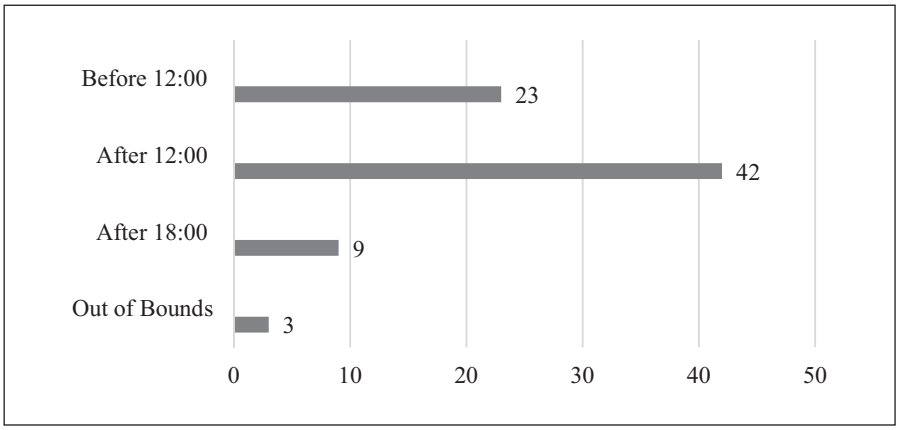


Figure 9. *Hourly distribution of fractures.*

The after 18:00, fractures occurred on illuminated slopes.

The distribution of fractures by slope difficulty is as follows:

- Green run (beginner) – 9 cases
- Blue run (early intermediate) – 34 cases
- Red run (advanced) – 23 cases
- Black run (expert) – 1 case

Only 3 of the registered incidents occurred out of the marked area.

DISCUSSION

Borovets ranked second among all Bulgarian winter resorts in the total number of injury incidents for the 2019/2020 season and had the lowest number of incidents per kilometer of ski slope. Most cases occurred on blue (beginner) runs. Males were significantly more likely to sustain an injury.

The lower extremities and especially the knee joints were the most frequently injured part of the body. The largest number of fractures affected mainly the lower leg and the collarbone and occurred most of-

ten on blue slopes. Other traumas most commonly affected the head and the chest. Incidents tend to peak between 12:00 and 18:00 due to the accumulated fatigue, the slowed reactions, and the higher afternoon attendance at the ski area. Another strong factor that can heavily influence the injury rate is the poor condition of tracks (Furnadzhiev, 1994).

The data reveal that the both skiing and snowboarding have a high risk of serious injury.

We recommend that the Bulgarian owners and operators of skiing and snowboarding facilities seek professional advice from winter sports experts on applying measures for the prevention of injuries and reducing the risk of accidents at the ski areas.

To ensure broader data collection for a more comprehensive analysis, we recommend that the Mountain Rescue Service revises the incident report form so that it includes information on whether the victims of injury were:

- riding alone or in a group
- skiing or snowboarding
- wearing personal protective equipment (helmet)

Acknowledgments
We would like to express our special thanks to the Mountain Rescue Service at the Bulgarian Red Cross for the information provided.

REFERENCES

Drazhev, D. (1980) Osnovi na nachalnoto obuchenie po ski. ETSNPKFKS-VIF "Georgi Dimitrov". Sofiya. // Дражев, Д. (1980) Основи на началното обучение по ски. ЕЦНПКФКС-ВИФ «Георги Димитров». София.

Furnadzhiev, V. (1994) *Ski za nachinaeshti i napredna-li*. Vector F, Sofia.// Фурнаджиев,.В. (1994). Ски за начинаещи *и* напреднали. Вектор Ф.,София.

Yankov, P., Zgurovski, Kr. (2008) *Snoubord*. Dedraks, Sofia.// Янков, П., Згуровски Кр. (2008). Сноуборд., Дедракс. София.

Zgurovski Kr., Yankov P. (2007) *Alpijska ski tehnika*. Bulgarian Ski School, Sofia. // Згуровски,Кр., Янков., П. (2007) Алпийска ски техника. Българско ски училище, София.

Corresponding author:
Peter Yankov, PhD
Snow Sports Dept.,
National Sports Academy "Vassil Levski"
Studentski grad, 1700 Sofia, Bulgaria
E-mail: iankovski61@gmail.com

ANALYSIS OF THE DIFFERENCES IN THE SPEED, ACCELERATION, AND POWER OF VOLLEYBALL PLAYERS ON DIFFERENT PLAYING SURFACES

Vladimir Kotev, Boris Yankov
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
Physical training of athletes on a sand surface is a method that is increasingly used in recent years. The present study analyzes how different surfaces affect students' sprint power. The experiment used the "Running Anaerobic Sprint Test"(RAST)- 6 sprints of 35 m, with a break of 10 seconds between them by Mackenzie 2005. The participants conducted the test twice, in the sports hall and on dry sand. The study included 20 students (male) from the Medical University of Varna aged 19-23, training volleyball and beach volleyball.From the obtained results, the following indicators have been calculated: speed, acceleration, strength, and power. The results show that sand surface reduces the participants' speed by an average of 10.66% which, is more than 0,5m per second. The average value of accelerations of all participants on the sand is 21.65% lower than indoor values. The difference in the ratio of the average values of the calculated powers is nearly 33%. The ability of students to maintain anaerobic performance on the sand is 1/3 lower than indoors. The results show that training on the sand increases requirements for physical capacity. As a result, students' efforts for the same action are significantly greater. In conclusion, it can be stated that the training process on sand could improve the physical capacity of athletes practicing all kinds of sports, including hard surfaces. This can be used when planning training activities for each type of sport, as well as for all age groups.

Keywords: *volleyball, students, sprint, sand.*

INTRODUCTION

It is a known fact that moving on a sand surface requires much greater effort than on a hard court. Over time, there have been a number of studies measuring the increase in energy expenditure of people carrying or pushing loads on various surfaces (Heinonen et al. 1959; Strydom et al., 1966; Soule and Goldman, 1972; Haisman and Goldman, 1974.) or by walking and running on the beach (Zamparo et al., 1992). Beach volleyball is played by teams of two players on a sandy surface, with periods of play and rest where the intensity is variable. In his research, Magalhães observed the pulse rate and the presence of lactate in the blood of the competitors during a game. The results show that in beach volleyball, the aerobic system is dominant, but the condition of the athletes also depends on the anaerobic alactate system. Various physiological and biomechanical differences are associated with exercising on a sandy training surface compared to a firmer and more conventional training surface such as grass (Lejeune et al., 1998; Pinnington et al., 2001; Zamparo et al., 1992). A physiological study (Zamparo et al., 1992) demonstrated that the energy expenditure of running on a soft surface (dry sand) is higher than on hard ground by 15-40% for a speed of 6-16 km/h. These differences include a significant change in kinematics and muscle activation patterns when running on sand (Pinnington et al., 2001), which contributes to significantly greater energy expenditure compared to running on a harder surface at similar speeds. Moreover, the high absorbent qualities of the sand surface can reduce ground reaction forces (Barrett et al., 1997; Bishop, 2003) and limit maximal performance in sprinting (Barrett et al., 1997) and jumping performance (Bishop, 2003, Castellano, Casamichana, 2010; Giatsis et al., 2004).

The present study aims to analyze how different surface affects sprint power in students.

METHODS

Running Anaerobic Sprint Test (RAST) was used to conduct the experiment. The test consists of 6 sprints of 35 m, with 10 sec. pause between them (Mackenzie, 2005). RAST was developed at the University of Wolverhampton (U. K.) to test an athlete's anaerobic performance. Twenty students (men) from Varna Medical University, aged between 19 and 23, practicing volleyball and beach volleyball, were submitted to both sand and indoor test. The tests were done on two consecutive Mondays after complete rest, at an air temperature of 22^{0}C, and after an equal warm-up. Participants were required to have breakfast no less than two hours before the test. After determining the six times of each student

by formulas, the following indicators are calculated:

- Speed
- Acceleration
- Strength
- Power

All values carry information about the anaerobic performance of the students and the speed of recovery processes. A comparative analysis was made between the performance of the participants on the sand and indoors. The MS Excel 2010 program was used to process the results. The SPSS statistical analysis program is used to calculate Student's t-test.

RESULTS

Figure 1 shows the differences in indoor and sand sprint times. Sand sprint times increase progressively with each subsequent attempt. In the indoor sprints, it is noticeable that the times increase until the fifth sprint, then in the sixth, we have a better time. The time differences ranged from 0.53 to 1.03 sec. The biggest difference in times is in the last sprints, and this is due to the faster time achieved in the indoor performance. From the average values of the times and the difference between them, it can be seen that the lag in the sprints on sand is about 0.7 seconds compared to those in the sports hall. Only the first sprint on sand gives a time under 6 seconds, while on the hard surface, we have a time over 6 seconds only in the last two sprints. The difference between the hall's fastest and the slowest attempt is 1.06sec. In the sand sprints, it is 1.4sec.

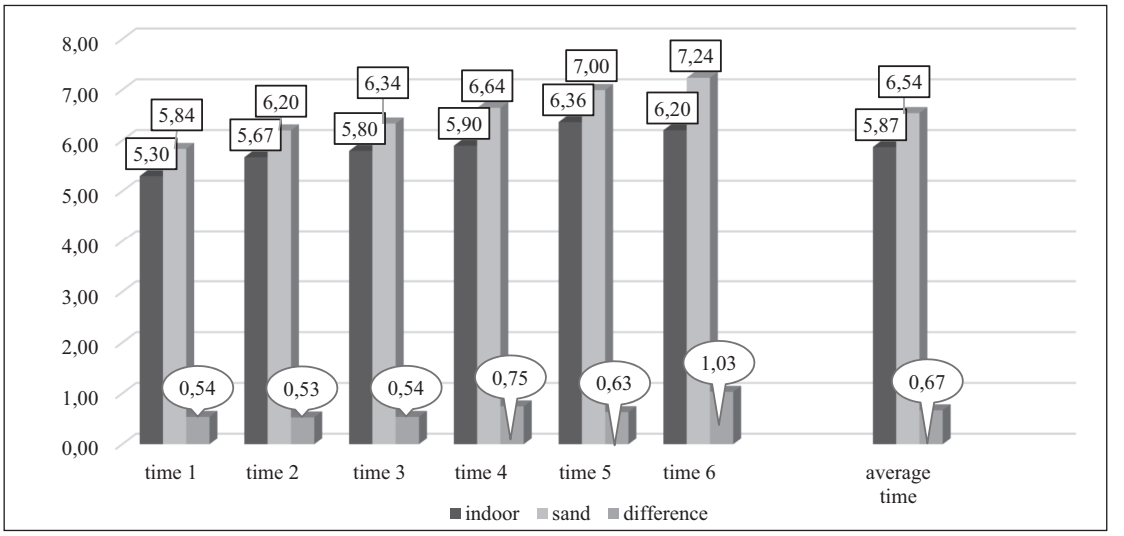


Figure 1. *Comparative time analysis*

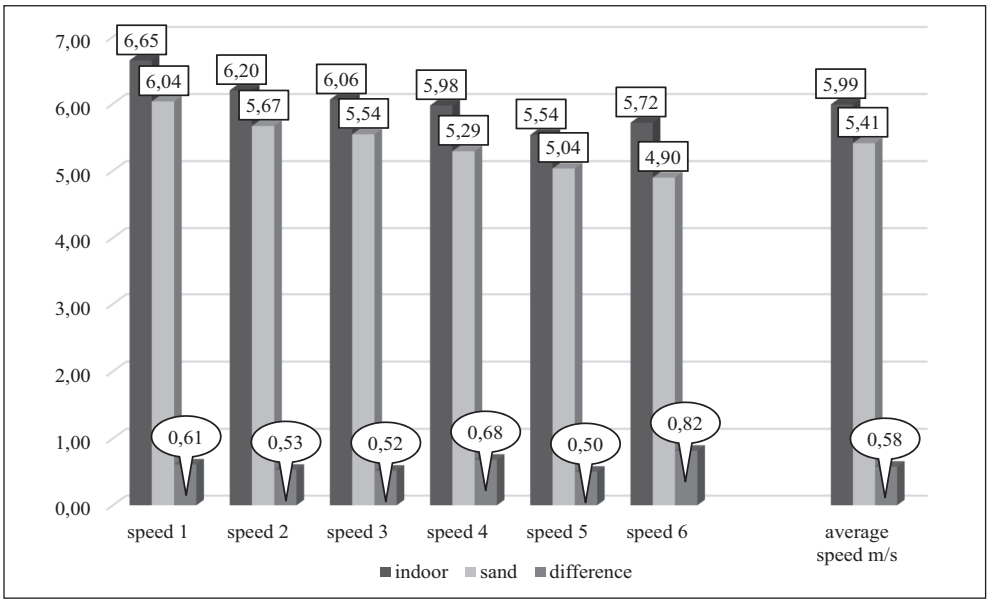


Figure 2. *Comparative speed analysis*

The difference between the average values of sand and indoor velocities is close to 0.6 m/s. The smallest difference in speed (0.5m/s) is in the fifth sprint, and this is due to the slower indoor performance time. The smallest speed in sprints on sand is 1.14m/s lower than the largest. The difference in speed on a hard surface between the fastest and slowest trials is almost the same at 1.11m/s. The graph shows that the students can maintain a speed ≥ 6m/s in the first 4 trials on a hard surface. Only in the last two sprints is there a speed drop of more than 0.5 m/s. On the sand, we see that already in the second sprint the, speed is below 5.7 m/s and decreases progressively to 4.9 m/s in the last attempt. The biggest differences between indoor and sand speeds are seen in the fourth (0.68m/s) and sixth (0.82m/s) sprints.

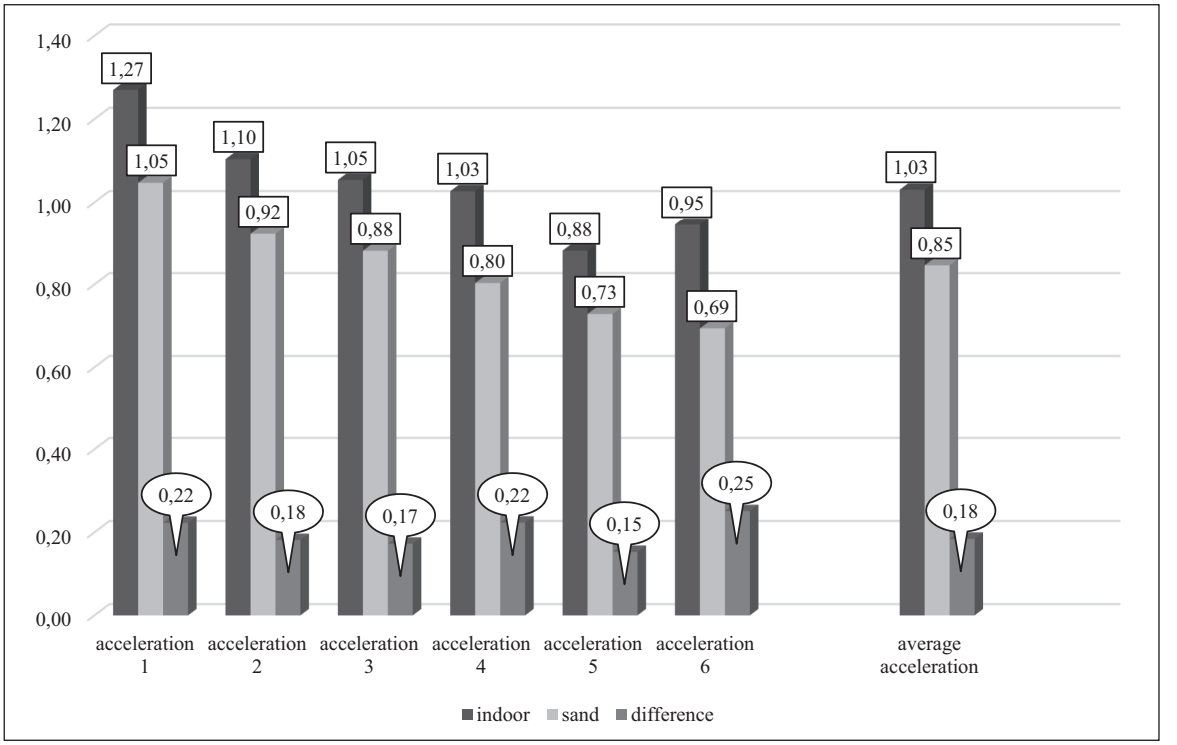


Figure 3. *Acceleration analysis*

We see the closest values for accelerations in the second, third, and fifth sprints. The biggest difference in the accelerations of the last sprints is 0.25m/s^2. Moreover, we can see a sharp drop in accelerations between the first and second indoor (0.17 m/ s^2) and sand (0.13 m/ s^2) sprints. In the first attempts, we have a maximum effort from the students and a lack of fatigue. After that, we observe a gradual decrease in the acceleration values, with those in the hall decreasing with smaller values. An increase in acceleration in the last indoor sprint is seen, which is due to the high motivation of the students. At the same time, the onset of fatigue from the work on the sand surface leads to a gradual decrease in accelerations for each subsequent sprint. The fastest indoor acceleration is 0.39 m/ s^{2,} faster than the slowest. The same indicator for sprints on sand is 0.36 m/ s^2. It can be concluded that when sprinting on the sand, the difference in the acceleration of each successive trial is minimal.

The strength for each sprint is a function of the students' acceleration and weight. The difference between the mean force values calculated for the indoor and sand sprints was 17.08 N. Figure 4 shows that the smallest difference is for sprints 5 and the biggest is for sprints 6 (21,28N). During the first trials, we see large differences in the values with a subsequent decrease in the differences in the second and third trials around 15NThe first three indoor sprints produce strength results higher than the best performance on the sand. Only after the fourth trial on hard surface, the magnitude of the force drops to the level of the highest recorded sand value. The decline level of force values calculated during sprints on sand is relatively greater than that of indoor trials. We can see that the force of each sprint decreases by between 7 and 10N, while in the gym, it decreases by 4 to 7N. Exceptions are the drops between the first and second attempts, where the decrease in force in the hall was 14.25N, and

on the sand, it was 10.6N. The highest difference in the calculated force values is seen in the last sprints. This is due to the better time achieved in the indoor trials and fatigue in the sprints on the sand.

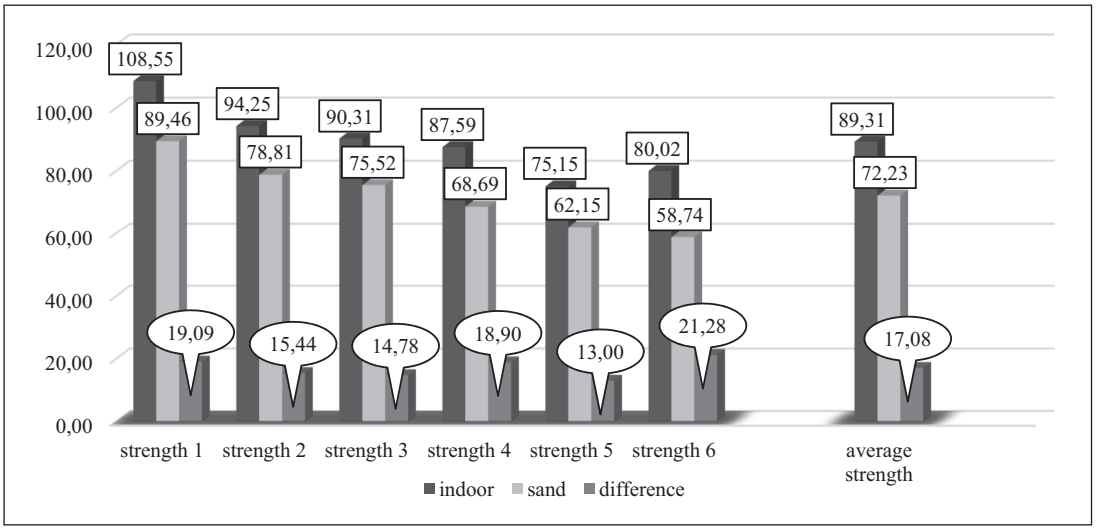


Figure 4. *Comparative strength analysis*

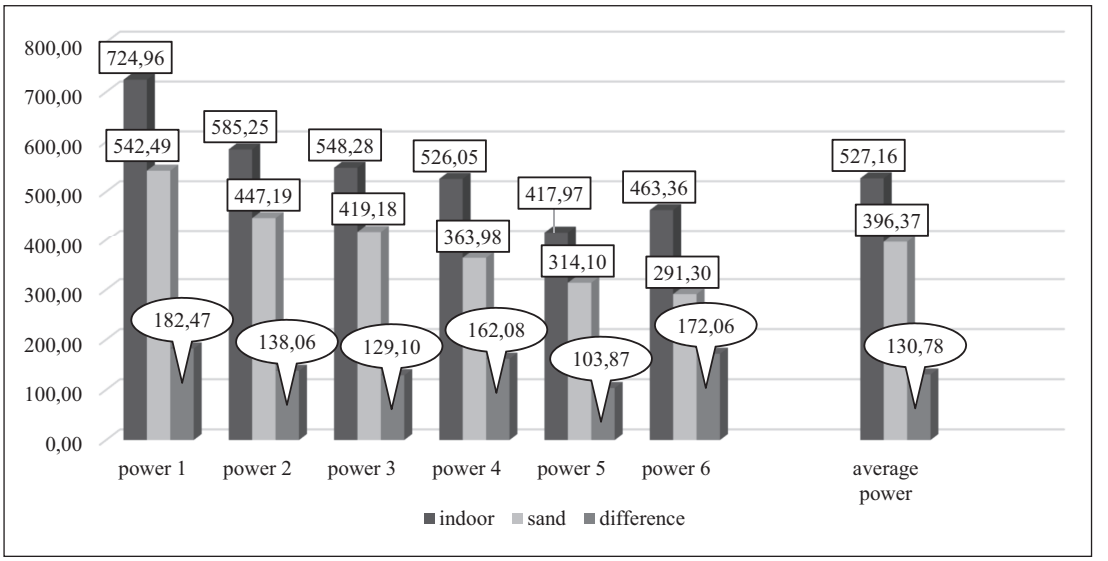


Figure 5. *Comparative power analysis*

Figure 5 presents the power values for each sprint and the average power values measured indoors and on the sand. The biggest differences are in the first and last sprints. This is related to the high results in the first and last indoor sprints. The average power of the indoor sprints is close to the peak power value of sprint 1 on the sand and is higher than any other calculated value for the sprints on the sand. The smallest difference of 103.87W in the fourth attempt is the result of the relatively poor results in the indoor sprint. The decreases in values in the first three indoor sprints were greater than those calculated for the sand trials. We can see drops of 139W, and 37W in the first three indoor sprints, while on the sand, the drops are 95W and 28W. After the third sprint, the drops in the power values calculated for the sand sprints were significantly larger than those in the sports hall.

DISCUSSION

The results obtained provide information on the difference between sprinting on a hard surface and on the sand. The values of all indicators for indoor sprints are greater than those for sand sprints. These data confirm the thesis of (e.g. Lejeune et al., 1998) "running on sand requires only 1.15 times more mechanical work than does running on a hard surface at the same speed and 1.6 times more energy expenditure than does running on a hard surface".

The higher power values as a function of the better indoor times are largely due to the higher stability and lower surface resistance. In his research (e.g., Binnie et al., 2013) came to the same conclusion „ A softer surface will provide less stability and energy return during the stance phase of gait, thereby requiring a greater input from the muscles to achieve the same movement output ".

Both surfaces showed fast progression of fatigue and a severe decline in performance from the following first sprint, and a subsequent smoother decline in research performance with each subsequent sprint. This trend is fully maintained in the sand testing, while in the indoor sprints, we have a large drop after the first sprint and a greater acceleration in the last sprint compared to the fifth. We attribute this more to the moral and volitional efforts made during the last performance of the sprints and not as some regularity.

Acceleration is the indicator that shows the positive change in the students' speed per unit of time. The results show that the influence of a sandy surface leads to a gradual decrease in accelerations with each subsequent trial. It is concluded that the increase of the vertical push does reduce the average step power but that a limit is set by the increase of the push-average power (e.g., Cavagna et al., 1991).

To achieve speed on sand equal to indoor speed, volleyball players must increase their power level by 1/3. Training on sand would increase their tolerance to such loads. An improvement in power due to training on sand is a prerequisite for an increase in power during the next attempts on the hard surface.

REFERENCES

Barrett, R., Neal, R. & Roberts, L. (1997). The dynamic loading responses of surfaces encountered in beach running. *Journal of Science and Medicine in Sport.* Vol.1, No. 1, pp. 1–11.

Binnie, M.J., Dawson, B., Pinnington, H.C., Landers, G., & Peeling, P. (2013). Part 2: Effect of training surface on acute physiological responses after sport-specific training. *Journal of Strength and Conditioning Research.* Vol.27, No. 4, pp. 1057–1066.

Bishop, D. (2003). A comparison between land and sand-based tests for beach volleyball assessment. *Journal of Sports Medicine and Physical Fitness* Vol.43, No. 4, pp. 418–423.

Castellano, J. & Casamichana, D. (2010). Heart rate and motion analysis by GPS in beach soccer. *Journal of Sports Science & Medicine.* Vol. 9 No. 1, pp. 98–103.

Cavagna, G.A., Willems, P.A., Franzetti, P. & Detrembleur C. (1991). The two power limits conditioning step frequency in human running. *Journal of Physiology*, Vol.437, No. 1, pp.95-108.

Giatsis, G., Kolloas, I., Panoutsakopoulos, V. & Papaiakovou, G. (2004). Biomechanical differences in elite beach-volleyball players in vertical squat jump on rigid and sand surface. *Sports Biomechanics.* Vol.3, No. 1, pp. 145–158.

Heinonen, A. O., Karvonen, M. J. & Runosteenoja, R. (1959). The energy expenditure of walking on snow at various depths. *Ergonomics* vol.2, pp. 389–394.

Lejeune, T.M., Willems, P.A. & Heglund, N.C. (1998). Mechanics and energetics of human locomotion on sand. *Journal of Experimental Biology*. Vol.201, No. 13, pp. 2071–2080.

Magalhães, J., Inácio, M., Oliveira, E., Ribeiro, J. C. & Ascensão, A. (2011). Physiological and neuromuscular impact of beach-volleyball with reference to fatigue and recovery. *Journal of Sports Medicine and Physical Fitness* Vol.51, No. 1, pp. 66–73.

Pinnington, H.C. & Dawson, B. (2001). Running economy of elite surf iron men and male runners, on soft dry beach sand and grass. *European Journal of Applied Physiology*. Vol.86, pp. 62–70.

Pinnington, H.C. & Dawson, B. (2001). The energy cost of running on grass compared to soft dry beach sand—*Journal of Science and Medicine in Sport.* Vol.4, No. 4, pp. 416–430.

Pinnington, H.C., Lloyd, D.G., Besier, T.F. & Dawson, B. (2005). Kinematic and electromyography analysis of submaximal differences running on a firm surface compared with soft, dry sand. *European Journal of Applied Physiology*. Vol.94, pp. 242–253.

Soule, R. G. & Goldman, R. F. (1972). Terrain coefficients for energy cost prediction. *Journal of Applied Physiology*. Vol.32, No. 5, pp.706–708.

Strydom, N. B., Bredel, G. A., Benade, A. J., Morrison, J. F., Viljoen, J. H. &Van Graan, C. H. (1966). The metabolic cost of marching at 3 M.P.H. over firm and sandy surfaces *Internationale Zeitschrift für angewandte Physiologie einschließlich Arbeitsphysiologie.* Vol.23, pp. 166–171.

Zamparo, P., Perini, R., Orizio, C., Sacher, M. & Ferreti, G. (1992). The energy cost of walking or running on sand. *European Journal of Applied Physiology*. Vol.65, pp.183–187.

Corresponding author:
Vladimir Kotev, Ph.D.,
"Basketball, volleyball, handball" department
National Sports Academy "Vassil Levski",
Sofia 1700, Studentski grad,
E-mail: vkotev.nsa@gmail.com

 DOI: 10.37393/ICASS2022/95 133 - 139

METHODOLOGY OF BACK PAIN RELIEF USING ISOMETRIC-TENSION POST-COVID-19 DISEASE

Krasimir Petkov, Bassel Tahboub
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
Objective – To establish a new and effective methodology for physical exercises to relieve back pain after Covid-19 disease.
Methods – This report deals with reviewing the author's methodology, which consists of isometric tension exercises based on karate blocking techniques. The exercises are five in number. The execution time is 7-8 minutes per set. Fit balls, foam rollers, and gym mats or equivalents may be used. A further study will be conducted to examine and evaluate the methodology on people with back pain after being infected with COVID-19. The individuals will be observed and measured with surveys. The results will be presented in further reports.
Discussion – Studies have shown that regular exercise helps to prevent pain (Sulejanov, 2009, Lizier et al., 2012, Washif et al., 2019) and it has been found that pain is worsened by Covid (Serrano-Ibáñez et al., 2021). Furthermore, as for the beneficial effect of isometric exercise on the body (Rio et al., 2017, Noorkõiv et al., 2015, Schott et al., 1995), this methodology differs in that it can be performed every day and in any place (gyms, medical centers, homes, and even at work). It does not take much time and is not complex. We assume that after applying the methodology and evaluating the results obtained, we will confirm the positive effect of the exercises on pain after Covid-19 disease.
Conclusion – In conclusion, after reviewing the methodology as well as the preliminary studies on the practical impact of physical exercise on the health of people with back pain, we assume positive results can be achieved. Therefore, the author's methodology will be applied to obtain data which is needed to produce a complete evaluation of its effectiveness in further reports.

Keywords: *pain, post-Covid, exercises, isometric*

INTRODUCTION

Covid-19 is a new coronavirus also known as SARS-CoV-2. The World Health Organization (WHO) announced it for the first time in December 2019 (WHO, 2021). According to studies in 2021, the most common accompanying symptoms after shortness of breath are muscle (myalgia), neuropathic, and joint pain (Weng et al., 2021).

Chronic pain increases stress, restricts physical activity, disrupts sleep, and reduces the possibility of complete recovery (Geneen et al., 2017). In all cases, the adequate treatment of the disease and the control of the pain increase the QoL of the patient (Megari, Kalliopi, 2013). In other words, inadequacy to control pain leads to a patient's inability to fully realise his/her intellectual, physical, educational, and professional abilities (Bogduk, 2006, Ahmed, Modic, 2007).

Pain is a biological phenomenon with a negative sign but with a positive sense. It is the first and most important sign of discomfort and should therefore be sought, localized, and characterised (Kolarov, 2003). According to WHO, motor-physical activity is defined as any body movement produced by skeletal muscles that requires energy expenditure. Physical inactivity (lack of physical activity) has been identified as the fourth leading risk factor for global mortality (WHO, 2020). Studies show that in a sedentary lifestyle, physical activity helps people with chronic musculoskeletal pain (D'Silva et al., 2018, Luque-Suarez et al., 2018). Studies show that a significant and moderately strong positive relationship exists between the level of physical activity and QoL in adults with spinal cord injury (Sandy et al., 2008), and even helps people with multiple sclerosis (Motl, McAuley, 2009).

Physical activity, health, and QoL are closely linked. The human body is designed to move and therefore needs regular physical activity to function optimally and to avoid illness (Hills et al., 2015). It has been shown that sedentary lifestyles are a risk factor for the development of many chronic diseases, including back pain, one of the major causes of discomfort and a factor in decreasing QoL in the western world (COM, 2008). As during Covid-19 there

wasn't much movement and activity as a result of quarantines and a sedentary lifestyle has arisen, which led to an increase in the number of people with back pain.

The three predisposing factors for back pain and its repetition are largely related to the positions and their maintenance. The most important is the correct sitting position that supports the spine curves, followed by the reduced volume of lumbar extension, and lastly, the frequency of flexion (McKenzie, 2003).

Pain can occur in different locations of the spine and can be treated differently depending on the location and type of pain. Several medications may be used to reduce pain (Zdziarski et al., 2015). Nowadays, treatment of pain involves eliminating its cause by using intra-articular injections (Vincent et al., 2013) and NSAIDs (Wertli, Steurer, 2018, Chou, Huffman, 2007), but they can be painful and not long-lasting or with side effects.

However, other treatment options can be used, as studies show that regular exercise has been identified as a primary preventive and management of pain (Sulejanov, 2009, Lizier et al., 2012, Washif et al., 2019). It is considered that there is a strong connection between COVID and the worsening of the pain. (Serrano-Ibáñez et al., 2021).

It has been proven that if pain is not given sufficient attention, it may become chronic and will increase stress, restrict motor activity, disrupt sleep, and reduce the possibility of complete recovery. In all cases, adequate control of pain will reduce its accuracy.

Since the main goal of physical exercise as an activity for health is to develop physical education tools and methods aimed at enhancing the functional capabilities of the endocrine and immune systems for their vital functioning (Sulejanov, 2009), these methods may help the body to better recover its strength after Covid-19.

People who do little or no physical activity are more likely to get very sick from Covid-19 than those who are physically active. A Communicable Disease Centre's (CDC) systematic review found that physical activity is associated with a decrease in COVID-19 hospitalizations and deaths, while inactivity increases that risk (CDC, 2022).

Here comes the role of isometric exercises as they reduce pain subsequent to several different intensities and durations of isometric contractions (Lemley et al., 2014). Furthermore, isometric exercises have an effect on improving physical endurance and posture by strengthening and stabilising the muscles (Lum, Barnosa, 2019). They have various effects on the body, as findings show beneficial results after the execution of these types of contractions (Rio et al., 2017, Noorkõiv et al., 2015, Schott et al., 1995).

The purpose of this manuscript is to establish a new and effective methodology for physical exercises to relieve back pain after Covid-19 disease.

METHODS

The author's methodology is for blocking pain. It comprises a set of isometric-based exercises and blocking-protective techniques of martial arts karate (Shotokan). A further study will be conducted to examine and evaluate the methodology on people with back pain after being infected with Covid-19. The individuals will be observed and measured with surveys. The results will be presented in further reports.

Methodology of exercises used

The methodology states for coordination of the static tension (isometric) combined with the dynamic tension (isotonic), which encompasses the same level of the spinal column with consideration of rhythmic breathing. Fit-balls, foam rollers, and gym mats or equivalents may be used. As follows:

Table 1. *General over review of the author's training program*

Duration of the methodology	Every day for 10 days
Number of performances per day	5
Number of exercises	5
Number of phases	4
Number of phase repetitions	3
Duration of phases	5-6 sec.
Duration of exercise	1 min (3x20 sec.)
Series duration	7-8 min
Duration of breaks	20-40 sec.
Way of execution	Slow pace
Type of load	Isometric + isotonic
Breathing rhythm	Inhale at 1st phase and exhale in the 4th phase

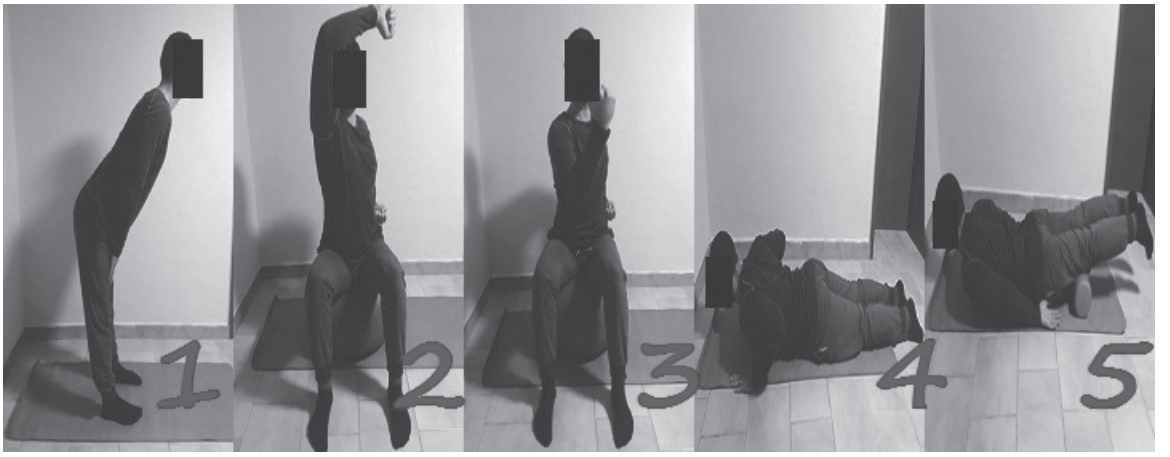


Figure 1. *Exercises that were used in author's methodology*

As illustrated in Figure 1, the author's methodology consists of five exercises. Each exercise has a different position, as the first is done standing, the second and the third are in a seated position, and the fourth and fifth are lying on the ground in a prone position. All the exercises emphasize the back muscles shown in Tables 1-5. It will be presented in detail for each exercise as a movement in each phase, activation, and influence.

Table 3. *Overview of phases and area of influence for the first exercise*

Phases	Movement	Activated nerves	Area of influence
Phase 1, 2, 3	Extension of thoracic lobe	Rami dorsales,	T1-T12
All phases	Lumbar extension	Thoracodorsalis, Rami dorsales	C6-C8 T12-L5
All phases	Scapula retraction	Accesorius, Dorsalis scapulae	C5
All phases	Extension of hip	Ischiadicus, Gluteus inferior, Gluteus superior	L2- S2
All phases	Plantar flexion	Tibialis, Fibularis superficialis	L4-S3

As can be seen in Table 2, above, in the first exercise, the set of movements that are involved, which comprise the use of the neck, back, hip, and leg muscles, This highlights the exercise's effects on the following areas: C5 to S3.

Table 4. *Overview of phases and area of influence for the second exercise*

Phases	Movement	Activated nerves	Area of influence
Phase 1, 2, 3, 4	Extension of thoracic lobe	Rami dorsales	T1-T12
All phases	Lumbar extension	Thoracodorsalis, Rami dorsales	C6-C8 T12-L5
Phase 2, 4	Torso rotation	Rami dorsales, Rami ventrales, ilioinguinalis, iliohypogastricus	T1-L1
All phases	Flexion in the shoulder	Axillaris, Pectoralis lateralis, Musculocutaneus	C5-C7
All phases	Extension in the shoulder	Axillaris, Subscapularis, Thoracodorsalis, Pectoralis lateralis, Pectoralis medialis, Radialis	C5-T1
Phase 2, 4	Internal rotation of the shoulder	Pectoralis lateralis, Axillaris, Thoracodorsalis, subscapularis	C5-C6
Phase 2, 3, 4	Abduction of the shoulder	Axillaris, Suprascapularis, subscapularis	C5-C6
All phases	Scapula retraction	Accesorius, Dorsalis scapulae	C5
Phase 2, 4	External rotation of the scapula	Accesorius, Thoracicus longus	C3-C6
All phases	Elbow flexion	Musculocutaneus, Radialis, Medianus ulnrais	C5-C8
Phase 3, 4	Elbow extension	Radialis	C6-C8
Phase 2, 3, 4	Supination	Radialis, musculocutaneus	C5-C6
Phase 2, 4	Pronation	medianus	C6-T1
All phases	Flexion of the fingers	Interosseus ant., Ulnaris, medianus	C7-T1
Phase 1, 3	Extension of the fingers	Interosseus post., ulnaris	C7-C8 T1

As shown in Table 3, above, in the second exercise, the set of movements that are involved includes neck muscles, back muscles, hip muscles, arm muscles, and leg muscles, which summarize the following area of impact of the exercise from C3-L5.

Table 5. *Overview of phases and area of influence for the third exercise*

Phases	Movement	Activated nerves	Area of influence
Phases 1, 2, 3, 4	Extension of thoracic lobe	Rami dorsales	T1-T12
All phases	Lumbar extension	Thoracodorsalis, Rami dorsales	C6-C8 T12-L5
Phase 2, 4	Torso rotation	Rami dorsales, Rami ventrales, ilioinguinalis, iliohypogastricus	T1-L1
All phases	Flexion in the shoulder	Axillaris, Pectoralis, lateralis, Musculocutaneus	C5-C7
Phase 2, 4	Extension in the shoulder	Axillaris, Subscapularis, Thoracodorsalis, Pectoralis lateralis, Pectoralis medialis, Radialis	C5-T1
Phase 2, 4	Horizontal adduction	Pectoralis lateralis, axillaris	C5-C6
All phases	Abduction of the shoulder	Axillaris, Suprascapularis, subscapularis	C5-C6

Phase 1, 3, 4	External rotation of the shoulder	Suprascapularis, axillaris	C5-C6
Phase 2, 4	Scapula protraction	Thoracicus longus, Pectoralis lateralis, Pectoralis medialis, Thoracodorsalis	C5-T1
All phases	Scapula retraction	Accesorius, Dorsalis scapulae	C5
All phases	Elbow flexion	Musculocutaneus, Radialis, Medianus, ulnrais	C5-C8
Phase 3, 4	Elbow extension	Radialis	C6-C8
Phase 2, 4	Supination	Radialis, musculocutaneus	C5-C6
Phase 3, 4	Pronation	medianus	C6-T1
Phase 2, 3, 4	Flexion of the fingers	Interosseus ant., Ulnaris, medianus	C7-T1
Phase 1, 3	Extension of the fingers	Interosseus post., ulnaris	C7-C8 T1

Table 4 shows that the third exercise involves a combination of movements that work the neck, back, hip, arm, and leg muscles. These actions outline the following regions of effect of the exercise from C5-L5.

Table 6. *Overview of phases and area of influence for the fourth exercise*

Phases	Movement	Activated nerves	Area of influence
Phase 1, 3	Head rotation	accessorius	C1-C8
Phase 1, 3	Neck rotation	Dorsalis scapulae, accessorius	C1-C8
Phase 1, 2, 3, 4	Neck extension	Dorsalis scapulae, accessorius	C1-C8
Phase 1, 2, 3, 4	Extension of thoracic lobe	Rami dorsales	T1-T12
Phase 1, 2, 3, 4	Lumbar extension	Thoracodorsalis. Rami dorsales	C6-C8 T12-L5
Phase 1, 3	Horizontal abduction of the shoulder	Axillaris, Subscapularis, Suprascapularis	C5-C6
Phase 1, 3	Scapula retraction	Accesorius, Dorsalis scapulae	C5
Phase 1, 3.	Extension of hip	Ischiadicus, Gluteus inferior, Gluteus superior	L2- S2
Phase 1, 3	Plantar flexion	Tibialis, Fibularis superficialis	L4-S3

The fourth exercise, as shown in Table 5 above, is a set of movements that include the neck, back, hip, and leg muscles, which summarises the following regions of effect of the exercise from C1-S3.

Table 7. *Overview of phases and area of influence for the fifth exercise*

Phases	Movement	Activated nerves	Area of influence
Phase 1, 2, 3, 4	Extension of thoracic lobe	Rami dorsales	T1-T12
All phase	Lumbar extension	Thoracodorsalis, Rami dorsales	C6-C8 T12-L5
All phase	Scapula retraction	Accesorius, Dorsalis scapulae	C5
Right / left leg	Flexion in the knee	Ischiadicus, Obturatorius, Femoralis, Tibialis	L2-S2
Right / left leg	Extension in the knee,	Femoralis, Gluteus superior	L2-L5
Right / left leg	Plantar flexion	Tibialis, Fibularis superficialis	L4-S3

Table 6 shows that the set of movements used in the fifth exercise engage the neck, back, and leg muscles, which summarizes the following region of effect of the exercise from C5-S3.

DISCUSSION

Studies have shown that regular exercise helps to prevent pain (Sulejanov, 2009, Lizier et al., 2012, Washif et al., 2019) and it has been found that pain is worsened by Covid (Serrano-Ibáñez et al., 2021). Furthermore, as for the beneficial effect of isometric exercise on the body (Rio et al., 2017, Noorkõiv et al., 2015, Schott et al., 1995), this methodology differs in that it can be performed every day and in any place (gyms, medical centers, homes, and even at work). It does not take much time and is not complex. We assume that after applying the methodology and evaluating the results obtained, we will confirm the positive effect of the exercises on pain after Covid-19 disease.

CONCLUSION

In conclusion, after reviewing the methodology as well as the preliminary studies on the practical impact of physical exercise on the health of people with back pain, we assume positive results can be achieved. Therefore, the author's methodology will be applied to obtain data which is needed to produce a complete evaluation of its effectiveness in further reports.

Hence, achieving this will benefit medical and sports science.

REFERENCE

Ahmed, M., & Modic, M. T. (2007). Neck and Low Back Pain: Neuroimaging. *Neurologic Clinics*, *2*, 439–471. https://doi.org/10.1016/j.ncl.2007.01.007

Bogduk, N. (2006). Chapter 52 Chronic low back pain. In *Handbook of Clinical Neurology* (pp. 779–790). Elsevier. http://dx.doi.org/10.1016/s0072-9752(06)80056-4

Centers for Disease Control and Prevention. (2022). Physical Activity and COVID-19. Available at: https://www.cdc.gov/physicalactivity/physical-activity-and-COVID-19.html (accessed on 01 July 2022)

Chou, R., & Huffman, L. H. (2007). Medications for Acute and Chronic Low Back Pain: A Review of the Evidence for an American Pain Society/American College of Physicians Clinical Practice Guideline. *Annals of Internal Medicine*, *7*, 505. https://doi.org/10.7326/0003-4819-147-7-200710020-00008

COM. (2008). Preporchitelni politicheski dejstvia v pomosht na fizicheskata aktivnost za ukrepvane na zdraveto. Available at: http://ec.europa.eu/assets/eac/sport/library/policy_documents/eu-physical-activity-guidelines-2008_bg.pdf (accessed 15 June 2021)

Coronavirus disease (COVID-19). (2021). WHO. Available at: https://www.who.int/emergencies/diseases/novel-coronavirus-2019/question-and-answers-hub/q-a-detail/coronavirus-disease-covid-19 (accessed 17 October 2021)

D'Silva, A., Gardiner, P. A., Boyle, T., Bebb, D. G., Johnson, S. T., & Vallance, J. K. (2018). Associations of objectively assessed physical activity and sedentary time with health-related quality of life among lung cancer survivors: A quantile regression approach. *Lung Cancer*, 78–84. https://doi.org/10.1016/j.lungcan.2018.03.010

Serrano-Ibáñez, E. R., Esteve, R., Ramírez-Maestre, C., Ruiz-Párraga, G. T., & López-Martínez, A. E. (2021). Chronic pain in the time of COVID-19: Stress aftermath and central sensitization. *British journal of health psychology*, *26*(2), 544–552. https://doi.org/10.1111/bjhp.12483

Geneen, L. J., Moore, R. A., Clarke, C., Martin, D., Colvin, L. A., & Smith, B. H. (2017). Physical activity and exercise for chronic pain in adults: an overview of Cochrane Reviews. *Cochrane Database of Systematic Reviews*, *2*. https://doi.org/10.1002/14651858.cd011279.pub3

Hills, A. P., Street, S. J., & Byrne, N. M. (2015). Physical Activity and Health: "What is Old is New Again". *Advances in food and nutrition research*, *75*, 77–95. https://doi.org/10.1016/bs.afnr.2015.06.001

Kolarov, Z. (2003). *Revmatichna bolka,* MLN, Sofia.

Lemley, K. J., Drewek, B., Hunter, S. K., & Hoeger Bement, M. K. (2014). Pain Relief after Isometric Exercise Is Not Task-Dependent in Older Men and Women. *Medicine & Science in Sports & Exercise*, *1*, 185–191. https://doi.org/10.1249/mss.0b013e3182a05de8

Lizier, D. T., Perez, M. V., & Sakata, R. K. (2012). Exercises for treatment of nonspecific low back pain. *Revista brasileira de anestesiologia*, *62*(6), 838–846. https://doi.org/10.1016/S0034-7094(12)70183-6

Lum, D., & Barbosa, T. M. (2019). Brief Review: Effects of Isometric Strength Training on Strength and Dynamic Performance. *International journal of sports medicine*, *40*(6), 363–375. https://doi.org/10.1055/a-0863-4539

Luque-Suarez, A., Martinez-Calderon, J., & Falla, D. (2019). Role of kinesiophobia on pain, disability and quality of life in people suffering from chronic musculoskeletal pain: a systematic review. *British journal of*

sports medicine, *53*(9), 554–559. https://doi.org/10.1136/bjsports-2017-098673

McKenzie, R., & May, S. (2003). *The Lumbar Spine*. Orthopedic Physical Therapy. Spinal Publications New Zealand Ltd., Waikenae

Megari K. (2013). Quality of Life in Chronic Disease Patients. *Health psychology research*, *1*(3), e27. https://doi.org/10.4081/hpr.2013.e27

Motl, R. W., & McAuley, E. (2009). Pathways between physical activity and quality of life in adults with multiple sclerosis. *Health psychology : official journal of the Division of Health Psychology, American Psychological Association*, *28*(6), 682–689. https://doi.org/10.1037/a0015985

Noorkõiv, M., Nosaka, K., & Blazevich, A. J. (2015). Effects of isometric quadriceps strength training at different muscle lengths on dynamic torque production. *Journal of sports sciences*, *33*(18), 1952–1961. https://doi.org/10.1080/02640414.2015.1020843

Rio, E., van Ark, M., Docking, S., Moseley, G. L., Kidgell, D., Gaida, J. E., van den Akker-Scheek, I., Zwerver, J., & Cook, J. (2017). Isometric Contractions Are More Analgesic Than Isotonic Contractions for Patellar Tendon Pain: An In-Season Randomized Clinical Trial. *Clinical journal of sport medicine : official journal of the Canadian Academy of Sport Medicine*, *27*(3), 253–259. https://doi.org/10.1097/JSM.0000000000000364

Stevens, S. L., Caputo, J. L., Fuller, D. K., & Morgan, D. W. (2008). Physical activity and quality of life in adults with spinal cord injury. *The journal of spinal cord medicine*, *31*(4), 373–378. https://doi.org/10.1080/10790268.2008.11760739

Schott, J., McCully, K., & Rutherford, O. M. (1995). The role of metabolites in strength training. II. Short versus long isometric contractions. *European journal of applied physiology and occupational physiology*, *71*(4), 337–341. https://doi.org/10.1007/BF00240414

Sulejanov, V. (2009). *Tehnologia ozdorovitelnoj fizicheskoj kulturi*. TVT Divizion, Moskva.

Vincent, H. K., Adams, M. C., Vincent, K. R., & Hurley, R. W. (2013). Musculoskeletal pain, fear avoidance behaviors, and functional decline in obesity: potential interventions to manage pain and maintain function. *Regional anesthesia and pain medicine*, *38*(6), 481–491. https://doi.org/10.1097/AAP.0000000000000013

Washif, J. A., Teichmann, J., Kok, L. Y., & Schmidtbleicher, D. (2019). Using stochastic resonance and strength training as part of a rehabilitation programme for recurrent low back pain treatment: a case study. *Journal of exercise rehabilitation*, *15*(1), 139–147. https://doi.org/10.12965/jer.1836532.266

Weng, L. M., Su, X., & Wang, X. Q. (2021). Pain Symptoms in Patients with Coronavirus Disease (COVID-19): A Literature Review. *Journal of pain research*, *14*, 147–159. https://doi.org/10.2147/JPR.S269206

Wertli, M. M., & Steurer, J. (2018). Medikamentöse Therapie bei akuten und chronischen lumbalen Rückenschmerzen [Pain medications for acute and chronic low back pain]. *Der Internist*, *59*(11), 1214–1223. https://doi.org/10.1007/s00108-018-0475-5

WHO. (2020). „Physical activity“ (Global Strategy on Diet, Physical Activity and Health). Available at: https://www.who.int/dietphysicalactivity/pa/en/ (accessed 17 October 2021)

Zdziarski, L. A., Wasser, J. G., & Vincent, H. K. (2015). Chronic pain management in the obese patient: a focused review of key challenges and potential exercise solutions. *Journal of pain research*, *8*, 63–77. https://doi.org/10.2147/JPR.S55360

Corresponding author:
Bassel Tahboub
PhD student
Department of “Heavy athletics, boxing, fencing and sport for all”
National Sports Academy “Vassil Levski”
Studentski grad, 21, Acad. Stefan Mladenov Str.
Sofia 1700, Bulgaria
E-mail: basselt@abv.bg

BENEFICIAL INFLUENCE OF PANEURHYTHMY ON THE AFFECTIVE BALANCE AND HAPPINESS

Ludmila Chervencova, Zshivka Zsheliaskova-Koynova
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
Introduction: Paneurhythmy is a unique Bulgarian and European recreational physical activity, appropriate for a pro-active approach in maintaining and improving health.
The aim of the present study is to find out if there are changes in the affective balance and the feeling of happiness with adults practicing Paneurhythmy.
Method: The subjects (n=155) of the experimental study were adults (18-69 years old), divided into two groups: an experimental group (EG, n=77, mean age 41.7), participating in a course of Paneurhythmy, and a control group (CG, n=78, mean age 41.8). Paneurhythmy courses were held indoors in the evening during the autumn-winter season. The experimental group subjects conducted an average of 22 Paneurhythmy lessons (SD 7.23).
The following questionnaires were used to measure the effect of the experiment: 1) Fordyce Emotions Questionnaire (FEQ) – Fordyce, 1988, Bulgarian adaptation by Zsheliaskova-Koynova & Ianovska (2008). 2) PANAS (Watson, Clark & Tellegen, 1988), Bulgarian version by Yordanova (2006).
Results: Comparing the results of the EG and the CG, we found the following significant differences: higher positive emotions (t_{152}=2.67, p=.008), lower negative emotions (t_{152}=2.15, p=.033) and stronger feeling of happiness (t_{146}=2.65, p=.009) with the EG after the Paneurhythmy training period. No changes were found in the CG for the same period.
Conclusions: Paneurhythmy training significantly improved the affective balance and the feeling of happiness in adults who trained indoors during the autumn-winter season.

Keywords: *recreation, physical activity, psychology, health*

INTRODUCTION

There is a shift in psychology from the focus on problems and deficits to a more holistic perspective, including positive factors. Scientists assert the opinion that health promotion should not merely focus on reducing symptoms and distress, but also aim to strengthen peoples' personal resources and mental health (Bieda et al., 2019).

Emotional regulation significantly affects mental and physical health (Ambrona & López-Pérez, 2014; Luque et al., 2020). Positive affect is significantly related to health (Little et al., 2007) and low levels of positive affect predict the development of depression (Morris et al., 2009; Panaite et al., 2020). Improvement of affective balance is important for building up resilience and psychological health (Yıldırım et al., 2021).

Happiness deserves to be studied in its own right as a factor in health because of its numerous associations with health, morbidity, and mortality (Steptoe, 2019). Happiness is significantly and positively related to health and it is concluded that happiness seems to be a cost-effective strategy for improving health (Wang et al., 2022). See & Yen (2018) point out that happiness is one of the factors that contribute significantly to health system efficiency.

The studies showed that genetic factors have a 40%-50% effect on happiness (Lykken & Tellegen, 1996), demographic factors have a 10% effect on happiness (Dogan, Totan & Sapmaz, 2013). It has also been concluded that purposeful activities (positive thinking, altruism, coping with stress etc.) have a 40% effect on happiness ((Lyubomirsky, 2001; Lyubomirsky, Sheldon, & Schkade, 2005). Therefore, it could be expected that new activities which increase positive emotions could contribute to happiness and health.

Paneurhythmy is a unique Bulgarian and European recreational physical activity performed in the morning in the open. Paneurhythmy is executed for about 75 min every day (playtime 60 minutes) in the period between March, 22nd - September, 22nd in the northern hemisphere of the Earth and between September, 22nd - March, 22nd in the

southern hemisphere of the Earth, when nature is in uplift (Chervencova, 2013; Douno, 2004). It is a unique combination of rhythmic movements, music, speech, thought, geometry, social interaction, philosophy and contact with nature. Paneurhythmy is aerobic activity and, for physically active healthy adults the intensity is low or moderate. Movements of Paneurhythmy are relatively slow and always smooth and light, which leads to practically no traumatic injuries and enables a conscious control over the movements. The exercises resemble dance and are played in standing position; involve almost all the muscles and joints in the human body and improve the locomotion and balance (Chervencova, 2013). The Paneurhythmy is enjoyable for practitioners and it is appropriate for a wide range of age groups. It is suitable not only for people of middle age but also for children and for elderly people (Chervencova, Zsheliaskova-Koynova, 2010).

Our study is the first to establish the impact of initial training in Paneurhythmy on positive and negative balance and happiness.

The aim of the present study is to find out if there are changes in the affective balance and the feeling of happiness with adults practicing Paneurhythmy.

METHODS

Participants

A total of 155 adults (18-69 years old) volunteered to participate in the study. The participants are divided into two groups: an experimental group (EG, n=77; mean age 41.7; females: n=67), participating in a course of Paneurhythmy, and a control group (CG; n=78; mean age 41.8; females: n=66), dealing with other types of physical activity.

Subjects of the experimental group participated in 5-6-months course of Paneurhythmy training for beginners. They conducted an average of 22 Paneurhythmy lessons (SD 7.23). The exercise training classes were arranged once (100 min) or twice a week (each 90 min) respectively for 5 or 6 months (October – March or October – April) in the evening. It included consecutively learning and training of the exercises, songs, names and basic humanistic message of all Paneurhythmy exercises. All classes were led by certificated Paneurhythmy instructors. They also kept an attendance record for each of the participants. The experimental group included only participants with no less than 50% attendances at Paneurhythmy training.

Descriptive statistics of general demographic characteristics and Physical activity are presented at Table 1.

Table 1. *Participant descriptive characteristics before the experiment*

Characteristics	**EG** (n=77) Mean (± SD)	**CG** (n=78) Mean (± SD)
Age, yr	41.7 (13.45)	41.8 (12.94)
Sex (women %)	85.7 %	85.9 %

EG – Paneurhythmy training group; CG – control group,

Subject Inclusion Criteria were*:* willingness to participate, age above 18, a full understanding of the study procedures, relatively good health (no history of any illness contraindicating exercise or limiting participation in the moderate intensity exercise program).

Subject Exclusion Criteria: Subjects were excluded if they had any significant general health problem or orthopedic problem that would keep them from fully participating in the research protocol. For experimental group: less than 50% attendance at Paneurhythmy training, pregnancy.

The tests were carried out before and after the initial training in Paneurhythmy for the experimental group and at the same time for the control group.

Measures

Fordyce Emotions Questionnaire (FEQ) – Fordyce, 1988; Bulgarian adaptation by Zsheliaskova-Koynova & Ianovska (2008).

The Fordyce Emotions Questionnaire (Fordyce, 1988) is a measure of perceived happiness. It is a valid measure of emotional well-being (Magyar-Moe, 2009). The FEQ can equally successfully examine happiness in general, as well as the state over a period of time. The questionnaire consists of two parts, which are combined into a total score on the scale (Zsheliaskova-Koynova & Ianovska, 2008).

Positive Affect and Negative Affect Schedule - PANAS (Watson, Clark & Tellegen, 1988); Bulgarian version by Yordanova (2006).

The test consists of 24 adjectives describing emotions and moods. Subjects rated on a 5-point Likert-type scale the extent to which they felt the way described in the items. Positive and negative emotions and moods form two scales – *Positive affect* and *Negative affect*. A higher score on the scales indicates a higher level of positive or, respectively, negative emotions.

Preliminary interviews with advanced practitioners of Paneurhythmy led us to the idea that there was some ambivalence in the understanding of one item of the test (the word "proud", which in the PANAS was assigned to the group of words reflecting positive emotions). This assumption was also confirmed by the results of the correlation analysis of the data from our study (showing no correlation of the item with the positive part of the PANAS and a weak positive correlation of the item with the negative part of the PANAS). Due to the presence of ambivalence, we decided to remove the item "proud" from the list of items, and thus the PANAS test in our study remained with one item less. Thompson (2007) also reports similar data on giving an additional negative meaning to the word "proud" from the PANAS test by individuals of different nationalities.

Statistical Analyses.

Analysis of data was performed using SPSS software. The means, ranges, standard deviations and standard errors of measure were calculated for each of the tests studied. We tested each of the variables for normal distribution with Kolmogorov-Smirnov test. In all EG and CG testing, the distribution of the studied indicators is normal, and in the statistical processing of the data we applied a t-test for independent and dependent samples. Differences between EG and CG (CI 95%) were compared with independent sample *t*-test to determine significant differences. The first and second testing of each group were compared with a Paired Samples T-Test (CI 95%). Effect sizes were calculated with JASP 0.16.3.

RESULTS

The statistical results are presented in Table 2. Before the Paneurhythmy training, the experimental group and the control group did not have statistically significant differences on any of the studied indicators.

Table 2. *Statistical results on the investigated indicators of EG and CG*

Variable		n	EG2 M (±SD)	pa	n	CG2 M (±SD)	pa	pb
FEQ	Measure 1	70	116.37 (38.2)	***	76	116.84 (31.3)		0.935
	Measure 2		129.09 (35.0)			113.18 (37.2)		0.009 **
	Difference		12.17			-3.66		
PANAS - Positive Affect	Measure 1	76	3.51 (0.59)	***	76	3.46 (0.6)		0.612
	Measure 2		3.73 (0.54)			3.48 (0.62)		0.008 **
	Difference		0.22			0.02		
PANAS - Negative Affect	Measure 1	76	2.18 (0.78)	***	76	2.0 (0.68)		0.149
	Measure 2		1.74 (0.63)			1.96 (0.64)		0.033 *
	Difference		-0.44			-0.04		

pa *– significance of differences for each group relative to baseline values;* ***pb*** *– significance of differences between group; no sign * – no statistically significant difference, *p<.05, **p<.01, ***p<.001.*

Comparing the results of the EG and the CG, we found the following significant differences: higher positive emotions (t_{152}=2.67, p=.008), lower negative emotions (t_{152}=2.15, p=.033) and stronger feeling of happiness (t_{146}=2.65, p=.009) in EG after the Paneurhythmy training period. No changes were found in the CG for the same period. Effect sizes (Cohen's d) for experimental group: positive affect, negative affect and happiness of experimental group are medium (Table 3).

Table 3. *Effect sizes (Cohen's d) for experimental group - comparison of the first with the second study of EG*

Variable	Cohen's d	95% CI for Cohen's d	
		Lower	Upper
FEQ	-0.506	-0.753	0.255
PANAS - Positive Affect	-0.456	-0.691	0.219
PANAS - Negative Affect	0.690	0.438	0.939

DISCUSSION

Our research shows that initial Paneurhythmy training of adults increases positive and decreases negative emotions and this shows a significant improvement in the emotional state of the practitioners through a strong increase in the prevalence of positive over negative emotions. Paneurhythmy training increases significantly the feeling of happiness. These changes were identified for the first time with specialized psychological tools in adults trained in Paneurhythmy in our study.

After laboratory induction of positive emotions, subjects show increased attention span, better working memory, enhanced creativity, and increased openness to new knowledge and perspectives (Kashdan & Rottenberg, 2010). Positive emotions predicted increases in both resilience and life satisfaction (Cohn et al., 2009).

Our results revealing improvement of the emotional state from a comprehensive Paneurthymy course, are consistent with previous data showing significant improvement in mood as a result of a single Paneurhythmy training session. Within the framework of a 5-6-month training course on Paneurhythmy for adults, we examined the trainees before and after one session and found statistically significant improvement in the "mood" indicator (Chervencova, 2010). In a previous publication, we reported that practicing Paneurhythmy in nature increases the preponderance of positive over negative emotions (Chervencova, Zshelyazkova-Koinova, 2014)

We assume that the superimposition of multiple consecutive and mutually reinforcing effects of regular Paneurhythmy activities leads to stable changes in the ratio of positive and negative emotions (in the direction of predominance of positive emotions), hence to an increase in emotional well-being and the general well-being of the individual.

Emotional state is strongly positively related to feelings of happiness. Lyubomirsky, King, & Diener (2005) found that the ratio between the time during which people experience positive emotions and, respectively, negative emotions, is a good predictor of their happiness. According to Dogan et al. (2013), affective balance has positive effects on happiness. Our current research also confirms that improving affective balance is associated with increased feelings of happiness.

There is a strong negative correlation between FEQ and negative emotions (Fordyce, 1988). Our study is in agreement with this finding because it shows a simultaneous decrease in negative emotions and an increase in happiness as measured by the FEQ.

We believe that the tendency for the predominance of positive emotions and the increase of happiness as a result of Paneurhythmy classes is due to the complex impact of Paneurhythmy through the joy of movement, music, singing and friendship; by positivizing thinking from the suggestion of the text of the Paneurhythmy (positive messages), and from the reflections on the meaning of its exercises.

Paneurhythmy training is effective tool for improvement of the affective balance and the overall happiness. Paneurhythmy is extremely economical and inexpensive since it does not require any special outfit, equipment or sport terrain (Chervencova, Zsheliaskova-Koynova, 2010). Paneurhythmy is enjoyable, socializing, and with wide and powerful positive influence on psychological state (Chervencova, 2010, 2013, 2020; Zsheliaskova-Koynova, Chervenkova, 2012). All this improves motivation and increases probability that Paneurhythmy will be maintained regularly for a long time period which is very important for every exercise health promotion program.

REFERENCES

Ambrona, T., & López-Pérez, B. (2014). A longitudinal analysis of the relationship between positive and negative affect and health. *Psychology*, *5*(08), pp. 859.

Bieda, A., Hirschfeld, G., Schönfeld, P., Brailovskaia, J., Lin, M., & Margraf, J. (2019). Happiness, life satisfaction and positive mental health: Investigating reciprocal effects over four years in a Chinese student sample. *Journal of Research in Personality*, *78*, pp.198-209.

Chervencova, L (2020) Paneurhythmy Exercises for Developing Partnership and Social Skills. *Central European Journal of Sport Sciences and Medicine*, Vol. 31, No. 3/2020, pp.17–32, DOI: 10.18276/cej.2020.3-02

Chervencova, L. (2010) A study on the immediate changes in self-confidence, activity and mood by Paneurhythmy training. *Personality. Motivation. Sport,* NSA Press, pp. 172-178 (In Bulgarian).

Chervencova, L. (2013). Paneurhythmy, health and wellness: a Bulgarian model of physical activity. St. Kl. Ohridski University Press, Sofia (in Bulgarian). available at: <http://panevritmia.info/images/uploads/Panevritmia-zadrave-i-blagopoluchie-Chervenkova-2013.pdf> (accessed 19.09.2020).

Chervencova, L., Z. Zsheliaskova-Koynova (2010) Therapeutic Potentiality of Paneurhythmy**.** Erasmus Programme of the European Community for higher education **-** Introducing Paneurhythmy: Fit, Creative and Social with the Bulgarian System for Recreation. Ed. Petrov, L., Veliko Tarnovo, St. Cyril and St. Methodius University Press, pp. 59-65.

Chervencova, L., Zshelyazkova-Koinova, Z. (2014) Changes in the affective balance in paneurthymia practitioners as a result of one season of training. *Personality. Motivation. Sports.* Volume 19, NSA Press, S., pp. 245-252.

Cohn, M. A., Fredrickson, B. L., Brown, S. L., Mikels, J. A., & Conway, A. M. (2009) Happiness unpacked: Positive emotions increase life satisfaction by building resilience. *Emotion,* 2009; 9 (3), pp. 361- 368.

Dogan, T., Totan, T., & Sapmaz, F. (2013). The role of self-esteem, psychological well-being, emotional self-efficacy, and affect balance on happiness: A path model. *European Scientific Journal*, 9(20), pp. 31-42.

Douno, B. (Peter Deunov) (2004) Paneurhythmy. Bialo Bratstvo Publishers, Sofia, available at: <http://www.panevritmia.info/images/uploads/Paneurhythmy_2004_english.pdf> (accessed 19.09.2020).

Fordyce, M. W. (1988). A review of research on the happiness measures: A sixty second index of happiness and mental health. *Social Indicators Research*, 20(4), pp. 355–381. https://doi.org/10.1007/BF00302333.

Kashdan, T. B., & Rottenberg, J. (2010). Psychological flexibility as a fundamental aspect of health. *Clinical psychology review*, *30*(7), pp. 865-878, doi: 10.1016/j.cpr.2010.03.001

Little, L. M., Simmons, B. L., & Nelson, D. L. (2007). Health among leaders: Positive and negative affect, engagement and burnout, forgiveness and revenge. *Journal of management studies*, *44*(2), pp. 243-260.

Luque, B., Castillo-Mayén, R., Cuadrado, E., Gutiérrez-Domingo, T., Rubio, S. J., Arenas, A., ... & Tabernero, C. (2020). The Role of Emotional Regulation and Affective Balance on Health Perception in Cardiovascular Disease Patients According to Sex Differences. *Journal of Clinical Medicine*, *9*(10), pp. 3165.

Lykken, D., Tellegen, A. (1996). Happiness is a stochastic phenomenon. *Psychological Science,* 7, 186–189.

Lyubomirsky, S. (2001). Why are some people happier than others: The role of cognitive and motivational processes in wellbeing. *American Psychologist,* 56, 239-249.

Lyubomirsky, S., King, L., & Diener, E. (2005). The benefits of frequent positive affect: Does happiness lead to success?. *Psychological bulletin*, *131*(6), pp. 803–855.

Lyubomirsky, S., Sheldon, K.M., & Schkade, D. (2005). Pursuing happiness: The architecture of sustainable change. *Review of General Psychology,* 9, 111-131.

Magyar-Moe, J. L. (2009). *Therapist's guide to positive psychological interventions*. Elsevier, USA.

Morris, B. H., Bylsma, L. M., & Rottenberg, J. (2009). Does emotion predict the course of major depressive disorder? A review of prospective studies. *British Journal of Clinical Psychology*, *48*(3), pp. 255-273.

Panaite, V., Rottenberg, J., & Bylsma, L. M. (2020). Daily affective dynamics predict depression symptom trajectories among adults with major and minor depression. *Affective Science*, *1*(3), pp. 186-198.

See, K. F., & Yen, S. H. (2018). Does happiness matter to health system efficiency? A performance analysis. *Health economics review*, *8*(1), pp. 1-10.

Steptoe, A. (2019). Happiness and health. *Annu Rev Public Health*, *40*(1), 339-359.

Thompson, E. R. (2007) Development and validation of an internationally reliable short-form of the positive and negative affect schedule (PANAS). *Journal of Cross-Cultural Psychology***,** 38(2), pp. 227-242.

Wang, W., Sun, Y., Chen, Y., Bu, Y., & Li, G. (2022). Health Effects of Happiness in China. *International Journal of Environmental Research and Public Health*, *19*(11), pp. 6686.

Watson, D., Clark, L., Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology*, 54(6), pp. 1063-1070.

Yıldırım, M., Arslan, G., & Wong, P. T. (2021). Meaningful living, resilience, affective balance, and psychological health problems among Turkish young adults during coronavirus pandemic. *Current Psychology*, 1-12.

Yordanova, T. (2006). Personality and the regulation of subjective well-being. Dissertation, Institute of Psychology, BAN, Sofia

Zsheliaskova-Koynova, Z., L. Chervenkova. (2012). Effects of Paneurhythmy learning on Personality Characteristics of Practitioners, *VI International Scientific Congress „Sport, Stress, Adaptation", Proceeding Book*, pp. 702-705.

Zsheliaskova-Koynova, Z., Ianovska, I. (2008). Adaptation of Fordyce's scale for the study of emotions (Fordyce, 1988) *Personality. Motivation. Sport*. Volume 13, NSA Press, S., pp. 74-82 (In Bulgarian).

Corresponding author:
Ludmila Chervencova, PhD,
Department Kinesitherapy and rehabilitation,
National Sports Academy"Vassil Levski",
Gurguliat str.,
Sofia, Bulgaria, 1000
E-mail: l.chervenkova@gmail.com

A BULGARIAN STUDY ON PATIENTS' AND DOCTORS' SATISFACTION WITH THE HOMEOPATHIC METHOD OF TREATMENT

Mariana Angelcheva, Dora Pachova
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
In the spirit of the Traditional Medicine Strategy 2014-2023, published by the World Health Organisation, for the first time in Bulgaria an empirical study was conducted aiming to improve the quality and organization of homeopathic treatment. A direct individual questionnaire on paper, filled in anonymously, was used to investigate patients' and doctors' attitudes and satisfaction with homeopathy. Respondents are 527 doctors and 547 patients. The study (2015-2019) was done by the National Center for Public Health and Analysis (NCPHA) under the guidance of Assoc. Prof. Iliana Yaneva, MD. According to the study, 97.4% of doctors share the opinion that "conventional and unconventional methods of treatment should complement each other". Leading arguments for patients' satisfaction: the „positive results of the treatment" – 81%; "the individual attitude towards the patient as a person" - 44.2%; „the good attitude of the doctor - attention, responsiveness, understanding" - 33.3 %. Long-term amelioration is affirmed by 60.5% of the patients, and 26.7% feel completely cured. The data analysed show very high satisfaction in patients and good quality of homeopathic care in the country.

Keywords: *satisfaction, health, homeopathy, integrative medicine, resilience*

INTRODUCTION

The COVID-19 pandemic put healthcare professionals and the National Health Services providers (NHSs) to serious tests - financial, moral and social. A new model for sustainable health systems with a focus on disease prevention and salutogenesis is necessary. The contemporary evidence shows the salutogenic approach could have a more central position in public health, and health promotion research and practice (ANHI, UK, 2018; Lindström, Eriksson, 2005; Eriksson, Lindström, 2008). Traditional Complementary and Integrative Medicine (TCIM) is recognized by World Health Organisation (WHO) as an important resource for cure and prevention, and for achieving "health for all" since the 1978 Almaty Declaration. The WHO TM Strategy 2014-2023 (WHO, 2018) points out a knowledge-based policy as key to integrating TCIM into NHSs and recommends more research on effectiveness, patient satisfaction, and individual resilience has to be performed. TCIM methods generally aim to support, stimulate, or realign the patient's health recovery mechanisms. The sector has an extensive knowledge base ready to be explored through appropriate research methods to develop health systems interested in achieving and maintaining good health and therefore reducing dependence on antibiotic treatment. For example, Global Initiative for Traditional Solutions to Antimicrobial Resistance Network (GIFTS-JPIAM) leads such research but more support from healthcare systems is needed. The meeting of the Joint Programming Initiative on Antimicrobial Resistance (JPIAMR) and European Public Health Alliance (EPHA) on June 20, 2022, outlined as a new long-term strategy the need to shift the focus of research from studying infectious agents to another important parameter - the effectiveness of the body's natural defense mechanisms.

There is a recognition in academia and health organizations that changes in medical research are needed (Porzsolt et al., 2015). In response, standards for patient-centered outcomes research are currently being developed internationally. The movement in biomedicine towards more comparative effectiveness research has focused firmly on evaluating different treatment options by including a more heterogeneous patient sample, using real-world treatment protocols that are less standardized, and focusing on patient-centered outcomes (Porzsolt et al., 2015). Research in real-world settings is the most promising approach to identifying the possible contributions of a variety of TCIM modalities to the health

of the public. The foundation for healthcare should be that patients can make informed decisions on their treatments, supported by context-based evidence (European Charter of Patient's rights, 2002). A lot of surveys and other studies demonstrate that many people would like to be treated with TCIM. Surveys conducted among patients in university hospitals show that more than 50% of patients in the departments of oncology, gastroenterology and even cardiology are requesting TCIM treatment and wish to be better informed about it. According to current figures also in primary medical care, 97% of Swiss pediatricians are asked about TCIM treatment methods and most often (35%) refer to specialists who apply homeopathy (Huber et al., 2019). Homeopathy is one of the established TCIM methods for acute and chronic conditions. It provides high quality published results, proving homeopathic method efficacy in infection diseases, epidemics, and Covid 19 (K.L.A., Y.Y.Y., 2020; Oliveira et al., 2021; Clapers et al., 2021; Michael et al., 2021; Daruiche et al., 2021; Kurd et al., 2022; Talele et al., 2022).

The history of homeopathy in Bulgaria is more than 120 years (Yaneva et al., 2021). Due to wars and political changes, there was a serious gap in its development. The new history of homeopathy starts in 1993. In April 1995, the Medicinal Products and Pharmacies in Human Medicine Act was published (State Gazette, Issue 36/18.04.1995), according to which homeopathic preparations are medicinal products and are subject to official registration in Bulgaria. Since 1996 there are homeopathic remedies in pharmacies in Bulgaria and different educational projects have begun. The first regulatory text about homeopathy was published in Chapter 6 – "Unconventional methods for a favorable impact on individual health" from the Health Act (State Gazette, Issue 70/10.08.2004). It states that the homeopathic method can be practiced only by persons holding Master's Degrees in 'Medicine' and/or 'Dental Medicine'. Next year Ordinance No. 7/01.03.2005 (State Gazette, Issue 22/15.03.2005) was issued also. As a result of these legal regulations, very good conditions for the development of the method in Bulgaria emerged. There are enough prepared doctors and enough patients to make a study and measure effectiveness and patient satisfaction.

In the spirit of all the above-cited documents and strategies for the first time in Bulgaria, a study simultaneously among homeopathic practitioners and their patients was initiated. Its ultimate goal is to improve the organization and quality of homeopathic treatment and meet the needs of both: homeopathic practitioners and their patients.

The aim of the study is to investigate the patients' and doctors' attitudes and satisfaction with homeopathy to improve the organization and quality of homeopathic treatment.

METHOD

An empirical study was conducted among two groups:

a) Professionals: 527 medical doctors - homeopathic medical doctors (HMD) and homeopathic dental doctors (HDD), 12,6% men and 87,4% women, divided in four age groups (up to 40 years; 41-50 years; 51-60 years; over 60 years).

b) Patients: 547 patients of the HMD and HDD from the 28 districts of Bulgaria; 74, 8 % women and 25,2% men, divided in tree age groups (18-39 years; 40-59 years; over 60 years); including criteria - men and women over 18 years old, who signed informed consent before filling in a questionnaire on paper with guaranteed anonymity.

The study has been conducted by the NCPHA in the period 2015 – 2019 under the guidance of Assoc. Prof. Dr. Iliana Yaneva, MD, PhD, with the assistance of the professional medical organizations in Bulgaria - Bulgarian Medical Homeopathic Organization (BMHO) and the Association of Homeopathic Physicians in Bulgaria (ALHB).

Research methods:

Sociological methods:

1. Direct individual questionnaires on paper - filled in anonymously by the respondents.
2. Documentary method - analysis of data from scientific sources.

Statistical methods:

1. Statistical package SPSS 20.0.
2. *Method for testing hypotheses* - method chi square x 2 - Fisher's Exact Test.
3. *A level of significance* at which the null hypothesis is rejected is assumed to be $p < .05$.

RESULTS

Homeopathic medical and dental doctors show permanent interest in the homeopathic method in everyday practice. 97.4% of the respondents share

the opinion that "conventional and unconventional methods of treatment should complement each other". This is a stable enough motive to look for additional knowledge (homeopathy and other holistic methods). Results from the tested hypothesis also confirm the descriptive statistics used in the paper for the analyses conducted. 79.3% of the homeopathic doctors have been satisfied with the collaboration with doctors applying conventional methods of treatment. 83% of the respondents are satisfied with their collaboration with other doctors applying non-conventional treatment methods. More than 70% of the respondent's homeopaths investigate and analyse the patients' results of different conventional and non-conventional treatments (including homeopathy) and pay attention to patients' needs and suggestions. HMD and HDD discuss with the patients what would be the best combination of methods in order to restore their health. In this way, they satisfy not only patients' imminent needs but also comply with their preferences (Figures 1 and 2).

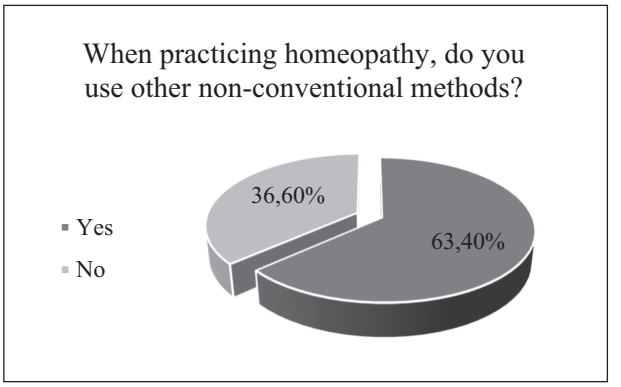


Figure 1. *When practicing homeopathy, do you use other non-conventional methods?*

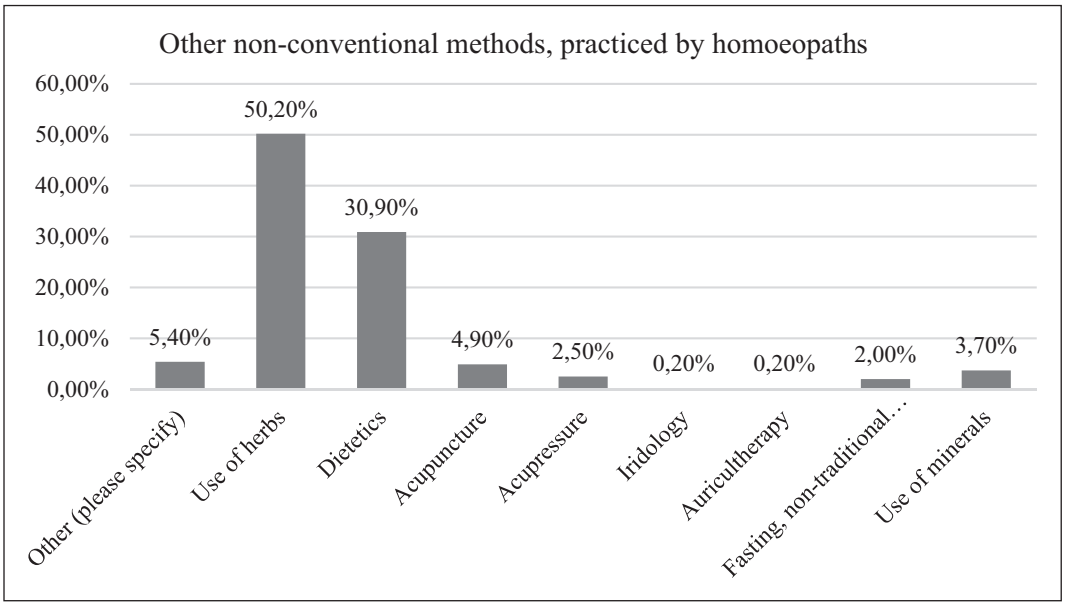


Figure 2. *Other non-conventional methods practiced by the homeopaths.*

We see that 77% of the respondents would point out as most important "The results from the treatment" on the question "What according to you has the biggest significance for the satisfaction of the patients with the homeopathic treatment?". Figure 3 also shows a very high percentage (65.3%) on another aspect - "The individual attitude", which is an important pillar in homeopathy overall.

According to 83.2% of HMD and HDD, informing the patients fully about their disease, conventional and non-conventional diagnosis, cure, and prognosis, contributes to higher satisfaction of the patients (Figure 4).

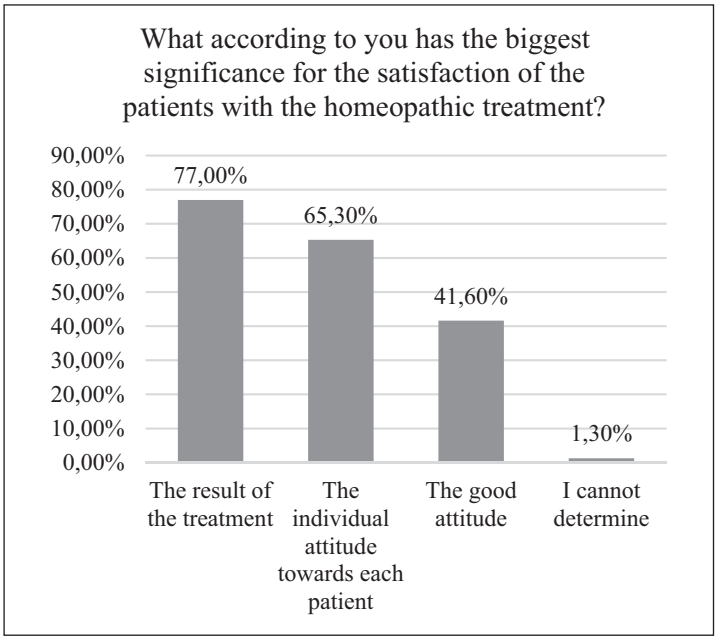


Figure 3. *"What according to you has the biggest significance for the satisfaction of patients with the homeopathic treatment?"*

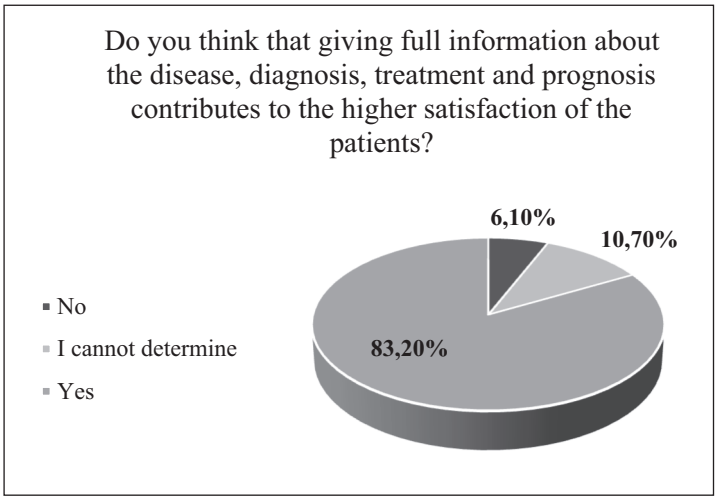


Figure 4. *"Do you think that giving full information about the disease, diagnosis, treatment and prognosis contributes to the higher satisfaction of the patients?"*

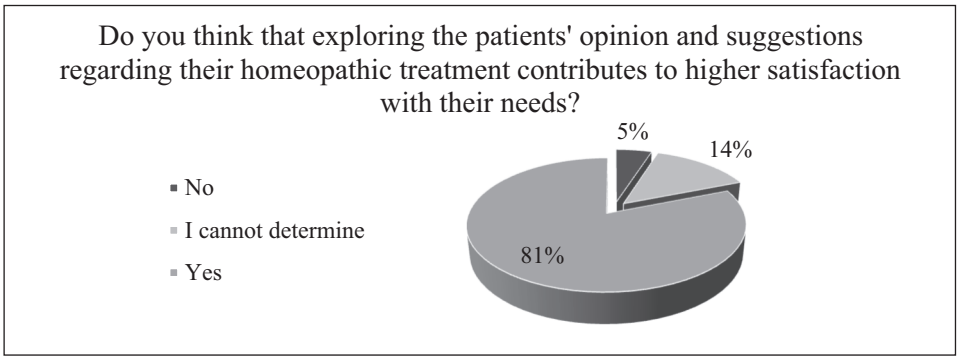


Figure 5. *Do you think that exploring patients' opinions and suggestions contributes to higher satisfaction with their needs?*

Looking at Figure 5 below, we see that 81% of the interviewed people point out that exploring patients' opinions and suggestions leads to higher satisfaction. The chart also shows that only 5% of patients have responded with "No".

The Scientific Framework of Homeopathy book points out following: "Homoeopathy is an integral part of treatment in many countries, especially those that use Complementary and Alternative Medicine (CAM). Worldwide, it is popular in about 100 countries, with patients frequently combining it with orthodox health care. In the current CAM workforce of EU, Homoeopathy is the second most provided method, only after acupuncture. In many part of south-east Asia, Homoeopathy is among the widely used modalities, apart from the traditional systems of those countries. In other continents, Australia, North America, South America and Africa, use of Homoeopathy in many countries is well documented." (Manchanda et al., 2021).

The patients in our study show positive attitude towards homeopathy. 68.8% of the respondents (not treated conventionally first) and 49.1% of them (with first choice conventional treatment) consider homeopathy harmless. For 93.3% of our respondents a disease condition is the main reason to look for a consultation with HMD or HDD. Homeopathic treatment was the first choice of treatment for 84.5% of the respondents.

The satisfaction of the patients is studied in three directions: a) information about the method, b) doctor's attitude and c) satisfaction with the suggestions given.

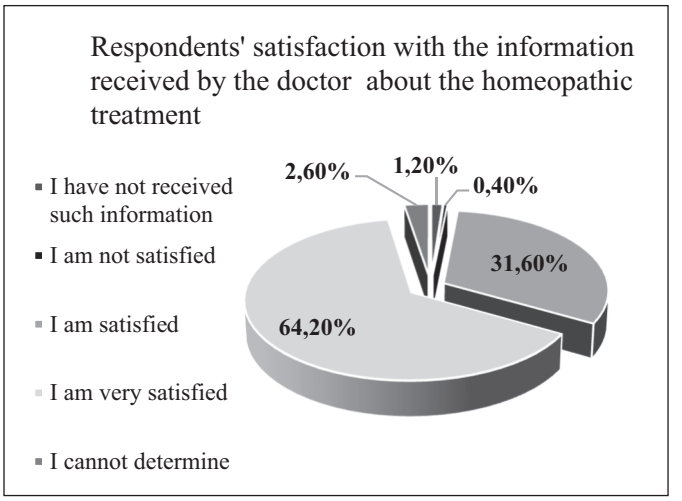


Figure 6. *Respondents' satisfaction with the information received by the doctor about the homeopathic treatment.*

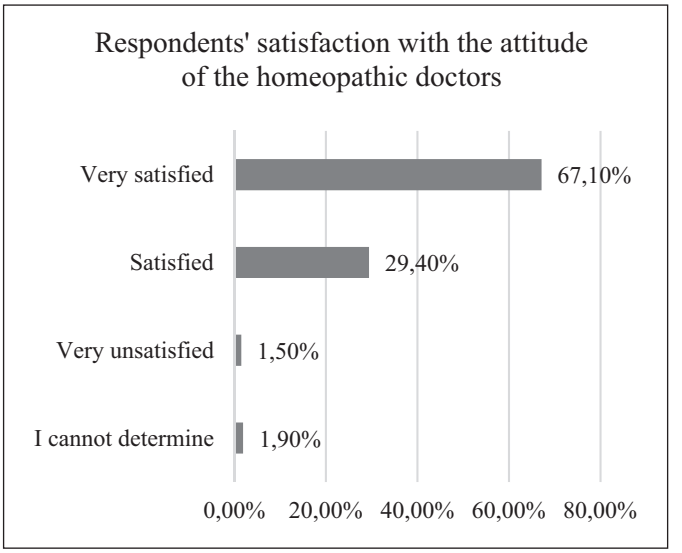


Figure 7. *Respondents' satisfaction with the attitude of the homeopathic doctors.*

The first two answers in Figure 6 "Very satisfied" and "Satisfied" (show that almost 96% of the respondents are satisfied with the information about the method (direction a). That leads to less than 5% for the last two results. Figure 7 represents direction b) and what we see is that "Very satisfied" and "Satisfied" responses are expressing a high degree of satisfaction with the attitude of their homeopathic doctors. Like Figure 6, we have less than 5% responses for "I am not satisfied" and "I cannot determine".

The main reason for the high patients' satisfaction (direction c) is the „result of the treatment, itself" (81%). 33.3% point out „the good attitude - attention, responsiveness, understanding" as source of satisfaction. 44.2% indicated also that „the individual attitude towards the patient as a person" is very important for their satisfaction (Figure 8).

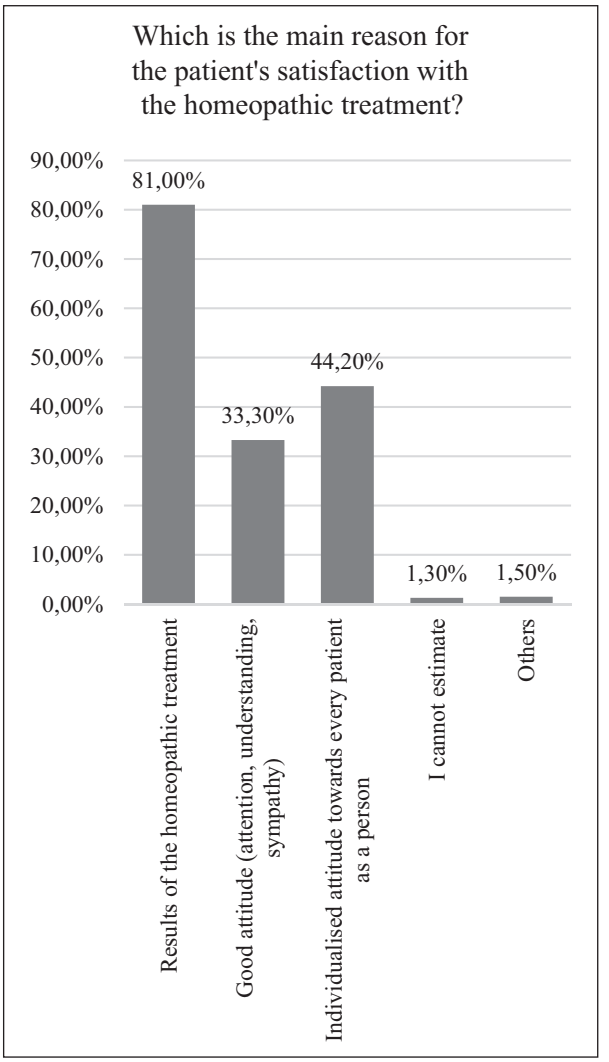


Figure 8. "*Which is the main reason for patient's satisfaction with the homeopathic treatment?*"

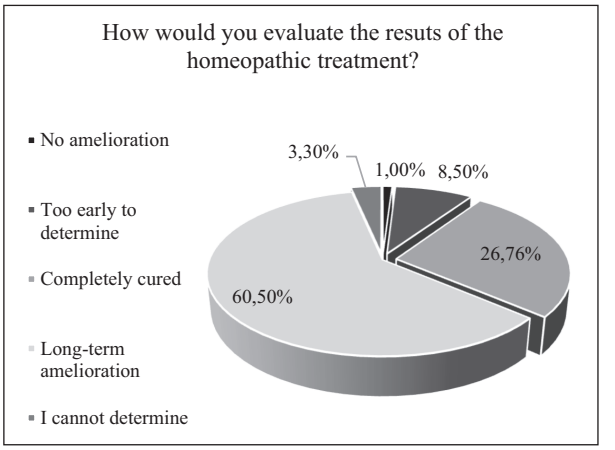


Figure 9. *"How would you evaluate the results of the homeopathic treatment?"*

The effectiveness of the method is clearly shown by the results of Figure 9 - the long-term amelioration is affirmed by 60.5% of the patients, and 26.7% feel completely cured.

The results of our study, guided by Assoc. Prof. Iliana Yaneva, MD, PhD, are confirmed by other researchers. Anglo-American studies about the motivation of patients to use homeopathy point to the homeopathy practitioners' high degree of empathy as particularly important (Rossi et al., 2009). A British study regarding the patient's choice of treatment with the methods of complementary medicine found that one of the main reasons is dissatisfaction with the way of communication and explanatory models for their disease with conventional doctors (Witt et al., 2005). Worried about the side effects of pharmacotherapy and the lack of a holistic treatment approach, patients highly appreciate the dedication, time and psychological support that TCIM therapists provide them.

A user map published by European Coalition on Homeopathic & Anthroposophic Medicinal Products (ECHAMP, 2019) makes visible the widespread use of homeopathy in the EU – including 77% of French, 62% of Austrians, 56% of Germans and 33% of Spanish, as well as 69% of Belgian households. It shows how 70% of users or more are satisfied or very satisfied with the outcome. 64% of family doctors and pharmacists in Bulgaria recommend homeopathy for simple conditions. These and other similar data are in accordance with WHO TM Strategy 2014-2023 which supports proactive policies for the integration of traditional and complementary medicine into national health systems.

CONCLUSION

A high general satisfaction of patients with the homeopathic treatment was observed in the first study of homeopathic treatment in Bulgaria with respondents medical doctors and patients. The analysis of the data confirms the work hypothesis "Bulgarian patients have a positive attitude and are satisfied with the homeopathic treatment in Bulgaria". These results are obtained in a period of very serious challenges for the healthcare system in our country. Respondents (Patients) would evaluate highly not only the methods but also the professionalism and the "personal attitude of the doctor to the patient". Results are also expressing the very high level of patients' satisfaction and the desire of these respondents to trust holistic methods (treatment) in the future. On the professional side (HMD and HDD respondents) figures are showing that the current approach is working and homeopathy treatment (separately or in addition to conventional medicine) is not only highly evaluated but also desired and important pillar in the medicine overall.-

This article is inspired by the work of and dedicated to the memory of Assoc. Ptof. Iliana Yanevaa, MD, PhD, who passed away on 30th April 2021.

REFERENCES

A Blueprint for Health System Sustainability in the UK (2018). *Published by the Alliance for Natural Health International,* ISBN 978-1-5272-3217-4, First published in December 2018.

Clapers, M., Velat, M., Clapers, J.M., Vidal-Jove, J., Mora, J. (2021). Analysis of Homeopathic Genus Epidemicus for COVID-19 Patients in Spain, *Homeopathy*, Vol. 110 № 4, pp. 236-243.

Daruiche, P.S.J., Canoas, W.S., Figueira, K.A.G., Peres, G.B. (2021). Homeopathy for COVID19 Prevention: Report of an Intervention at a Brazilian Service Sector Company, *Homeopathy*, Vol.111 № 2, pp. 105-112.

Eriksson, M., Lindström, B. (2008). A salutogenic interpretation of the Ottawa Charter, *Health Promotion International*, Vol. 23 №2, pp. 190-199.

Use of Homeopathy in the European Union European - Coalition on Homeopathic & Anthroposophic Medicinal Products, https://echamp.eu/echamp-resources/echamp-brochures/use-of-homeopathy-in-the-eu.pdf/view 2019

European Charter of Patient's rights (2002). Available online: https://ec.europa.eu/health/ph_overview/co_operation/mobility/docs/health_services_co108_en.pdf (accessed on 14 01 2022).

Health Act (*State Gazette*, Issue 70/10.08.2004).

Huber, B.M., von Schoen-Angerer, T., Hasselmann, O., Wildhaber, J., Wolf, U. (2019). Swiss pediatrician survey on complementary medicine, *Swiss Med Wkly,* 149:w20091.https://doi.10.4414/smw.2019.20091.

To, K.L.A, Fok. Y.Y.Y (2020). Homeopathic clinical features of 18 patients in COVID19 outbreaks in Hong Kong, *Homeopathy*, Vol. 109 №3, pp. 146-162.

Kurd, R., Freed, Y., Jarjoui, A., Izbicki, G., Levin, P., Helvitz, Y., Sherr, J., Oberbaum, M. (2022). Homeopathic Treatment for COVID-19-Related Symptoms: A Case Series, *Complement Med Res,* Vol. 29 №1, pp. 83-88.

Lindström, B., Eriksson, M. (2005). Salutogenesis, *Journal of Epidemiology and Community Health*, Vol. 59, pp. 440-442. http://dx.doi.org/10.1136/jech.2005.034777

Manchanda, R.K., Khurana, A., Wassenhoven, M. V., Sharma, B., Kaushik, S., Nayak, D. et al. Editors. (2021). Scientific Framework of Homoeopathy, Central Council for Research in Homoeopathy, Liga Medicorum Homoeopathica Internationalis, European Committee of Homoeopathy. New Delhi. April 2021. ISBN: 978-93-81458-66-2

https://www.lmhi.org/file/scientific_framework/Scientific%20Framework%20of%20Homoeopathy%20book_2021.pdf

Takacsa, M., Frass, M., de Gernot Walderf, P., Rottensteiner, F.M. (2021). Adjunctive homeopathic treatment of hospitalized COVID-19 patients (COVIHOM): A retrospective case series, *Complementary Therapies in Clinical Practice. Elsevier Public Health Emergency Collection,* Vol. 44, 101415.

Medicinal Products and Pharmacies in Human Medicine Act, State Gazette, Issue 36/18.04.1995.

Oliveira, A., Stern, M., Almeida, C., Bolognani, F., Holandino, C., Rocha, L. (2021). Homeopathic medicine as health promotion during COVID-19 pandemic period in Niteroi city, *International Journal of High Dilution Research*, Vol. 20 №1, pp. 15-16.

Ordinance No. 7/01.03.2005 on the requirements for the activity of persons who practice unconventional methods for a favorable impact on individual health, promulgated *State Gazette*, Issue 22/15.03.2005.

Porzsolt, F., Rocha, N.G., Toledo-Arruda, A.C., Thomaz, T.G., Moraes, C., Bessa-Guerra, T.R., Leão, M., Migowiski, A., Araujo da Silva, A.R.A., Weiss, C. (2015). Efficacy and effectiveness trials have different goals, use different tools, and generate different messages, *Pragmatic Obs Res,* Nov 4, 6:47-54. https://doi.10.2147/por.S89946

Rossi, E., Endrizzi C., Panozzo MA, Bianchi A., DA

FreM. (2009), Homeopathy in the public health system: a seven year observatirial study at Lucca Hospital (Italy) *Homeopathy* , 2009 Jul, 98(3):142-8.doi: 10.1016/j.homp.2009.04.001.

Talele, G., Vaidhya, S., Chowdhary, A., Herscu, P., Shah, R. (2022). Randomized Double Blind, Placebo-Controlled Feasibility Study, Evaluating the Efficacy of Homeopathic Medicines in the Prevention of COVID-19 in a Quarantined Population. *Homeopathy.* 2022 Feb, Vol. 111 №1, pp. 49-56. doi: 10.1055/s-0041- 1735235. Epub 2021 Sep 30. PMID: 34592778.

WHO. WHO Traditional Medicine Strategy 2014–2023, (2013); WHO: Geneva., 47 http://www.amcofh.org/research/commun

World Health Organisation (2018). Traditional and complementary medicine in primary healthcare.Availableonline:https://apps.who.int/iris/bitstream/handle/10665/326299/WHO-HIS-SDS-2018.37-eng.pdf?sequence=1&isAllowed=y (accessed on 14 01 2022).

Witt, CM., Ludtke, R., Baur, R., Willich, S.N. (2005). Homeopathuc medical practice: long term results of a cohort study with 3981 patient, *BMC Public Health*, 2005, 5:115.

Yaneva, I., Pachova, D., Enev, I., Angelcheva, M., Vladimirova, M., Danova, N., Karanesheva, T. (2021). Homeopathic treatment in Bulgaria, National Center for Public Health and Analysis, Sofia.

Corresponding author:
Mariana Angelcheva, MD, PhD
Department of Physiotherapy and Rehabilitation,
National Sports Academy "Vassil Levski",
1, Gurguljat Str.,
Sofia, Bulgaria
E-mail: angelcheva_dr@abv.bg

AMATEUR TENNIS PLAYER PROFILE FROM SOUTH-WEST BULGARIA AND NORTHERN GREECE

Atanasia Lyuga, Dimitar Tomov, Daniela Tomova
South-West University "Neofit Rilski", Blagoevgrad, Bulgaria

ABSTRACT
There are few surveys related to amateur tennis. The existing surveys on this topic inform regarding the available facilities, prices for services and different programs. Our survey was focused on comparison of gender and age of amateur tennis players, as well as conditions and opportunities for amateur tennis in a hundred kilometers radius area covering two countries – Bulgaria and Greece. The collected information may be useful for tennis enthusiasts from both countries, and it may contribute to improvement of the relationship and partnership between them, especially since the distance between some tennis clubs in R. Greece and R. Bulgaria is less than sixty kilometers. The objective of the current study was creating a profile (age, gender, social and sport) of the amateur tennis player from Northern Greece and Southwestern Bulgaria and opening up opportunities for practicing amateur tennis in these border regions.
The results established some differences in the profile of amateur tennis players from the two countries, by gender and preferences. There was a significant difference in the age of Greek and Bulgarian tennis players, in Greece, the highest percentage was this one of 19 - 25 year olds, while the highest percentage of players in Southwestern Bulgaria was between 25-30 years old. The tennis courts in Bulgaria seem to be better maintained than those in Greece. On the positive side, the distances to the tennis clubs are not long, and the participants from both countries responded that this made it easier for them to practice tennis. The tennis amateurs are used to playing in one place, and prefer to play with the same partner. Tennis is an affordable sport as both in Greece (region of Macedonia) and in South-West Bulgaria, the prices of tennis services are within the means of all surveyed tennis players.

Keywords: *interest, gender, age conditions, programs, tennis services, accessibility*

INTRODUCTION

Tennis is one of the most popular games nowadays. Tennis is a sport that is often popularized by media (Stoyanova, 2013). It is not only the most popular racquet sport, but it is also among the three sports with the most (over 1.2 billion) followers worldwide. It is played by 87 million people of all ages and all sexes in Europe, North and South America, Asia, Australia, Japan, Russia. The International Tennis Federation is the third largest in its membership of 213 national federations. (Itftennis.com)

The International Tennis Federation is the third largest tennis federation, with 210 national federations as members (International Tennis Federation, 2021). David Haggerty, ITF President, says in the Global Tennis Report 2021 that the ITF member countries are 210 and the goal is to increase the number of people playing tennis to 120 million by 2030 (International Tennis Federation, 2021).

Evidence of the game's growing popularity around the world in recent years are the millions of fans and followers of top tennis players on social media (Hodgkinson, 2016).

After a literature review of print and Internet sources, we found that research in tennis is focused primarily on the regularly practicing athletes. (Skorodumova, 1994; Bolitieri, 2009, Crespo and Miley, 2002; Read, Quinn, & Crespo, 2003; Reid et al, 2009 Robert, & Gropel 2004, Roetert, & Ellenbecker 2009).

The existing surveys related to amateur tennis are few and inform regarding the available facilities, prices for services and different programs. (Eskiyecek & Keskin 2020; Chansheng, 2017; Xin He 2022)

For example, one study among students (Stoyanova, 2013) established that the interest in playing amateur tennis was only weakly related to the interests in some other sport games with a ball.

It was of interest to us to define the gender, age, conditions and opportunities for practicing amateur tennis in an area with a radius of one hundred kilometers covering two neighboring regions. In the context of the scientific intentions thus declared, our study pursued the following *objective*: to create a profile (age, gender, social and sport) of the amateur tennis player from Northern Greece and South-West

Bulgaria and to reveal the opportunities for practicing amateur tennis in these two bordering regions.

We believe that the information obtained as a result of this research may be useful for tennis lovers from both countries, where in some cases the distance between a tennis club in Greece and a tennis club in Bulgaria is less than sixty kilometers. We hope the research findings to contribute to improving the relationship and partnership between them.

METHODS

The study was conducted from February 2021 to May 2021. This was a cross-sectional study.

Participants

The participants in the study were 130 amateur tennis players, of which 75 from Greece (from the cities of Pella, Thessaloniki, Kilkis, Serres and Drama), and 55 from Bulgaria (from the cities of Blagoevgrad, Petrich, Sandanski, Gotse Delchev and Bansko). In this region of Bulgaria, the earliest organized tennis began to be played in 1982 in Blagoevgrad. In the other settlements in both regions, tennis courts and clubs appeared 10 to 20 years later.

The difference between the number of the studied amateur tennis players from Bulgaria and Greece was not statistically significant ($\chi2 = 3.077$, df = 1, p = .079).

Table 1. *Percentage distribution of some socio-demographic characteristics of the studied Bulgarian and Greek amateur tennis players*

Socio-demographic characteristics	**Greek** amateur tennis players	**Bulgarian** amateur tennis players
Gender:	63% women 37% men	51% women 49% men
Age	45% aged 19-25, 43% aged 26-50 years, 12% over 50 years old	31% aged 19-25 years, 63% aged 26 - 50 years, 6% over 50 years old

There were not any statistically significant differences ($\chi2 = 0.018$, df = 1, p = .893) between the number of the studied men in Bulgaria (N=27) and in Greece (N=28), but the studied women amateur tennis players in Greece (N=47) were statistically significant more ($\chi2 = 4.813$, df = 1, p = .028) than the studied Bulgarian women tennis players (N=28) – see Table 1.

Statistically significant ($\chi2 = 5.120$, df = 1, p = .024) more participants from 19 to 25 years were studied in Greece (N=33) than this age group in Bulgaria (N=17) – see Table 1. There were not any statistically significant differences between the number of Greek (N=33) and Bulgarian (N=35) participants from 26 to 50 years old ($\chi2 = 0.059$, df = 1, p = .808). There were not any statistically significant differences between the number of Greek (N=9) and Bulgarian (N=3) participants above 50 years old ($\chi2 = 3$, df = 1, p = .083).

The studied Bulgarian and Greek amateur tennis players statistically significant differed in their education ($\chi2$ = 21=072, df = 3, p < .001; Cramer's V = 0.403, i.e., a moderate effect size, according to IBM, 2022) – see Table 2. Significantly more amateur tennis players with secondary and higher education than expected were studied in Bulgaria – see Table 2. Significantly more amateur tennis players with doctoral education than expected were studied in Greece – see Table 2.

Table 2. *Frequency distribution of educational characteristics of the studied Bulgarian and Greek amateur tennis players*

			Education			
			Elementary	Secondary	Higher	Doctoral
Country	Bulgaria	Observed Count	3	21	30	1
		Expected Count	5.5	16.1	23.7	9.7
		% within country	5.5%	38.2%	54.5%	1.8%
	Greece	Observed Count	10	17	26	22
		Expected Count	7.5	21.9	32.3	13.3
		% within country	13.3%	22.7%	34.7%	29.3%

Instruments

The survey was the main method of data collection in this study. All participants answered to three main groups of questions - about their sports experience, motivation, as well as about their playing conditions and some financial issues related to accessibility to the tennis services used.

Methods for data analysis

The results were descripted as percentages and were compared by means of chi-square analysis by means of SPSS 20.

RESULTS

Table 3 compares the results of the responses of Greek and Bulgarian tennis amateurs regarding their sports experience.

Table 3. *Percentage distribution of some responses of Greek and Bulgarian tennis amateurs concerning their sports experience*

Questions	**Greek** amateur tennis players' answers	**Bulgarian** amateur tennis players' answers
How many times a week do you play tennis?	13% - every day, 17% - 6 times a week, 24% - 4 times a week, 46% - 1-2 times a week	12% every day, 17% - 6 times a week, 23% - 4 times a week, 48% 1-2 times a week
Are you playing with the same partner?	57% - same 43% - different	60% - same 40% - different
What tournaments do you participate in?	20 athletes in club tournaments, 20 in city, 25 in municipal, 5 in regional, 32 in state, 2 in international tournaments	46 athletes in club tournaments, 25 in city, 24 in municipal, 7 in districts, 3 in state, 3 in international tournaments

There were not any statistically significant differences between the studied Bulgarian and Greek tennis players in their frequency of playing tennis during the week, i.e. how many times a week they played tennis ($\chi 2 = 0.054$, df = 3, p = .997) – see Table 3. The largest percentage of both groups of participants indicated that they played tennis 1-2 times a week. They preferred to play tennis with the same partner in both countries – see Table 3. The studied Greek and Bulgarian amateur tennis players participated in almost the same number of tournaments – 104 tournaments in total for the Greek tennis players and 108 tournaments in total for the studied Bulgarian tennis players – see Table 3. However, the studied Bulgarian tennis players participated in more club tournaments (N = 46) than the Greek amateur tennis players (N = 20), while the last participated in more state tournaments (N = 32) than the former (N = 3) – see Table 3.

Table 4. *Percentage distribution of some responses of Greek and Bulgarian tennis amateurs concerning t heir motivation*

Questions	**Greek** amateur tennis players' answers	**Bulgarian** amateur tennis players' answers
Why do you play tennis?	52% - for fun 26.6% - to improve health 21.3% - because it's trendy	47.3% - for fun 30.9% - to improve health 21.8% - because it's trendy
Who introduced you to tennis?	38.7% - friends 30.7% - family 16% - classmate 8% - PE teacher 6.6% - coach	49.1% - friends 25.4% - family 1.8% - classmate 14.5% - PE teacher 9% - coach

There were not any significant differences between the studied Bulgarian and Greek amateur tennis players in their explanations why they played tennis ($\chi2 = 0.346$, df = 2, p = .841) – see Table 4. Primarily tennis was played for recreation and as a means of improving health. There were not any significant differences between the studied Bulgarian and Greek amateur tennis players in the types of people who introduced them to tennis ($\chi2 = 8.99$, df = 4, p = .061) – see Table 4.

Table 5. *Percentage distribution of some responses of Greek and Bulgarian tennis amateurs concerning some financial issues related to tennis services*

Questions	**Greek** amateur tennis players' answers	**Bulgarian** amateur tennis players' answers
What are the prices for the services?	One hour -10 euro, individual lesson with coach 50 euro in a group 10 euro	One hour -10 leva, (5 euro) individual lesson with a coach 20-30 leva (10-15 euro) in a group 10 leva (5 euro)
Do you use some appliances that you rent?	Yes 42.6% No 57.3 %	Yes 56.3% No 43.7%
Price of tennis racket	44% spend from 100 -200 euros, 28% up to 100 euros and 28% > 200 euros	40% up to 200 leva = (about 200 euros) 30,1% up to 200-400 BGN = (about 100-200 euros) 29,8% > 400 leva = (about 200 euros)
Over what period of time do you buy a new racket and balls?	45.3% every 2-3 years 25.3% - buy 1 racket every year 29.3% - buy a racket every > 3 years	47.2% - every 2-3 years 25.4% buy 1 racket every year 27.2% > 3 years
How many tennis rackets do you have?	38.6% -2 rackets 36% - 1 racket 20% - 3 rackets 5.3 % > 3 rackets	34.5% - 2 rackets 32.8% - 1 racket 14.5% - 3 rackets 18.2% > 3 rackets
How often during the year do you change the cordage on the rackets?	52% - once 37.3% - 2 times 10.7% > 3 times	41.8% - once 40% - 2 times 18.1% > 3 times

The price of the court and the price of group lessons in the two regions was very similar. Noticeable is the difference in the price of individual lessons, almost 4-5 times higher in Greece compared to Bulgaria.

There were not any significant differences between the studied Bulgarian and Greek amateur tennis players in their use of some appliances that they rent ($\chi2 = 2.383$, df = 1, p = .123) – see Table 5. There were not any significant differences between the studied Bulgarian and Greek amateur tennis players in the period of time over which they bought a new racket and balls ($\chi2 = 0.073$, df = 2, p = .964) – see Table 5. Most of them bought new rackets on average every 2 years. There were not any significant differences between the studied Bulgarian and Greek amateur tennis players in the number of rackets they had ($\chi2 = 5.642$, df = 3, p = .13) – see Table 5. Most Greek and Bulgarian athletes owned 2 rackets each. There were not any significant differences between the studied Bulgarian and Greek amateur tennis players in the frequency of changing of the cordage on the rackets ($\chi2 = 2.043$, df = 2, p = .36) – see Table 5. The studied athletes had their racquets strung at the clubs where they played, in most cases once a year.

Table 6. *Percentage distribution of some responses of Greek and Bulgarian tennis amateurs concerning how the price of tennis court reflected on their visits to court*

			Does the cost of the service limit your visits to the court?	
			not bothered by the price of the court	Yes, the price limits the court visits
Country	Bulgaria	Observed Count	48	7
		Expected Count	37.7	17.3
		% within country	87.3%	12.7%
	Greece	Observed Count	41	34
		Expected Count	51.3	23.7
		% within country	54.7%	45.3%

Significantly more Bulgarian amateur tennis players than expected were not bothered by the price of the tennis court, in difference with Greek amateur tennis players who limited their court visits more than expected ($\chi2 = 15.624$, df = 1, $p < .001$, Cramer's V = 0.347, i.e. moderate effect size, according to according to IBM, 2022) – see Table 6.

Table 7. *Percentage distribution of some responses of Greek and Bulgarian tennis amateurs concerning their playing conditions*

Questions	**Greek** amateur tennis players' answers	**Bulgarian** amateur tennis players' answers
Do the tennis courts have lighting installed?	85.3% of the courts have lighting without lighting are 14.6%	There is lighting on 94.5% of the courts without lighting are 5.4%
Whose property are the tennis courts?	21.3% - state 61.3% - municipal 12% - private 5.4% - corporate	12.7% - state 56.3% - municipal 25.4% - private 5.5% - corporate
Do you play in one club or do you go to the other as well?	84% play at the same club 16% in other clubs	81,8% play at the same club 18.2% in other
Does your club organize tournaments for amateurs?	35 club tournaments, 5 city tournaments, 45 municipal tournaments, 0 regional, 15 state, 12 international	39 club tournaments, 21 city tournaments, 33 municipal tournaments, 4 regional 3 state, 2 international

There were not any significant differences between the answers of the studied Bulgarian and Greek amateur tennis players regarding the lighting of tennis courts in each country ($\chi2 = 2.802$, df = 1, $p = .094$) – see Table 7. Almost all facilities in both Greece and Southwest Bulgaria had lighting, and could be used in the evening hours.

There were not any significant differences between the answers of the studied Bulgarian and Greek amateur tennis players regarding the types of the property of tennis courts in each country ($\chi2 = 4.708$, df = 3, $p = .194$) – see Table 7. Most courts in both regions were municipally owned.? In Greece, the courts with a hard surface (64%), and in Bulgaria, a larger part are clay courts (69.1%), answered the respondents.

There were not any significant differences between the answers of the studied Bulgarian and Greek amateur tennis players regarding if they played tennis in the same tennis club or in other tennis clubs ($\chi2 = 0.107$, df = 1, $p = .743$) – see Table 7. Tennis players usually used the same courts. The tennis clubs of the studied Greek and Bulgarian amateur tennis players organized some tournaments for amateurs – almost the same number of club tournaments in Bulgaria as in Greece – see Table 7.

Table 8. *Percentage distribution of the responses of Greek and Bulgarian tennis amateurs concerning their proximity to tennis courts*

			How close is the court you play on to your home?	
			up to 5 km	longer distance
Country	Bulgaria	Observed Count	51	4
		Expected Count	42.7	12.3
		% within country	92.7%	7.3%
	Greece	Observed Count	50	25
		Expected Count	58.3	16.7
		% within country	66.7%	33.3%

Significantly more Bulgarian amateur tennis players than expected lived near the tennis court, in difference with Greek amateur tennis players whose homes were far from the tennis court more frequently than expected ($\chi 2 = 12.434$, df = 1, $p < .001$, Cramer's V = 0.309, i.e., moderate effect size, according to according to IBM, 2022) – see Table 8.

When asked what they thought as necessary for improvement of the conditions and opportunities for amateur tennis in their area, both the studied Bulgarian and Greek amateur tennis players recommended free participation, creation of new courts, maintenance of courts, lighting of courts, free equipment (rackets, balls), participation in tournaments, and hiring coaches. All participants said that in order to improve the conditions and opportunities for amateur tennis, the following should be done:

- Access to municipal and state tennis facilities to be free and unrestricted.
- Construction of new modern courts and improved maintenance of existing ones,
- installation of adequate lighting,
- free provision of equipment (rackets, balls),
- opportunities to participate in tournaments and
- hiring of tennis coaches.

DISCUSSION

After a thorough and correct processing of the data from the present study, we found that the number of female amateur tennis players in Northern Greece was higher than that of men. In the South-West Bulgaria, the number of men and women who participated in the survey was approximately equal. Another significant difference was in the age of the Greek and Bulgarian players - in Greece the largest percentage of players was 19-25 years old, and they were significantly more in number than this age group in Southwestern Bulgaria. Amateur tennis players with a doctoral degree of education prevailed in Greece (Macedonia) compared to Southwestern Bulgaria.

The studied amateur tennis players in Bulgaria and in Greece had similar motivation for playing tennis. More participants from Greece (Macedonia) than from Bulgaria were not satisfied with the price of the courts they used and with the distance to the tennis court that reflected on the affordability of tennis service. In this part of Greece, the tennis courts are mostly hard surfaced, in contrast to Southwest Bulgaria, where clay courts predominate.

Both in Bulgaria and in Greece, the amateurs were well organized and participate in a large number of tournaments throughout the year. Most of them played in club and municipal competitions, but the number of participants in international competitions was small.

CONCLUSION

We can summarize that we found almost no differences in the profile of the amateur tennis player in the regions Macedonia in Greece and Southwestern Bulgaria regarding their motivation for playing tennis – they loved tennis and played it for fun with almost the same frequency in both countries. The amateur tennis players in the regions Macedonia in Greece and Southwestern Bulgaria differed regarding their gender, age and educational profile, as well as in their estimation of affordability of tennis services being slightly higher in Bulgaria than in Greece.

REFERENCES

Alexandrova, A. (2009). *Testirane v obrazovanieto* [Testing in education]. Plovdiv: Plovdiv University Paisii Hilendarski.

Bizhkov, G., & Krajewski, V. (2002). *Metodologia I metodi na pedagogicheskite izsledvania* [Methodology and methods of pedagogical research]. Sofia: Sofia University "St. Kliment Ohridski" Press.

Bolitieri, N. (2009). Tennis Academy, SOFTPRESS, Sofia.

Chansheng Chen (2017) Research and analysis of the state of development of amateur tennis in Zhuhai DOI:10.24104 /rmhe/

Crespo, M. & Miley D. (2002). ITF Advanced coaches manual;

Hodgkinson, M. (2016). *Fedegrafika* [Fedegraphica: A graphic biography of Roger Federer]. Sofia: Knigomania.

Itftennis.com. (n.d.). Retrieved October 1, 2022, from https://www.itftennis.com/en/about-us/organisation/what-we-do/

IBM. (2022). *Cramér's V*. https://www.ibm.com/docs/en/cognos-analytics/11.1.0?topic=terms-cramrs-v

International Tennis Federation. (2021). *ITF Global Tennis Report 2021*. http://itf.uberflip.com/i/1401406-itf-global-tennis-report-2021/0?

Eskiyecek Janan Gulbin & Keskin Yozlem, (2020). Reasons for tennis to tennis and tne level of realization of the expectations of tennis players-amateurs from tennis – the case of Diyarbakir province DOI:10.5281/zenodo.3643369

Read, M., Quinn, A. & Crespo, M. (2003). Strength and Conditioning for Tennis. ITF Ltd ;

Reid, M. et al, (2009). Planning and periodisation for elite players aged 17-18, Strength and Conditioning Journal, 31/4;

Robert, P. & Gropel, J. (2004). *World Class Tennis*, Exmo Publishers.

Roetert, E.P. & Ellenbecker, T. (2009). Periodization training, ITF CSSR 47, Pages 10-11;

Skorodumova, A. (1994). Tennis.

Stoyanova, S. (2013). Meta analiz na sportni interesi kam igri s topka pri uchenitsi v Balgaria [Meta – analysis of sports interests in games with a ball among students in Bulgaria]. *Yearbook in Psychology, 4*(4), 220-238.

Xin He (2022) The Effectiveness of Tennis Celebrity Endorsement on Tennis Enthusiasts' Purchase Intention to Endorse a Tennis Product DOI:10.1007/978-981-19-5727-7_24In the book: Proceedings of the 2022 International Business and Policy Research Conference

Corresponding author:
Daniela Tomova, PhD
Department Theory and Methodology of Physical Education
South West University " Neofit Rilski"
E-mail: danitomova@swu.bg

 DOI: 10.37393/ICASS2022/99 161 - 167

ADAPTED FOOTBALL PROGRAM TO DEVELOP THE MOTOR SKILLS OF CHILDREN WITH INTELLECTUAL DISABILITIES

Velichka Aleksandrova
National Sports Academy „Vassil Levski", Sofia, Bulgaria

ABSTRACT
Adapted physical activity and sport is the art and science of development, implementation and control of a specially designed program in a given type of sport for children with various disabilities.
The purpose of the present study is to develop and prove the effectiveness of an adapted football program for developing the motor skills of children with intellectual disabilities.
The subject of research is the effectiveness of the adapted soccer program, and the subject of the research is the motor qualities of children with intellectual disabilities.
Methodology: Participants in the study are a total of 20 children with intellectual disabilities from the SC Adapted Sports. They are divided into two groups: Experimental - includes 10 children participating in a specialized program in adapted football and Control - includes 10 children participating in standard activities in adapted physical activity. Classes were held twice a week according to a previously prepared program that met the specific needs of the children being taught. We used a 20 / 40 m field for mini football with high-quality artificial grass in the „Green Sport" Sports Complex, Sofia. The experimental program includes a variety of motor actions, with which the goal and tasks of the study were realized. Her duration of application was a total of 9 months.
Results: After the applied statistical computer processing, an analysis of the working material of our study was made. To objectify the results of the experiment, the data were systematized and subjected to variation and comparative analysis. Based on the obtained results and their analysis, we found that the experimented program on adapted football for developing the motor qualities of children with intellectual disabilities is effective, observing a tendency to improve the studied indicators of physical ability and functional state. The selection of appropriate tests was fully tailored to the individual characteristics of the children in the target group.

Keywords: *Adapted football, children, intellectual disabilities*

INTRODUCTION

In recent years, one of the challenges for sports specialists is related to the preparation and integration of children with various disabilities in various motor activities. The many difficulties that have to be overcome cause great interest in the problem. In this sense, these children attract the attention of more and more researchers from different fields.
Free access to sports is a major emphasis in modern policies regarding the education and upbringing of children with intellectual disabilities. (Bakhchevanski, 2019; Mihailova, 2019; Kirilova et al., 2020; Lefterova, 2020)

Modern trends require the inclusion of adapted physical activity as part of the complex rehabilitation of these children. Carrying out the adapted motor activities has an extremely versatile impact on the child's organism. (Djobova, 2018; Aleksandrova, 2019; Yosifov, 2019; Kirilova et al., 2018; Malchev, 2019; Marinov, 2020)
They cause positive changes in the activity of the neuromuscular, cardiovascular and respiratory systems, the musculoskeletal system and the psycho-physical condition of the children. One of the most accessible environments for learning and integrating children with intellectual disabilities is the one created in sports activities

Through games and physical exercises, opportunities are provided for both learning and performance, according to opportunity and level of preparation. (Dimitrova, 2015; Vladova, 2018)
In this regard, the direction of our research is related to the possibilities of implementing a specialized program in adapted football - a program that can and should find its application in sports activities for children with intellectual disabilities.

The adapted football game is characterized by a huge variety and uniqueness of actions, constantly changing game situations. Motor actions and movements are of a natural and unforced nature, which largely determines their accessibility for practice by children with intellectual disabilities. Systematic activities with adapted football greatly

contribute to the development of general and special endurance.
Characteristic of the football game is the increased motor activity of children, associated with a large expenditure of energy and various emotional experiences, caused by the combat and the continuous change of game situations.

Children's game preparation is aimed at increasing game activity and the general efficiency of all actions on the field. For this reason, in the educational and training process, a precise selection of adapted means is required in the form of games with adapted content and conditions for improving the game preparation.

In the sports-pedagogical aspect, physical ability is mainly reduced to the development of physical qualities and the development of movement habits. The most favorable for this is precisely childhood, when motor skills and qualities develop quite complexly. (Zemfirov, 2020)

Adapted football in these children causes significant transformations and changes in the entire organism, psyche and consciousness - the biochemical and biomechanical properties of the locomotor apparatus are improved.

Positive changes occur in the activity of the cardiovascular system, respiratory and nervous system. It is obvious that the role of motor activity in building the biological, personal-psychic, spiritual-moral and aesthetic components is growing significantly.

In view of this, motor activity contributes to the creation of a biological basis for good mental performance and a favorable mental background and comfort of the child, and at the same time increases the adaptation capabilities of the body and psyche to constantly changing external impacts and influences. (Kaloyanova, 2020)

The aim of the present study is to develop and prove the effectiveness of an adapted soccer program for developing the motor skills of children with intellectual disabilities.

METHODS

Participants

Participants in the research are a total of 20 children with intellectual disabilities from the „Adapted Sports" SC, divided into two groups:

- Experimental group - 10 children. In this group, a developed program of adapted football was implemented twice a week for 60 minutes.
- Control group - 10 children. In this group, a standard program of adapted physical activity was applied twice a week for 60 minutes.

All parents granted their written informed consent, and the study was approved by the Ethics Committee and the study conformed to the standards set in the Ethical codecs of the National Sports Academy "Vassil Levski" – Part four, paragraph 2.6 and 2.7.

Training protocols

For the needs of the experimental research, in a period of nine months, we applied a specialized program including various means of the game of football to affect the physical and functional condition of children with intellectual disabilities.

The funds in the adapted soccer program were precisely dosed and tailored to the age and level of readiness of the children. The main exercises used in the experimental methodology are: general developing exercises;naturally applied exercises – walking, running, jumping, etc.;spatial orientation exercises;exercises to affect the function of the cardiovascular and respiratory system; exercises to improve coordination movements; exercises with a ball - individually, in pairs; exercises to develop different qualities - agility, flexibility, speed, endurance, strength; exercises for guiding the ball with the inner part of the foot; exercises for mastering false movement (feint); exercises to build motor habits; exercises for the correct acquisition of a straight shot; exercises for mastering a straight hit on a moving ball in pairs; exercises alternating between moderate running and sprinting for 5-10m. after a signal; ball handling exercises; exercises to stop the ball with the foot; exercises for driving the ball with a change of direction; goal shooting exercises; exercises to master stopping a low-flying ball with the inner part of the foot; running and jumping exercises; imitation exercises of head shots; exercises for mastering head kicks from the spot; exercises to develop the physical quality, speed of reaction; exercises for mastering lateral throwing; relaxing exercises; stretching exercises. In the preparatory part of the classes, the applied exercises were for adapting the body to the physical load, and in the main part, specialized football exercises and various mobile games were applied. The final part included breathing and

relaxation exercises. In this way, the density and variety of the activity was achieved. In the specialized program in adapted football, the emphasis was on the preliminary preparation for motor activities and the psychological adaptation to the activities. For children in the target group who had never practiced physical activity or had had an interruption, low- to moderate-intensity exercise lasting 30-40 minutes was recommended.

The goal was to gradually build up to 60 minutes of moderate to moderately high intensity exercise. The football program implemented in the experimental group allowed a greater variety of the means and methods used and a positive impact on the physical and functional condition of the children of the target group.

The prepared program, including a standard methodology for adapted physical activity in the control group, contained general developing exercises, strength exercises, aerobic exercises, body balance exercises. An essential place in the physiological and motor adaptation was occupied by the functional capabilities of the cardiovascular system, the degree of endurance of the physical load and the capabilities of the musculoskeletal system in the children of the control group.

Statistical Analyses

The effectiveness was established by analyzing the influence of physical exercises on the motor skills and habits characterizing the physical development, physical performance of the studied group. The study participants took part in six tests involving the measurement of physical and functional indicators at the beginning and at the end of the period to reveal the level of motor abilities and the impact on physical and functional status. The test battery included in the study is presented in Table 1.

Table 1. *Indicators of physical capacity*

Indicators	Measurement units	Accuracy of measurement
Vital capacity	cm^3	1.0
Strength endurance of abdominal muscles	s	0.01
Strength endurance of back muscles	s	0.01
Long jump from a place	cm	1.0
Throwing a solid ball	cm	1.0
Body balance	s	0.01

To compare the reliability of the differences in the mean values of the investigated indicators of physical and functional condition between the experimental and control groups, we used the statistical method for comparing hypotheses t - Student‘s test for independent samples with a significance level $\alpha < .05$.

RESULTS

Table 2 and Table 3 present the comparison of the respective mean values by variables for the experimental and control groups - beginning and end of the study.

Table 2. *Comparison of mean values by variables and coefficient of variation for experimental and control groups - beginning of the study*

	Experimental group I measuremen			Control group I measurement		
	Mean	S	V%	Mean	S	V%
Vital capacity (cm^3)	1480	244.0	16.48	1380	196.00	14.20
Abdominal Muscle Strength (s)	17.80	6.8	38.20	15.23	4.34	28.49
Back Muscle Strength (s)	14.23	2.45	17.21	15.67	8.94	25.14
Explosive strength of lower limbs (cm)	102.4	13.60	13.28	101.23	6.10	6.02
Explosive strength of upper limbs (cm)	426.11	27.89	6.60	425.45	34.69	8.15
Balance of body (s)	7.23	1.01	12.86	8.13	0.93	11.43

Table 3. *Comparison of mean values by variables and coefficient of variation for experimental and control groups - end of the study*

	Experimental group II measuremen					Control group II measurement				
	Mean	**S**	**V%**	**D**	**t**	**Mean**	**S**	**V%**	**D**	**T**
Vital capacity (cm^3)	1920	132.0	6.87	440	1.97	1630	113.0	6.93	250	1.65
Abdominal Muscle Strength (s)	21.25	5.60	26.35	3.45	2.31	17.48	1.45	8.29	2.25	1.98
Back Muscle Strength (s)	17.18	3.17	18.45	2.95	2.03	18.34	1.35	7.36	2.67	3.00
Explosive strength of lower limbs (cm)	133.8	13.21	9.90	31.4	2.56	112.34	12.88	11.5	11.11	2.84
Explosive strength of upper limbs (cm)	528.2	38.18	7.23	102.14	2.41	476.23	28.45	5.97	50.78	2.86
Balance of body (s)	10.71	0.83	7.75	3.48	1.25	8.78	0.56	6.37	0.65	2.65

From the data in the table, it can be seen that at the beginning of the study, there is no significant difference between the experimental and control groups in the average values of the physical and functional condition indicators, while at the end of the study, there is such a difference between the two groups.

The analysis shows that when comparing the results at the beginning and at the end of the study, there are changes in the average levels of the studied indicators in the experimental group, in contrast to the control group. For the physiometric indicator - „Vital capacity“ (cm^3), a difference of 190 cm^3 is obtained in the average values in the two groups. In the children of the experimental group engaged in adapted football, the vital capacity increased by 440 cm^3 (I study –Mean = 1480 cm^3 at St.d ± 244.0, II study Mean = 1920 cm^3 at St.d ± 132.0) in comparison with children from the control group engaged only in a standard program of adapted motor activity, who increased their vital capacity by 250 cm^3 (I study – Mean = 1380 cm^3 at St.d ± 196.0, II study Mean = 1630 cm^3 at St. .d ± 113.0). Also, for the indicators of physical incapacity „Strength of upper limbs“ (cm) and „Strength of lower limbs“ (cm) the values are in favor of the experimental group. The difference between I and II research for the first indicator is d = 102.14 cm for the experimental group compared to the difference of the children from the control group group d = 50.78 cm. In the second indicator „Lower extremity strength“ (cm), the difference in the experimental group was d= 31.40 cm compared to the control group d = 11.11 cm. Most likely, this is the long-term effect of the means of the football game affecting the physical qualities and the specific features of the neuromuscular apparatus of children with intellectual disabilities. After the applied specialized program of adapted football, the children of both groups had better results regarding the indicator „Abdominal muscle strength“ (s) and „Back muscle strength“ (s). In the first indicator, the difference in the values of I and II studies in the experimental group is d = 3.45 s compared to the control group d = 2.25 s. The values of the second indicator „back muscle strength“ (s) were better in the experimental group (I study -Mean = 14.23 at St.d ± 2.45, II study Mean = 17.18 at St.d ± 3.17) compared to the control group (I study –Mean = 15.67 at St.d ± 8.94, II study Mean = 18.34 at St.d ± 1.35).

For the „Body Balance“(s) indicator, the result is in favor of the children of the experimental group, where the difference in the values in the I and II studies is d = 3.48 s, while the difference in the values in the I and II studies in the control group children engaged only in motor activity according to a standard program is d = 0.65 s.

Based on this, it can be assumed that the reason for the change in the studied indicators is the influence of the specialized soccer program applied in the experimental group. At the end of the study, the values of the coefficient of variation (V%) and the standard deviation (St.d) in the target group decreased, which determines the relative homogeneity and uniformity in terms of physical and functional abilities in children with intellectual disabilities. (Figure1).

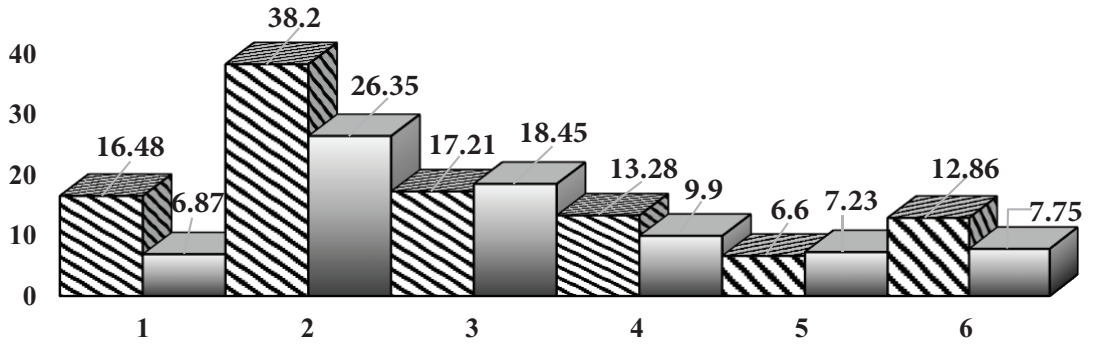


Figure 1. *Dynamics of the values of the coefficient of variation (V%) in the experimental group - beginning and end of the experimen*

In summary, it can be argued that the results achieved during the experimental study are a good basis for expanding the motor activity of children with intellectual disabilities, by including in the next stages of their training, adapted football activities. It can certainly be argued that the adapted soccer program has a positive effect on the physical and functional features of children with intellectual disabilities.

DISCUSSION

On the basis of many experimental searches, verification and scientific justification of the private methods in the field of adapted physical activity and adapted sports, it is possible to find rational means, methods and organizational forms for educational and training work with children with intellectual disabilities of different age groups.

Biogenetic analysis, knowledge from physiology, psychology and sociology are widely used. Most of the research is aimed at the study of the individual characteristics, justified by the specific pathology. However, there are still no general methodological concepts (Aleksandrova, et al., 2017).

The special pedagogical and methodical literature, published in our country and abroad, related to the practice of motor activities including the game of football for children with intellectual disabilities, as well as the results of our systematic training and the accumulated rich experience, served us as a basis for creating a program in adapted football for children with intellectual disabilities. The game of soccer can affect the socialization of these children by providing them with the opportunity to participate actively in different ways. The built correct strategy enables adequate primary socialization of children to and through sport and the principles related to it, to overcome social barriers in society (Dimitrova, 2015).

Many authors prove that physical activity and motor skills can improve social interaction, orientation and mobility of children with intellectual disabilities (Nikolova, et al., 2011; Lieberman, et al., 2013; Nesheva, 2019).

The author‘s program in adapted football for children with intellectual disabilities is tailored to the level of preparation, the specific features of the disability and the time for the implementation of pedagogical interaction. The first level provides the necessary foundation (base) for adaptation to the physical load and acquisition of initial soccer skills and habits.
In the second level, elements and coordination of the football game are studied, consolidated and perfected.

The theoretical contribution of the adapted football program for children with intellectual disabilities is the totality and effective use of theoretical and practical achievements of the individual sciences and parts of pedagogy, adapted sports, especially football, in accordance with the characteristics of children with disabilities, which with a good, diverse and systematic work can lead to the achievement of a beneficial effect on the level of motor performance, work ability and socialization.The practical contribution of the author‘s program is the attempt to standardize the specificity, dosage, intensity and environmental conditions.

In this way, the sport of football is promoted among children with intellectual disabilities and access and

opportunity for participation is ensured by applying a variety of adapted football programs for motor activity, suitable for the interests, opportunities and limitations arising from the individual characteristics of children, who cannot be included under the requirements of the standard football training programme.

CONCLUSION

In the literary sources studied by us, we found the presence of many theoretical aspects on various problems related to children with intellectual disabilities and, at the same time, few developed methods and programs for their development and improvement

The possibilities of applying an informative test battery to assess the degree of development of motor qualities in intellectual disabilities are limited. The selection of appropriate tests must be fully tailored to the individual characteristics of most of the examined.

The adapted soccer program for developing motor skills of children with intellectual disabilities is effective. It can also be used in practice.

REFERENCES

Aleksandrova, V. (2019). Dvigatelnata aktivnost kato preventsia za dobro zdrave pri uchenici sas spetsialni obrazovatelni potrebnosti. *Nauchno prilojna konferentsia Fizicheska aktivnost i zdrave*.NSA PRES. Sofia. // Александрова, В. (2019). Двигателната активност като превенция за добро здраве при ученици със специални образователни потребности. Научно-*приложна конференция* Физическа активност и здраве. НСА ПРЕС. София.

Aleksandrova, V., Djobova, S., Kirilova, I. & Hristov, O. (2017). Adaptirana fizicheska aktivnost i sport. *Elektrono pomagalo*. NSA, Sofia. // Александрова, В., Джобова, С., Кирилова, И.& Христов, О. (2017). Адаптирана физическа активност и спорт.Електронно помагало. НСА.София.

Bahchevanski, S. (2019). Zanimaniata s vetrohodstvo kato sredstvo za integratsia pri detsa s uvrejdania. *Nauchno prilojna konferentsia Fizicheska aktivnost i zdrave*. NSA PRES. Sofia. //Бахчевански, С. (2019). Заниманията с ветроходство като средство за интеграция при деца с увреждания. Научно-приложна конференция Физическа активност и здраве. НСА ПРЕС.София.

Vladova, I. (2018). Multikurturalizam. Olimpizam. Obrazovanie. *Monografia*.NSA PRES. Sofia. // Владова, И. (2018). Мултикуртурализъм. Олимпизъм. Образование. Монография. НСА ПРЕС. София.

Dimitrova, A. (2015). Sotsialna integratsia na detsa sas spetsialni potrebnosti v oblasta na sporta. *Nauchni trudove na Rusenski universitet*. Ruse. // Димитрова, А. (2015). Социална интеграция на деца със специални потребности в областта на спорта. Научни трудове на Русенски университет. Русе.

Djobova, S. (2018). Teoretiko-prilojni aspekti na sporta za hora s uvrejdanya. *Monografya*. Sofia. // Джобова, С. (2018). Теоретико-приложни аспекти на спорта за хора с увреждания. Монография. София.

Yosifov, R. (2019). Obektivnost pri otsenyavaneto na fizicheskata aktivnost. *Nauchno prilojna konferentsia Fizicheska aktivnost i zdrave*.NSA PRES. Sofia. // Йосифов, Р. (2019). Обективност при оценяването на физическата активност. Научно-приложна конференция Физическа активност и здраве. НСА ПРЕС. София.

Kirilova, I., Djobova, S.& Andonov, S. (2018). Zanimanya pri detsa sas sindrom na Daun vav vodna sreda – spetsifichni riskove. *Sport i sigurnost*. Sofia. // Кирилова, И., Джобова, С. & Андонов, С. (2018). Занимания при деца със синдром на Даун във водна среда – специфични рискове. Спорт и сигурност.София.

Kirilova, I., Djobova, S. & Aleksandrova, V. (2020). Priobshtavane vav fizicheskoto vazpitanie i sport – prakticheski modeli i adaptatsia. *Lichnost, motivatsia i sport – XXIV nauchna konferentsia*. NSA PRES.Sofia. // Кирилова, И., Джобова, С. & Александрова, В. (2020). Приобщаване във физическото възпитание и спорт – практически модели и адаптации. Личност,мотивация и спорт – XXIV научна конференция. НСА ПРЕС. София.

Kaloyanova, D. (2020). Intelektualni zatrudnenya: definitsia, harakteristika i klasifikatsia. Psihichni problemi pri hora s intelektualni zatrudnenya. *Upravlenie i obrazovanie.* Sofia. // Калоянова, Д. (2020). Интелектуални затруднения: дефиниция, характеристика и класификация. Психични проблеми при хора с интелектуални затруднения. Управление и образование. София.

Lefterova, D. (2020). Za dostapa do obrazovanie na detsa i uchenitsi sas spetsialni obrazovatelni potrebnosti. *Pedagogika.* Sofia. // Лефтерова, Д. (2020). За достъпа до образование на деца и ученици със специални образователни потребности. Педагогика.София.

Mihailova, P. (2019). Alternativni strategii za priobshtavane na detsa s mnojestvo uvrejdanya. *Pedagogicheski almanax.* Veliko Tarnovo. // Михайлова, П. (2019). Алтернативни стратегии за приобщаване на деца с

множество увреждания. Педагогически алманах. Велико Търново.

Malchev, M. (2019). Fizicheskoto vazpitanie i sportat v priobchtavachtoto obrazovanie.*Monografya.*Ai and Bi. Veliko Tarnovo. // Малчев, М. (2019). Физическото възпитание и спортът в приобщаващото образование. Монография. Ай анд Би. Велико Търново.

Marinov, T. (2020). Osnovi na fizicheskoto vazpitanie. Teoria i metodika. *Monografya*. NSA PRES. Sofia. // Маринов, Т. (2020). Основи на физическото възпитание. Теория и методика. Монография. НСА ПРЕС. София.

Nikolova, M., Goranova, Z.& Ludjeva. N. (2011). Adaptiranata fizicheska aktivnost v rehabilitatsiata i readaptatsiata na hora s uvrejdanya. *Peti mejdunaroden nauchen kongres „Sport,stress,adaptacia" NSA „Vasil Levski". Sport i nauka.* Sofia. // Николова, М., Горанова, З. & Луджева, Н. (2011). Адаптираната физическа активност в рехабилитацията и реадаптацията на хора с увреждания. Пети международен научен конгрес „Спорт, стрес, адаптация" на НСА „ Васил Левски". Спорт и наука. София.

Nesheva, I. (2019). Adaptirana dvigatelna metodika sas sredstvata na gimnastika pri xora s uvreden sluh. *Nauchno spisanie za Smart inovatsii v Rekreativnata (Wellness) industria i Nishov turizam.* Sofia. // Нешева, И. (2019). Адаптирана двигателна методика със средствата на гимнастика при хора с увреден слух. Научно списание за Смарт иновации в Рекреативната *(Wellness) ин*дустрия и Нишов туризъм. София.

Zemfirov, M. (2020). Obrazovatelna politika pri klasicheskya podhod na Jan Piaje v balgarskoto priobshtavashto obrazovanie. *Pedagogika.* Sofia. // Земфиров, М. (2020). Образователна политика при класическия подход на Жан Пиаже в българското приобщаващо образование. Педагогика. София.

Lieberman, L., Ponchillia, P., Kay, S.& Ponchillia, V. (2013). Physical Education and Sports for People with Visual Impairments. *American Foundation for the Blind.*

Corresponding author:
Velichka Aleksandrova
Department of Water Sports, AFAS sector
National Sports Academy „Vassil Levski"
Studentski grad, 21, Acad. Stefan Mladenov str.
Sofia 1700, Bulgaria
E-mail: vili_polito@abv.bg

 DOI: 10.37393/ICASS2022/100 168 - 173

EMPOWERMENT OF PERSONS WITH INTELLECTUAL DISABILITIES THROUGH INVOLVEMENT IN SPECIAL OLYMPICS BULGARIA

Stefka Djobova, Ivelina Kirilova
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
Special Olympics is the world's largest sports organization for children and adults with intellectual disabilities. It was established to provide year-round sports training and competition opportunities in a variety of Olympic-type sports. Nowadays, it is a global movement of devoted people gathered to create a new world of inclusion where every single person is accepted and welcomed, regardless of ability or disability. In Bulgaria, the Special Olympics program started in 1994 and since then is constantly advocating for access to sports for the disadvantaged groups in our society. The aim of this study is to reveal the power of sport in the transformation of the lives of persons with intellectual disabilities involved in the Special Olympics program in Bulgaria.
Single-case research design was applied for examining changes in outcome variables in a researched target group. For the truly recapture of the researched individuals, we made use of narrative in terms of "live stories". The grounded theory of this study is empowerment, as defined by the United Nations Social Development Network. The transformative power of sports has a positive influence on personal and sport-specific competencies, relatedness, expansion of opportunities, and autonomy. Involvement in Special Olympics contributes to personal development and inspires a sense of belonging. Training and competition involvement are increasing opportunities and experiences that lead to the empowerment of a single person with an intellectual disability.

Keywords: *Empowerment, intellectual disability, Special Olympics*

INTRODUCTION

Empowerment of women and particularly women with intellectual disabilities (ID) is a new global phenomenon. It has been a long time since the very first World conference on the status of women convened in Mexico City at the year 1975. The conference coincided with the International Women's Year, made to remind the international community that discrimination against women continued to be a persistent problem in much of the world. According to the United Nations (UN) at this conference, "women played a highly visible role" and adopted the World Plan of Action for the Implementation of the Objectives of the International Women's Year (UN, n.d.). This step provokes many countries' governments to adopt the concept and to work actively in the area of women's empowerment (Mandal, 2013). In his article Concept and Types of Women Empowerment, Mandal tries to reveal the origins of the term "empowerment" and he suggests that it has replaced the previous term "development". In recent years, empowerment can be a trendy word, a process, an outcome, or be defined as a final destination of the efforts of our society to turn into an inclusive ecosystem where everyone is accepted, welcome, valued, and have an opportunity to contribute to the development and wellbeing. According to the UN (n.d.), it "means inactive participation in decision-making, equal opportunity, economic freedom, and the right to give an opinion, access to the productive resources that can make enable to increase the earnings. It is giving the strength to fight against any inequalities and get self-respect and confidence". Nowadays, it is progressively used and connected to social development groups such as youngsters, poor people, seniors, people with disabilities, marginalized people, etc. The United Nations Headquarters in New York from 10 to 12 September 2012 organized an Expert Group Meeting (EGM) on "Promoting Empowerment of People in Achieving Poverty Eradication, Social Integration, and Full Employment and Decent Work for All". The meeting has decided that the most appropriate definition of Empowerment was: "as an iterative process with key components including an enabling environment that encourages popular participation in decision-making that affects the achievement of goals like poverty eradication, social integration, and decent work for all as well as sustainable development" (UN, n.d.).

Many people consider sports as a vehicle for change, and it can have this value in the disability area as well. If persons with intellectual disabilities don't have the skills to perform in scientific or other highly sophisticated domains, they are able to do well in the sports domain and build self-confidence, self-awareness, and appreciation of people (especially for those involved in a team sport). Barbu et al. (2021) claim that sports can be a valuable tool to enhance the voices of persons with ID and help them become visible in our society. In the area of sports Special Olympics (SO) - the world's largest sports organization for children and adults with intellectual disabilities was established to provide year-round sports training and competition opportunities in a variety of Olympic-type sports. The year 2004 was remarkable for SO. The efforts of the organization to show the power of sport and a holistic approach in giving opportunities to persons with ID were valued by stakeholders and the United States (US) government, and the "Special Olympics Sport and Empowerment Act" was signed by US President George W. Bush. This gives $15 million every year for five years to Special Olympics programs. The funding goes to initiatives encouraging greater respect and understanding for people with intellectual disabilities. This marks the first time that Special Olympics secures support through legislation (Special Olympics, n.d.). The act has recognized the contribution to the organization, and some of the reasons for funding are recognition of the dignity and value of the giftedness of children and adults with an ID; determination to end the isolation and stigmatization of people with an ID; encouragement of skill, sharing, courage, and joy through year-round sports training and athletic competition for children and adults with ID; provide a significant positive effect on the quality of life, improving their health and physical well-being, building their confidence and self-esteem, and giving them a voice to become active and productive members of their communities. The purpose of this Act is to provide support to SO in its mission to facilitate participation and raise public awareness of the SO movement, fight against negative stereotypes about people with ID, build athletic and family involvement through sports, and last but not least to promote the extraordinary gifts of people with ID (Special Olympics Sport and Empowerment Act of 2004).

Nowadays, it is a global movement of devoted people gathered to create a new world of inclusion where every single person is accepted and welcomed, regardless of ability or disability. SO has defined Empowerment as feeling, acting, and being in control of one's own life as much as possible, and it involves having the power to make choices and decisions about your own life (Special Olympics, n.d.). SO goal is to foster an environment where all athletes feel, act, and are empowered. Figure 1 presents the five empowerment components defined by SO.

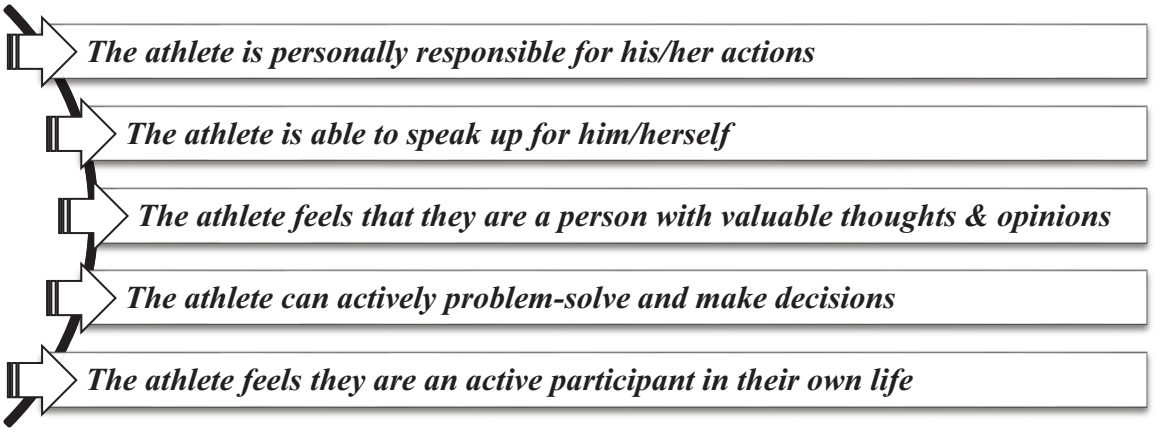


Figure 1. *Athlete Empowerment Components according to SO.*

Moreover, SO provides a supportive and inclusive environment for athletes to realize their empowerment goals by proposing five pathways presented in Figure 2.

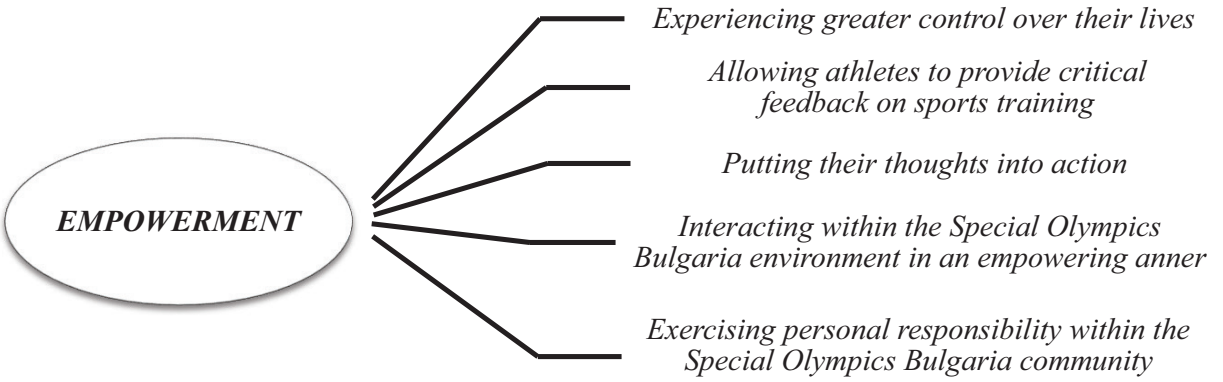


Figure 2. *Pathways for realizing empowerment by SO athletes.*

In Bulgaria, the Special Olympics program started in 1994 and has constantly advocated for access to sports for disadvantaged groups in our society. As Nelson Mandela had said, the sport has the power to change the world, to inspire; it is the language that all can understand and can create hope where once there was only despair.

Aim and objectives of the study

This study aims to reveal the power of sport in transforming the lives of persons with intellectual disabilities involved in the Special Olympics program in Bulgaria.

METHODS

The single-case research design was applied to examine outcome variables changes in the researched target group. We focused on the life stories of three women with intellectual disabilities who have more than five years of involvement in the program. To genuinely recapture the researched individuals, we used narrative in terms of "live stories". In order to provide an explicit construction of our research, we adopted a theoretical model based on the five categories of empowerment as published by Mandal (2013) and presented in Figure 3.

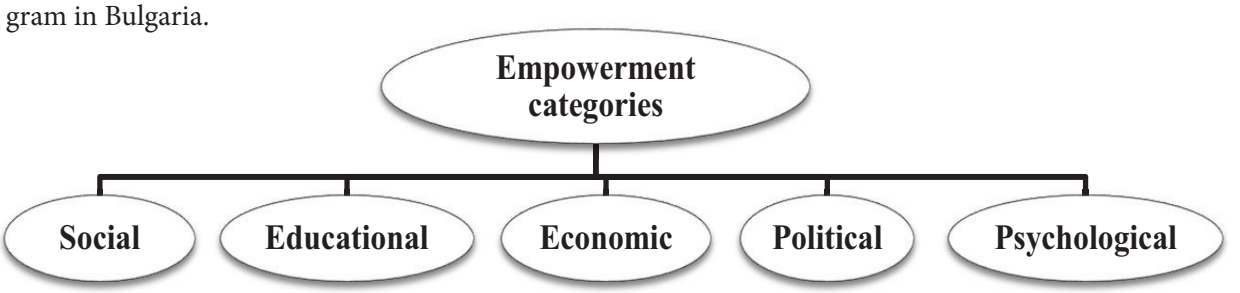


Figure 3. *Categories of empowerment.*

Social empowerment presents women's social relations and positions in social structures, giving them more of a purpose beyond being a woman with a disability. Education is crucial to female empowerment and presents someone's constant desire to challenge themselves and learn more.

Economic stands to demonstrate that being disadvantaged in that category can take away access to becoming empowered. The political segment is chosen to present that having a voice and being in the light of media is crucial in gaining power and authority for being involved in decision-making – "nothing for us without us". Psychological empowerment is essential for women to build self-confidence and recognize their self-worth.

RESULTS

The grounded theory of this study is empowerment, as defined by the United Nations Social Development Network. The transformative power of sports positively influences personal and sport-specific competencies, relatedness, expansion of opportunities, and autonomy. Involvement in Special Olympics contributes to personal development and inspires a sense of belonging. Training and competition involvement are increasing opportunities and experiences that lead to the empowerment of a single person with an intellectual disability.

Fanka (41) has been involved with Special Olympics since 2004. She has been abandoned by her parents and spent all her life living in institutions for persons with ID. We met her at the national games and noticed her sports talent. She received an opportunity to practice many sports like swimming, table tennis, athletics, sailing, kayaking, football, and bocce. She has won countless medals, and her most significant sports achievement is a gold medal in badminton from the European Summer Special Olympics Games in Warsaw, 2010. Increased participation in training and competitive events improved her initially poor social and communication skills. Lightening her horizon of friendships, she decided to reveal another talent of hers. She is also a very talented artist – painter, and handcraft maker. She overcame her low self-esteem, gained confidence, and shared the results of her artistic creativity with her coaches and sports friends. Climbing her first step of empowerment, she quickly experienced the need for education. Special Olympics offered her the first opportunity to succeed, and she gained confidence and the urge to perform better. She followed lessons in painting; she followed a course in computer skills development. The endless desire to perform brought her to public speech and public behavior classes. She won several prizes in painting contests, sold all out at her first author exposition of forty paintings, and improved her economic situation. Through leadership training offered by SO, she is fully aware of her rights and stands for herself and her friends in the institution.

Lili (27) has been involved with Special Olympics for the last six years. She is swimming playing tennis and basketball. She is charming, smiley, involved in many activities, and surrounded by loving and supportive parents and friends. She follows several classes, and in a day-care center, she is involved in vocational activities like cooking and handcrafting. Her functioning requires partial support for certain activities. For her, social, educational, and economic categories of empowerment exist. Her personal growth started when she was selected to be a part of the national team in the SO World summer games in Abu Dhabi in 2019. She was challenged to break her daily routine, get out of her comfort zone, and travel alone for the first time in her life and spend time away from her mother and family. There was a preparatory period, but she grew up psychologically during the two weeks with the team. She made tremendous efforts to follow the busy daily schedule, train, compete, and participate in social activities. She managed to break up all her low expectations, and now everyone looks at her with different eyes.

Viktoria (39) has been involved with Special Olympics for the last five years. She discovered us looking for opportunities to practice any physical activity. Her functioning does not fit the SO eligibility athlete's profile, so we offered her the opportunity to participate as a partner or volunteer, but it did not work exactly as we planned. We observed that she has a deficient physical fitness level, and the fitness testing results proved our observations. She perceived that herself too. She asked us to stay in the SO team and start with basketball training. During the training, we observed several health issues, and our supervision helped her to take care of them. Awareness and understanding of her health were achieved due to her involvement in SO. Soon she became friends with nearly everyone on the team. She was training with the athletes and volunteers to help with administrative work or the organization of events. For less than a year, the social component of empowerment was achieved for her – she made so many new friends, became involved in social work, and was empowered enough to initiate and accomplish a sporting event for persons with rare diseases herself. Non-formal and continuous education became a new opportunity for her to develop. Shortly Victoria found a job, and she is managing that well. In her case, all five components of empowerment were achieved, and now she can be an advocate for herself.

The results of our study are evidence that Special Olympics can change the lives of the athletes with intellectual disabilities and our coaches, families, volunteers, and others who have the opportunity to participate.

In addition, sport is a universal language that contributes to creating an inclusive environment. All these confirmed functions of sport are directly related to community transformation and development, which on the other hand, are the elements of social capital. In previous research, Djobova et al. (2019) suggested that sports activities provided in inclusive settings, like programs of SO Unified sports, can powerfully contribute to building social capital (SC). We adopted the grounded theory for social capital from the political scientist Rob-

ert Putnam. He describes SC as those features of life, such as networks, trust, and norms, that allow participants to act together to pursue shared objectives, in other words, to improve the efficiency of society by facilitating coordinated actions (Putnam, 1993). Alternatively, results indicate that sports participation empowers women with intellectual disabilities in many ways. The support for this process, presented in Figure 4, indisputably contributes to the social capital regarding community development and personal well-being. The critical component for successful empowerment is the inclusive sport environment and positive attitudes toward inclusion at a personal level. Empowered persons provoke positive actions and have the ability to bring people together. In return, the efficacy of established social practices creates an environment for more people to be empowered. All these transformative action-based results and complex relations are personified in the simple slogan of the Special Olympics "Revolution is Inclusion".

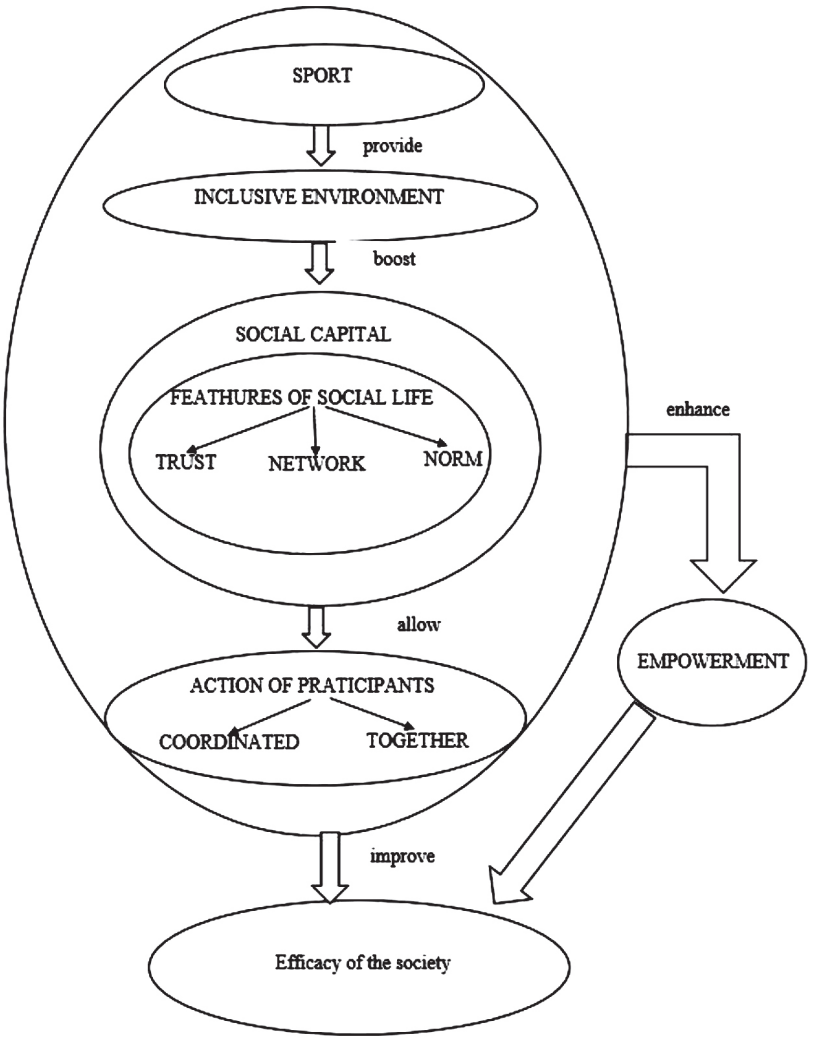


Figure 4. *Relationship between empowerment and social capital.*

DISCUSSION

As Mandal (2013) has written in his article measuring women's empowerment is challenging because it often requires long, involved scales to measure multiple dimensions. Nevertheless, measuring the empowerment of women with intellectual disabilities through sport is a more complicated and complex process. According to the UN (n.d.), sport profoundly changes the person with a disability by empowering persons with disabilities to realize their full potential and advocate for societal changes. Thus, through sports, persons with disability, particularly those with ID, obtain core social skills, develop independence, and become empowered to act as agents of change. The Special Olympics athlete development spectrum presents personal

benefits for the athletes. Among them are gaining sports skills, socialization, and personal development of self-esteem, confidence, trust, and relationships (Djobova et al., 2020). In addition, sport is proven as a universal language and a contributor to the creation of an inclusive environment. All these confirmed functions of sport are directly related to community transformation and development, which on the other hand, are the elements of social capital. In previous research, Djobova et al. (2020) have suggested that sports activities provided in inclusive settings like programs of SO Unified sports can powerfully contribute to building social capital.

Researching empowerment Perkins & Zimmerman (1995) discuss the presence of a wide diversity of settings and empowerment interventions. We fully agree that the empowerment process and outcomes vary in their outward form. However, we also have evidence to propose sports involvement as one of the most empowering practices. Leadership training seems naturally linked with sports training. It can include public speaking, acting as an athlete health advocate, being a team captain, becoming a community leader, and preparing athletes for positions as committee members or on the board of the national SO programs. These roles give athletes a voice in shaping the Special Olympics movement and a chance to spread the word about the transformations Special Olympics can bring to individuals and families. Families of SO athletes are crucial because, traditionally, parents have low expectations regarding the abilities of their children with intellectual disabilities. Through participation in sports, persons with ID can demonstrate that they are much more capable than everyone thinks. Sport performance stands against prejudice and fears of public embarrassment and isolation. Through participation in sports, female athletes benefit personally by reducing dependence and becoming physically and mentally stronger. Participants in our study demonstrate that these skills can be transferred into other fields, including employment. By providing women with intellectual disabilities the opportunity to train and compete and demonstrate their physical ability, sports can help to reduce gender stereotypes in a male-dominated society and negative perceptions associated with disabilities. In addition to training athletes with ID on how to become better in sports, we empower them to access and use community resources to increase them and contribute to the growth of social capital.

REFERENCES

Barbu, D., Barbu, M., Călinescu, L., Cosma, G., Cosma, A., Forțan, C., Mihaela, Z. (2021). Empowering, communication and motivation for people with intellectual disability in colpbol sport practice. *Journal of Sport and Kinetic Movement*, No. 38, Vol. II

Djobova, S., Borukova, M., Kirilova, I. (2020). Building social capital through inclusive basketball, *Trakia Journal of Science*, 18(1), 891-896.

Mandal, K. C. (2013). Concept and Types of Women Empowerment. *International Forum of Teaching and Studies*, *9*(2), 17–30.

Perkins, D. D., & Zimmerman, M. A. (1995). Empowerment theory, research, and application. *American journal of community psychology*, *23*(5), 569-579.

Putnam, R.D., Leonardi, R, Nanenetti, R. (1993). *Making democracy work: civic traditions in modern Italy.* Princeton, NJ. Princeton University Press.

UN (n.d.). Empowerment: What does it mean to you? Introduction to web services for remote portlets, available at: https://www.un.org/esa/socdev/ngo/outreachmaterials/empowerment-booklet.pdf (accessed 02 July 2022)

UN (n.d.a). Introduction to web services for remote portlets, available at: https://www.un.org/en/conferences/women/mexico-city1975 (accessed 02 July 2022)

United Nations. (n.d.b). *Disability and Sports Enable*. Introduction to web services for remote portlets, available at: https://www.un.org/development/desa/disabilities/issues/disability-and-sports.html (accessed 10 July 2022)

Special Olympics Sport and Empowerment Act of 2004 (2004). https://www.congress.gov/108/plaws/publ406/PLAW-108publ406.pdf (accessed 05 July 2022)

Special Olympics (n.d.). Introduction to web services for remote portlets, available at: http://www1.specialolympicsontario.com/wp-content/uploads/2017/02/athlete-empowermentguide.pdf (accessed 05 July 2022)

Special Olympics (n.d.a). Introduction to web services for remote portlets, available at: https://www.specialolympics.org/about/history/the-sun-never-sets-on-the-special-olympics-movement (accessed 10 July 2022)

Corresponding author:
Stefka Djobova, PhD
Department Water sports
National Sports Academy "Vassil Levski"
Str. Gurguliat 1, Sofia, Bulgaria
E-mail: stefka.djobova@nsa.bg

EXTENT OF INCLUSION IN ERASMUS+ SPORT PROJECTS

Ivelina Kirilova, Stefka Djobova, Yoanna Dochevska, Velichka Aleksandrova & Ivaylo Zdravkov
National Sports Academy Vassil Levski, Sofia, Bulgaria

ABSTRACT
Since the 1960s, the Council of Europe has developed recommendations and resolutions ensuring full participation of persons with disabilities into social and sport life. Diversity, equity, and inclusion are the elements that shape sports in the last decade. The right of people with disabilities to participate in recreational or sporting activities on equal terms as other populations through an inclusive approach is emphasized in the International Convention on the Rights of Persons with Disabilities. In 2021's Briefing of the European Parliament is stated that there is a lack of centralized data collection on the participation of people with disabilities in sports at the European Union level. The Erasmus+ Sport program provides funding for sports actions, including the development of inclusive policies aiming to remove barriers and improve the participation of people with disabilities in sports. This study aims to explore the extent of inclusion of persons with disabilities in sports among the Erasmus+ Sport projects co-funded until 2020. Using a secondary research method, we analyzed data extracted from Annual reports, Compendiums, and other official European and stakeholder publications, the European Commission Erasmus+ Project Results Platform. As a result, 515 sport-related projects were identified. Applying secondary selection criteria related to disabilities and sports led to 41 projects focusing on inclusion. Development of inclusive sport policy and supporting the inclusion of persons with disabilities in sports is a long-standing demand, and a great amount of expectations are linked with Erasmus+ Sport. Despite being a funding mechanism, the Program provides an opportunity for the implementation of priorities identified in the Work Plan for Sport. Participation in projects provides opportunities for sports organizations to implement the latest European policies aligned with different aspects regarding the rights of persons with disabilities associated with sports.

Keywords: *people with disabilities, participation, physical activity, EU*

INTRODUCTION

Since the 1960s, the Council of Europe has developed recommendations and resolutions ensuring full participation of persons with disabilities in social and sport life. Diversity, equity, and inclusion are the elements that shaped sports in the last decade. The right of people with disabilities to participate in recreational or sporting activities on equal terms as other populations through an inclusive approach is emphasized in the International Convention on the Rights of Persons with Disabilities. The European Union Work Plan for Sport for 2011-2014 gave priority to the themes as the integrity of sport, in particular, the fight against doping, match-fixing, and the promotion of good governance; social values of sports as health, social inclusion, education and volunteering; economic aspects of the sport - sustainable financing of grassroots sports and evidence-based policymaking (European Union Work Plan for Sport for 2011-2014, 2011). The priorities are not directly related to persons with disabilities, but the working plan is aligned with the White Paper, which underlines the social role of sport as an enhancer of social inclusion in and through sport. The following Working plan for 2014 – 2017 emphasizes the key topics related to the persons with disabilities in the area of Sport and Society, in particular social inclusion targeting Access to sport for people with disabilities (European Union Work Plan for Sport for 2014-2017, 2017). The Council adopted the 4th EU Work Plan for Sport on 4 December 2020. This Resolution of the Council is the guiding document in the field of sport. It sets out the key priority areas and topics that the EU Member States and the Commission should prioritize in the period 2021 - 2024. The main priority areas are - protecting integrity and values in sports, socio-economic and environmental dimensions in sports, and promotion of participation in sports and health-enhancing physical activity. In the 2020s, with the beginning of the pandemic of COVID-19, sports and physical activity were more necessary than ever before. Therefore, the EU Commission created the #BeActiveAtHome campaign in May 2020 to help Europeans exercise and remain physically active (European Commission, 2020). In 2020, the #Beinclusive EU sports awards once again recognized sports organizations work-

ing with ethnic minorities, refugees, people with disabilities, youth groups at risk, or other groups that face challenging social circumstances (European Commission, 2020). In 2021's Briefing of the European Parliament, it stated that there is a lack of centralized data collection on the participation of people with

disabilities in sport at the European Union level. In the year of 2014, following the Lisbon Treaty, a new field of European-level competence in the Erasmus+ Programme the sport was introduced. The Sports action within Erasmus+ aims the promotion of the European dimension in sports by supporting activities such as not-for-profit European sports events, collaborative partnerships, the strengthening of evidence-based policy-making in sports and dialogue with relevant European stakeholders (European Commission, n.d.a). The Erasmus+ Sport program provides funding for sports actions, including the development of inclusive policies aiming to remove barriers and improve the participation of people with disabilities in sports. Erasmus+ actions in the field of sports promote participation in sports, physical activity, and voluntary activities. They are designed to tackle societal and sport-related challenges (European Commission, n.d.).

The four actions - Cooperation Partnerships, Small-scale Partnerships, Not-for-profit European Sport Events, and Capacity building in the field of sports are targeting all stakeholders in the sports sector. Cooperation partnerships are designed for organizations to develop and implement joint activities to promote (among others) sport and physical activity, as well as deal with threats to the integrity of sport (such as doping or match-fixing), promote dual careers for athletes, improve good governance, and foster tolerance and social inclusion. Also, to encourage the creation and development of European networks in the field of sport. They are aiming to help sports organizations to increase quality in the work, activities, and practices of organizations and institutions involved, build the capacity of organizations to work transnationally and across sectors, address common needs in the field of sport and enable transformation and change (at individual, organizational or sectoral level).

Cooperation Partnerships are connected to the Erasmus+ program's overall priorities as well as 4 sport-specific priorities and one of the horizontal priorities in Erasmus+ is inclusion and diversity in sport, common values, civic engagement, and participation. Sport-specific priorities are related to encouraging healthy lifestyles for all, promoting integrity and values in sports, education in and through sports, combating violence and tackling racism, discrimination, and intolerance in sports, and tackling violent radicalization.

On the other hand, Small-scale Partnerships are for grassroots organizations, less experienced organizations, and newcomers to the Programme. Small-Scale Partnerships have simpler administration, smaller grants, and shorter durations than Cooperation Partnerships.

The action Not-for-profit European Sport Events are designed to encourage sporting activity, implement EU strategies for social inclusion through sport, foster volunteering in sport, fight against discrimination, and encourage participation in sports and physical activity.

Capacity-building in the field of sports projects are international cooperation projects based on multilateral partnerships between organizations active in the field of sport in the EU Member States and third countries associated with the Programme and the Western Balkans. They aim to support sports activities and policies as a vehicle to promote values as well as an educational tool to promote the personal and social development of individuals and build more cohesive communities (European Commission, n.d.).

Aim and objectives of the study

The goal of this study is to explore the extent of inclusion of persons with disabilities in sports among the Erasmus+ Sport projects completed with results until 2020.

METHODS

Using a secondary research method, we analyzed data extracted from Annual reports, Compendiums, and other official European and stakeholder's publications and European Commission Erasmus+ Project Results Platform.

Using the European Commission Erasmus+ Project Results Platform, the following searching criteria were applied: projects status – "completed" and "with results", actions – "sport". Secondary searching criteria that have been applied were "inclusion" and "disabilities". The applied statistical analysis includes a descriptive statistic with one-dimensional frequency analysis.

RESULTS

As a result of primarily applied criteria, 515 sport-related projects were identified. Applying secondary selection criteria related to disabilities, sports and inclusion led to the identification of 41 projects completed with results until the date of conducted research.

Since 2014 the number of funded projects smoothly growing. It starts from one in the year 2014, two in 2015 increases to twelve in 2016, reaching the maximum growth in 2017, and then smoothly the number decrease to eight in 2018 and one in 2019 – Figure 1.

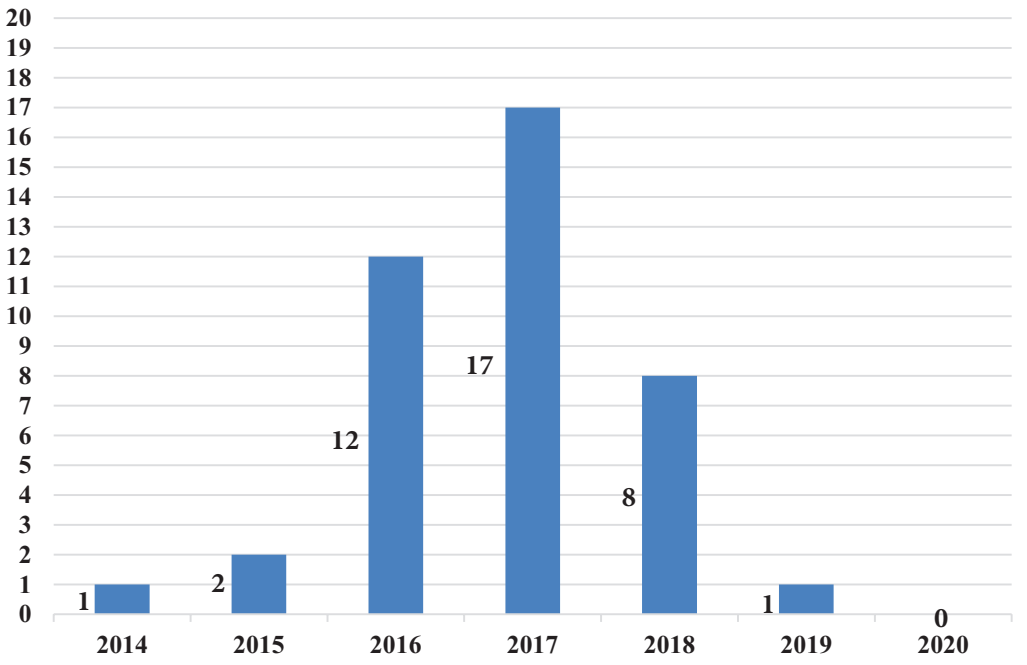


Figure 1. *Annual project distribution.*

Thirty-seven projects are under action Collaborative Partnerships, and five are Not-for-profit European sport events - Figure 2.

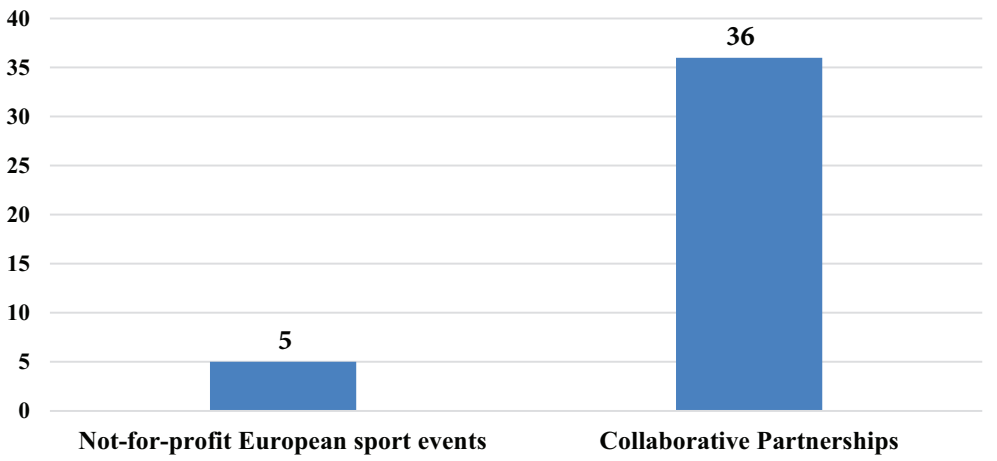


Figure 2. *Project distribution regarding the action.*

Sixteen courtiers coordinated projects throughout the researched period. Fourteen projects are coordinated by Italy, six by Spain, four by Slovenia, two by Poland, Croatia, and Germany, and other courtiers are coordinated by one project each Figure 3.

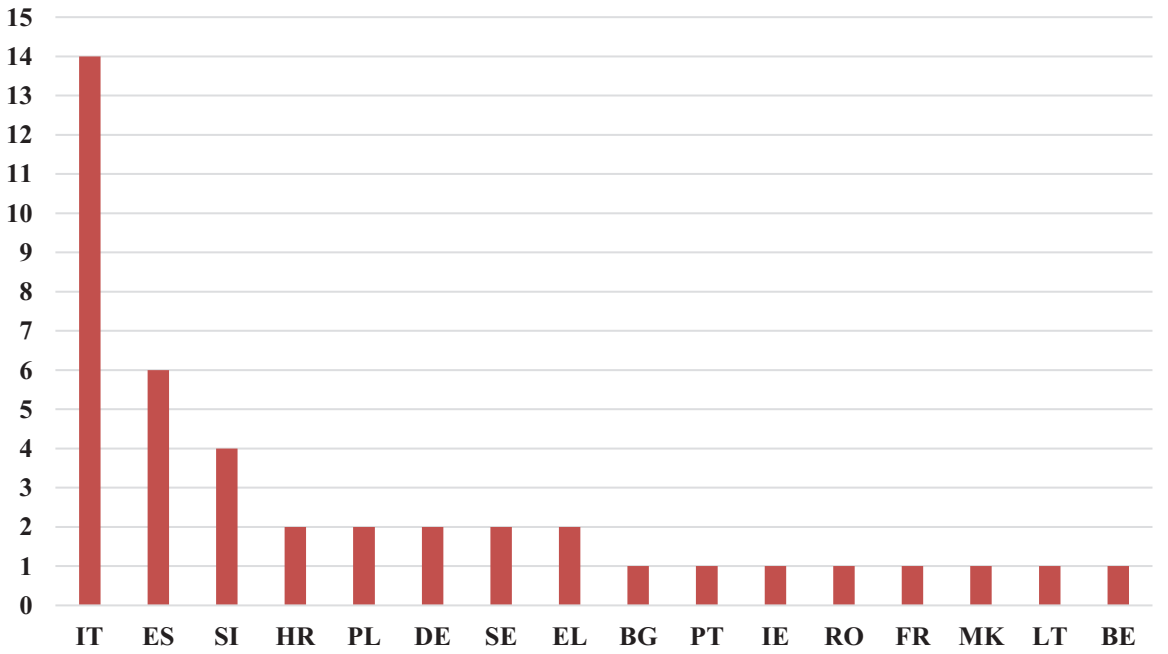


Figure 3. *Project coordination by countries*

Erasmus+ is the EU's program to support education, training, youth, and sport in Europe. Between 2014-2020 its budget of 14.7 billion euros provided opportunities for over 4 million Europeans to study, train, gain experience, and volunteer abroad (European Commission, n.d.a).

A total budget of 22.43 million euros was committed for this Action in 2014, funding 6 not-for-profit sports events, 39 collaborative partnerships, and 5 studies.

Compared to the first year of implementation, 2015 focused more on grassroots sports, and in general on all sports projects aimed at increasing the level of participation in sports and physical activity. A total budget of 22.9 million euros was earmarked for the whole sports chapter in 2015 (European Commission, In 2016 with 34.1 million euros supported 140 projects related to sports. 45 % of the projects were supporting social inclusion through sport and combating violence and racism. 24% of projects were supporting participation in sports and physical activities, including the European Week of Sport. The rest were supporting the other priorities under the annual objectives (European Commission, 2016). In 2017 Erasmus + sport was funded with 45.2 million and beneficiaries were 162 projects, with 68 large-scale projects among them. 20 of these large-scale projects were supporting social inclusion through sport and combating violence and racism and 17 - participation in sports and physical activities, including the European Week of Sport (European Commission, 2017). In the year 2018, the budget for sports was increased to 46.5 million euros with 199 funded projects. Social inclusion through sports was again among the four leading priorities In Sport, a budget of 49.3 million euros funded 260 projects (European Commission, 2018). The highest EU Grant awarded in the research period is for the project led by SO Europe Eurasia Foundation, Ireland with the title Special Olympics: Leading the Way to Inclusion overall 6 million euros (European Commission Erasmus+ Project Results Platform). It promotes social inclusion, equal opportunities, volunteering, and participation in sports. The fifth edition of the European Week of Sport reached a new record in 2019 with the participation of 15.3 million Europeans from 42 countries and regions in 28 300 events. As in previous years, in 2019, the Sport Chapter focused on more grassroots sports with increased support to small collaborative partnerships and, in general, on all sports projects aimed at increasing the level of participation in sports and physical activity. Social inclusion is also a priority in the field of sports: 52% of all small collaborative partnerships and 27% of larger collaborative partnerships are devoted to promoting social inclusion and equal opportunities in sports. In addition, the third edition of the #Beinclusive EU sports awards recognized organizations using the power of sport to increase social inclusion for disadvantaged groups (European Commission, 2020a).

Seven of all 41 projects are distinct as good practices. According to EU Commission, Good practices can be defined as "…strategies, approaches and/or activities that have been shown through research and evaluation to be effective, efficient, sustainable and/or transferable, and to reliably lead to the desired result". Two good practice projects are under the action "non for profit sport event". This nomination emphasizes the need for visibility and more sports events at the participation level where every participant could become a role model and inspiration for others. Another learning outcome of the selected good practices is the safe participation approach. The challenge thou appears how to sustain these practices, develop them further and adapt them to the local needs. We consider it important that this kind of data should be available to a large number of sport sector stakeholders and policymakers.

DISCUSSION

Development of inclusive sport policy and supporting the inclusion of persons with disabilities in sports is a long-standing demand and a great number of expectations are linked with Erasmus+ Sport. Despite being a funding mechanism, the Program provides an opportunity for the implementation of priorities identified in the Work Plan for Sport. Participation in projects provides opportunities for sports organizations to implement the latest European policies that are aligned with different aspects regarding the rights of persons with disabilities associated with the sport.

The historical perspective of inclusion begins with the urge of educating children with and without disabilities together at all times and settings. For half a century it has become reality for many countries around the globe. The inclusion movement has enchanted the interest of scholars, educators, politicians, and public stakeholders. Through its commitment to universalism, the inclusion of persons with disabilities in sports has become an increasingly prominent objective of the international sports movement, as well as the European Union sport policy. Development of inclusive sport policy and supporting the inclusion of persons with disabilities in sports is a long-standing demand and a great number of expectations are linked with Erasmus+ Sport. Despite being a funding mechanism the Program provides an opportunity for the implementation of priorities identified in the Work Plan for Sport. Participation in projects provides opportunities for sports organizations to implement the most recent European policies that are aligned with different aspects regarding the rights of persons with disabilities associated with sports. As everlasting process inclusion was observed to go through different stages of awareness and understanding. Based on our findings we confidently can affirm that inclusion in sports is moving steadily on the way to sustainable development. The reason we emphasize its importance is that modern education is underpinned by the bloody history of exclusion according to Ball (2013). Slee (2005) reminds us that inclusion has lost its initial power in education but we can argue that it follows an accretive trend in the framework of global policy reform in sports. In social experience, disability is a diverse and shifting concept but in sports, context is defined clearly as an undisputable human right (CRPD, 2006). The increase in funding, the number of projects, and thematic complexity are clear evidence of societal change and sustainable development based on equity and universalism.

ACKNOWLEDGMENTS

This paper is part of the intellectual outcome of the Train4Inclusive project, co-funded by the Erasmus + Programme of the European Union.

REFERENCES

Ball, S. J. (2013). *Foucault and education: Disciplines and knowledge.* Routledge.

CRPD. (2006). Introduction to web services for remote portlets, available at: https://www.un.org/development/desa/disabilities/convention-on-the-rights-of-persons-with-disabilities.html (accessed 13 July 2022).

Sport actions. Erasmus+. (n.d.). Retrieved July 10, 2022, from https://erasmus-plus.ec.europa.eu/opportunities/opportunities-for-organisations/sport-actions

Erasmus+. European Education and Culture Executive Agency. (n.d.). Retrieved July 8, 2022, from https://www.eacea.ec.europa.eu/grants/2014-2020/erasmus_en

European Commission. (2015). Erasmus + Annual Report, Luxembourg: Publications Office of the European Union

European Commission. (2016). Erasmus + Annual Report, Luxembourg: Publications Office of the European Union

European Commission. (2017). Erasmus + Annual Report, Luxembourg: Publications Office of the European Union

European Commission. (2018). Erasmus + Annual Report, Luxembourg: Publications Office of the European

Union

European Commission. (2020). Erasmus + Annual Report, Luxembourg: Publications Office of the European Union

European Commission. (2020a). Erasmus + Annual Report, Luxembourg: Publications Office of the European Union

What are 'good practices'? European Website on Integration. (n.d.). Retrieved July 11, 2022, from https://ec.europa.eu/migrant-integration/page/what-are-good-practices_en

European Commission Erasmus+ Project Results Platform. Introduction to web services for remote portlets, Retrieved July 11, 2022, available at: https://erasmus-plus.ec.europa.eu/projects/search/?page=1&sort=&domain=eplus2021&view=list&map=false&searchType=projects

European Union Work Plan for Sport for 2011-2014. (2011). Introduction to web services for remote portlets, available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A42011Y0601%2801%29 (accessed 12 July 2022).

European Union Work Plan for Sport for 2017-2020. (2017). Introduction to web services for remote portlets, available at: https://data.consilium.europa.eu/doc/document/ST-9639-2017-INIT/en/pdf (accessed 12 July 2022).

Slee, R. (2005). *Education and the politics of recognition: Inclusive education, an Australia snapshot*. In D. Mitchell (Ed.), Contextualizing inclusive education: Evaluating old and new international paradigms. London, England: Routledge Falmer

Corresponding author:
Ivelina Kirilova, PhD
Department Water sports
National Sports Academy "Vassil Levski"
Str. Gurguliat 1, Sofia 1000
E-mail: afas@nsa.bg

PHYSICAL EDUCATION

 DOI: 10.37393/ICASS2022/102 183 - 188

STUDENTS‘ ASSESSMENT CRITERIA FOR THE COMPONENT EVALUATION FROM OTHER PARTICIPATIONS

Yanko Rumenov
South-West University “Neofit Rilski”, Blagoevgrad, Bulgaria

ABSTRACT
By implementing the new system of physical ability assessment of students, the development and publication of books, dissertations, and scientific articles by some authors related to the assessment of sport-technical skills in a particular sport, the last of the three components of the evaluation of physical education and sport somehow remained in the background, while the importance of it in the formation of the grade in percentage is the same as that for the assessment of physical ability-25%. This report is concerned with this component: assessment of other participants, as we have formulated 5 criteria and indicators with a maximum of five points that students can receive for each one. We equate each point to 1%, i.e. 25% in total for the 5 criteria, which are one part of the three-component system for forming the grade. We approbated them in a natural practical environment, with 245 students from two schools participating in the study. The surveyed students were from grades from all three educational stages. At the beginning of the school year, the teachers were introduced to the developed criteria, and during the first school term, they expertly monitored the students‘ performance. At the end of the school term, when forming a termly assessment, pupils were assessed based on the criteria developed. Analyzing the results obtained for the criteria related to class work, activity, effort, and willingness during the lesson, we could observe that motivation to participate in class, willingness, and effort were shown by the classes of the primary stage. With each grade, especially in the high school stage, this desire and motivation, unfortunately, decreases, with most of them not showing the necessary activity in the lesson. Results for all criteria are presented in tabular and percentage terms, with specific implications for practice. The criteria outlined would make the assessment more objective and set and deserved. They will motivate students to exert more effort, be more active, participate in competitions and wear appropriate sports clothing in class.

Keywords: *assessment formulation, criteria, indicators, learning process, incrementand effort.*

INTRODUCTION

The assessment of students in school is part of educational assessment. It can be seen as a systematic process of collecting, analyzing, and interpreting data (information) to determine the extent to which educational objectives are being met.

According to Wiggins and McTighe, diagnostic and formative assessment is used to acquire information related to teachers and students. Diagnostic assessment takes into account students‘ initial knowledge and skills in the subject matter and allows teachers to identify problem areas and tailor the curriculum accordingly. Formative assessment provides teachers and pupils with feedback on progress to date. The summative assessment reflects the new knowledge and skills acquired, which would either confirm the quality of the implemented curriculum or necessitate its reorganization (Wiggins & McTighe, 2011).

The effectiveness of formative assessment depends not only on the content of the feedback, and its applicability to learning but also on the expansion of opportunities to increase students‘ motivation and self-esteem.

A key element of the overall work of the physical education and sports teacher is the evaluation of the results of educational work with students, which should correspond to the philosophy, goal, and objectives of physical education and sport in the school, as a purposeful pedagogical process with a pronounced complex impact.

Many foreign authors have attributed the downplaying of the subject of PE and sport to the lack of emphasis on well-founded assessment tools directly linked to the curriculum to be applied by teachers (Hay & Macdonald, 2008; Henninger & Carlson, 2011; MacPhail & Halbert, 2010; James, Griffin & France, 2005).

Assessment in the subject of physical education and sport is made of three main components: the acquisition of motor skills, theoretical knowledge, and competences, control, and assessment of physical ability and assessment of other participation (class work, assistance, independent work, participation in sports competitions), each of which has a different weight in the formation of the grade.

In the framework of the learning process in physical education and sport, the evaluation of students' performance would become an incentive for higher results and a lasting and correct technical mastery of the set disciplines and sports, with a view to a higher grade obtained. They could also build skills to evaluate the physical exercises of their classmates; motivate for better technical performance, and detect and correct the mistakes made.

The changes in the field of school physical education and sport dictated the entry into force in the 2019/2020 school year of a new system for assessing the physical ability of students from the first to the thirteenth grade, including tests, standards, rating scale and methodology for measuring and assessing the motor abilities of students (Marinov et al., 2019, System for assessing the physical ability of students from the first to the thirteenth grade).

With the implementation of the already existing system for assessing the physical ability of students, the development and publication of scientific production by some authors related to the assessment of sports and technical skills in a particular sport, the last of the three components in the assessment of physical education and sport remained in the background, and its weight in the formation of the grade in percentage is the same as that for the assessment of physical ability-25%. The criteria formulated are linked to an assessment of other participations (class work, assistance, independent work, participation in sporting competitions) at the end of each school term. Here again, we rely on the teacher's expert judgment, who must assess how the pupils have done on the relevant criteria from other participation.

Aim and objectives of the study

In this context, and due to the lack of other authorial searches concerning the clarification, formulation, and objective percentage evaluation, our research objective emerged: to derive criteria for each of the other contributions described above involved in the formation of the evaluation.

In order to achieve the objective thus formulated, it is necessary to solve the following main tasks:

1. To study and analyze the literature and research papers related to the assessment of students' performance in physical education and sport.
2. To develop specific criteria and indicators for the assessment component from other participations.
3. To approbate in a real working environment and analyze the results obtained from the assessment.

For the realization of the research and the set tasks we used the following methods:

- Theoretical analysis and synthesis-analysis of the scientific and methodological-applied sport-pedagogical literature;
  - Method of expert evaluation-assignment of points by the teacher for the corresponding criteria in the evaluation;
  - Percentage analysis of the obtained results.

As mentioned the weight of this component in the formation of the assessment is 25%. In this regard, we formulated 5 criteria with a maximum of five points that students can receive for each one. We equate each point to 1%, i.e. 25% in total for the 5 criteria, which are one part of the three-component system for forming the grade in physical education and sport. Each of the criteria is presented in Tables 1 to 3

Table 1. *Activity, effort, sportswear, and class preparedness*

Criteria 1: class work, activity, effort and desire during class		**Criteria 2:** Sportswear
indicators	**points**	**indicators**
does not show any interest in participating in class	1	regularly wears inappropriate sports clothing
regularly shows no desire to participate in class	2	is often without a sports outfit
does not actively participate in class every time	3	3-4 times during the term has been without sports outfit
shows willingness and effort most of the time	4	1-2 times during the term is without sports outfit
shows effort and diligence, participates actively every class	5	every class is in appropriate sportswear (outfit)

Table 2. *Participation in sports competitions and school games, incrementing PE tests*

Criteria 3: Participation in sports competitions		**Criteria 4:** Physical fitness assessment test increment
indicators	**points**	**indicators**
does not take part in sports competitions	1	increment on 1 of the tests from the previous assessment
participates in internal school sports competitions	2	increment of 2 tests from the previous assessment
participates in internal school and inter-school sports competitions	3	increment of 3 tests from the previous assessment
participates in internal school and inter-school sports competitions and school games	4	increment of 4 tests from the previous assessment
participates in internal school and inter-school sports competitions and school games trains in a sports club	5	increment in all tests from the previous assessment

Table 3. *Self-performance of the exercises*

Criteria 5: Assistance, independent work	
indicators	**points**
needs help from the teacher, fails to cope with the exercises alone	1
regularly has difficulty and needs help with exercises	2
does not always have difficulties and needs help with the exercises	3
performs most exercises independently and assists classmates in their performance	4
performs most exercises independently and assists classmates in their performance, is prepared to demonstrate the exercise to classmates	5

In order to apply the criteria, it was necessary to carry out a study in a real environment, which we implemented in the first term of the 2019/20 school year in two schools in the cities of Petrich and Sandanski. 245 students (136 boys and 109 girls) participated in the study. At the beginning of the school year, the parents of the studied students filled out informed consent declarations for conducting the pedagogical experiment. Table 4 shows the distribution of the number of pupils by grade for the two cities.

Table 4. *Distribution of the number of students by grade*

Grades from Sandanski	**Number of students**	**Grades from Petrich**	**Number of students**
III^{-d}	23	IV^{-th}	26
two IV^{-th} grades	52	V^{-th}	22
two VI^{-th} grades	48	IX^{-th}	28
		X^{-th}	23
		XI^{-th}	23

RESULTS AND DISCUSSION

At the beginning of the school year, the teachers were presented with the developed criteria, and during the first school term they expertly monitored the students‘ performance. At the end of the school term, when forming the termly assessment, the third component - the assessment of other participation (class work, helping, independent work, participation in sports competitions), students were assessed on the basis of the developed criteria. We present the results of the evaluation in percentages in the following Tables 5 to 9.

Table 5. *Assessment results for criteria 1*

Assessment results for criteria 1: Class work, activity, effort and desire during class								
number of points	III-d grade form Sandanski	IV-th grade form Sandanski	VI-th grade form Sandanski	IV-th grade form Petrich	V-th grade form Petrich	IX- th grade form Petrich	X- th grade form Petrich	XI- th grade form Petrich
1	0%	0%	5%	1%	3%	3%	2%	10%
2	2%	6%	7%	5%	8%	14%	11%	16%
3	7%	11%	13%	3%	16%	18%	44%	33%
4	43%	40%	40%	41%	42%	39%	23%	27%
5	48%	43%	35%	50%	31%	26%	20%	14%

Analyzing the obtained results for all grades studying in two schools for the criterion related to the work in class, activity, effort and desire during the lesson, we can state that motivation for participation in class, desire and effort, show the classes of the primary stage. With each grade, especially in the high school stage, this willingness and motivation unfortunately decreases, as most of them do not show the necessary activity in the lesson.

Table 6. *Assessment results for criteria 2*

Assessment results for criteria 2: Sportswear								
number of points	III-d grade form Sandanski	IV-th grade form Sandanski	VI-th grade form Sandanski	IV-th grade form Petrich	V-th grade form Petrich	IX- th grade form Petrich	X- th grade form Petrich	XI- th grade form Petrich
1	0%	0%	0%	0%	0%	1%	4%	2%
2	0%	0%	0%	0%	0%	6%	16%	28%
3	1%	3%	12%	2%	6%	17%	39%	31%
4	8%	10%	21%	4%	12%	66%	33%	27%
5	91%	87%	77%	94%	82%	10%	8%	12%

The results obtained for the criterion of sportswear, show that students in the primary stage of training almost always have appropriate sportswear, while the opposite is true for students in the secondary stage of training. There is a high percentage of pupils who have not worn appropriate sports clothing more than 4 times during the school term. If we consider that the teacher does not allow them to actively participate in the lesson without a sports outfit, then for them it is a lost (lack of) motor activity. And in school, the higher the grade the students are in, the lower their motor activity.

Table 7. *Assessment results for criteria 3*

Assessment results for criteria 3: Participation in sports competitions								
number of points	III-d grade form Sandanski	IV-th grade form Sandanski	VI-th grade form Sandanski	IV-th grade form Petrich	V-th grade form Petrich	IX- th grade form Petrich	X- th grade form Petrich	XI- th grade form Petrich
1	0%	0%	0%	0%	1%	5%	3%	12%
2	13%	2%	5%	8%	2%	16%	23%	23%
3	24%	23%	16%	13%	16%	18%	33%	38%
4	24%	23%	58%	13%	28%	42%	35%	17%
5	39%	52%	46%	66%	53%	19%	6%	10%

The third criterion relates to students‘ participation in sports competitions. Here it is necessary to mention that the school games are for students from the 5th grade upwards, but in general most

of the studied students in the primary stage of education receive the maximum number of points due to their activity and willingness to participate in any kind of sports competitions, and separately almost every student goes to training after school in private sports clubs in different types of sports. Participation in various sports competitions and tournaments is lower for older students, and there are some who do not participate in sports competitions.

Table 8. *Assessment results for criteria 4*

Assessment results for criteria 4: Physical fitness assessment test increment								
number of points	III-d grade form Sandanski	IV-th grade form Sandanski	VI-th grade form Sandanski	IV-th grade form Petrich	V-th grade form Petrich	IX- th grade form Petrich	X- th grade form Petrich	XI- th grade form Petrich
1	2%	4%	2%	1%	3%	17%	23%	20%
2	16%	12%	7%	5%	13%	21%	33%	15%
3	35%	21%	18%	17%	18%	20%	23%	53%
4	39%	41%	58%	61%	57%	32%	15%	10%
5	8%	22%	15%	16%	9%	10%	6%	2%

The results of the criterion relating to the increment of the tests assessing physical ability show that the percentage improving their scores on all tests for each grade is relatively low. The majority of students surveyed improved their scores on three or four of the five physical ability tests. It is recommended that, in tests (measuring motor skills) where a student does not improve their performance (there is stagnation), the teacher should emphasise individually, through targeted exercises, to develop the relevant motor skill.

Table 9. *Assessment results for criteria 5*

Assessment results for criteria 5: Assistance, independent work								
number of points	III-d grade form Sandanski	IV-th grade form Sandanski	VI-th grade form Sandanski	IV-th grade form Petrich	V-th grade form Petrich	IX- th grade form Petrich	X- th grade form Petrich	XI- th grade form Petrich
1	5%	10%	8%	4%	3%	11%	4%	2%
2	10%	21%	17%	15%	12%	20%	21%	14%
3	12%	21%	15%	19%	27%	25%	15%	12%
4	35%	40%	30%	32%	24%	38%	34%	41%
5	38%	29%	30%	30%	34%	6%	26%	31%

The results of the last criteria, related to assistance and independent work in class, show that some of the students in all three phases of learning performed most of the exercises independently and assisted their classmates in their performance. Likewise, if the teacher pointed them out, they were prepared to demonstrate the exercise to their classmates.

CONCLUSION

In a short and clear conclusion, we will share that the criteria for the evaluation component derived from other participations (class work, assistance, independent work, participation in sports competitions) will make the same more objective and actually set and deserved. They will motivate students to put more effort, be more active, participate in competitions and wear appropriate sports clothing in class. Opportunity to demonstrate and justify that each of the PE and sport grades has value and not place high ones on inactive, unmotivated and non-criteria students. When applied, the mark (termly or annual) will be more dependent on the activity of the pupils in the lesson rather than the sympathy and subjective judgement of the teacher.

REFERENCES

Hay, P. H. & Macdonald, D. (2008). (Mis)appropriations of criteria and standards referenced assessment in a performance-based subject. *Assessment in Education: Prin-*

ciples, Policy & Practice, 15(2), 153-168.

Henninger, M. L., & Carlson, K. B. (2011). Strategies to increase the value of physical Educators in K-12 schools. *Journal of Physical Education, Recreation & Dance.* 82 (6), 17-20.

James, A. R., Griffin, L. L., & France, T. (2005). Perceptions of assessment in Elementary physical education: A case study. *Physical Educator* 62(2), 85-95.

MacPhail, A., & Halbert, J. (2010). "We had to do intelligent thinking during recent PE: Students' and teachers' experiences of assessment for learning in post-primary physical education. *Assessment in Education: Principles, Policy & Practice*, 17(1), 23-39.

Marinov, T et al. (2019). *A system for assessing the physical capacity of students from I to XII grade*. Ministry of Education, Sofia.

Wiggins, G., & McTighe. J. (2011). *The understanding by design guide to creating high-quality units.* Alexandria: VA. Association for Supervision and Curriculum Development (ASCD).

Corresponding author:
Yanko Rumenov
Faculty of Pedagogy,
Department of Theory and
Methodology of Physical Education
South-West University "Neofit Rilski",
Blagoevgrad, Bulgaria
E-mail: qnkor@swu.bg

 DOI: 10.37393/ICASS2022/103 189 - 194

CHANGES IN THE MANIFESTATION OF THE MOTOR ABILITY SPEED IN BOYS AT THE LOWER SECONDARY STAGE OF PRIMARY EDUCATION

Dilyana Nancheva, Korneliya Naydenova
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
Tracking the changes and peculiarities in the manifestation of motor abilities in school age is one of the prerequisites that determine the effectiveness of the learning process. Effective learning, in turn, is a leading goal of modern education. In this sense, tracking and identifying peculiarities and changes in the manifestation of motor abilities is an enduring issue in the theory and practice of physical education.
On the basis of the above, we set as the aim of the present study to identify the peculiarities in the manifestation of the motor ability speed in pupils at the lower secondary stage of primary education. In order to achieve this aim, we set ourselves the following tasks:

1. *Reading about the problem in scientific sources.*
2. *Processing the results of the 30-meter-race test of the boys.*
3. *Revealing the impact peculiarities of the speed performance of schoolboys in the aspect of age.*

We fulfilled our study tasks by processing the achievements of the boys aged 10 - 14, who participated in the 30-meter-race test. We applied a variance and comparative statistical analysis which allowed us to specify the impact peculiarities of the motor ability in its age aspect.
After processing and analyzing the results of the study, we found a lot of changes in the speed performance of 10-14 years old schoolboys. In this regard, it is significant to note the changes recorded within one school year, which had the appropriate level of reliability to allow us to formulate recommendations for the work of teachers of „Physical Education and Sport".

Keywords: *physical education, schoolboys, speed*

INTRODUCTION

The subject of Physical Education and Sports implies the parallel implementation of cognitive and motor activity. Ensuring the unity of these two activities entails numerous opportunities for the multifaceted formation and development of the student as an individual. Authors such as (Cadoret et al., 2018), (De Giorgio et al, 2018) and (Polevoy, 2019) even consider the importance and impact of the motor component of physical education classes on the intellectual development of students. At the same time, the school age is the one in which the most significant changes occur in the individual in terms of their motor abilities, which are determined by the characteristics and specificities of age development. The full use of this age for the development of motor skills and qualities of students implies the effectiveness of the applied means and methods, which in turn will accelerate the process of improvement of their individual parameters. In this regard, tracking the status and changes in the different aspects of the manifestation of students' motor abilities is a mandatory stage, which assists in the process of selecting methods and means on the one hand, and in determining the right time for their implementation on the other.

This necessitates the continuous monitoring and reporting of changes in the different manifestations of motor abilities during school age. One of these manifestations is the motor ability speed, which is related to a child's speed of movement and ability to process information and make decisions in different situations. This also explains the existence of a number of studies in recent years that have tracked changes in the manifestation of different motor abilities, in particular speed. Here we can point to authors such as (Marinov, 2014) (Dimitrova, 2019), (Kostova, 2019), (Borisov, 2019), (Polevoy, 2019), (Zlatev, 2020), (Fiori et al., 2020). A study by Angelov and Kachaunov (2019) shows an increase in the Run 30m test scores for both girls and boys from 7 to 14 years of age. Grueva-Pancheva (2019) comments on significant changes in the manifestation of speed in boys from the lower secondary stage. Marinov (2014) defines the level of development of the motor quality speed in students of the lower secondary stage as „relatively good". On the other hand, Kumar (2006) points out that changes in the

manifestation of the motor quality speed bipa occur both parallel to the growth and development of the individual and as a result of purposeful work to develop the quality.

The data tracked so far by various researchers of the problem and by us give us reason to assume that in the contingent of male subjects studied by us, at the age of 12 - 14 years, during the period of the study, significant changes occurred in terms of the manifestation of the motor ability speed.

Aim and objectives of the study

On the basis of the above, we set as the aim of the present study to identify the peculiarities in the manifestation of the motor ability speed in pupils at the lower secondary stage of primary education. In order to achieve this aim, we set ourselves the following tasks:

1. Reading about the problem in scientific sources.
2. Processing the results of the 30-meter-race test of the boys.
3. Revealing the impact peculiarities of the speed performance of schoolboys in the aspect of age.

METHODS

The study contingent comprised a total of 105 boys from 81 Victor Hugo High School, Sofia, distributed as follows: 27 boys from V Grade (aged 12 years), 36 boys from VI Grade (aged 13 years), 44 boys from VII Grade (aged 14 years). We examined the selected contingent of the research subjects through a double testing, which we carried out at the beginning and the end of the school year, through the Running 30 meters test, which is part of the modern system for assessing the physical fitness of students in Bulgaria. This system has been in place since the school year 2018/2019. All participants studied have signed an informed consent from their parents that the information received from the research will be used in the present survey.

The object of the study is the motor quality speed in students of the lower secondary stage of primary education, and the subject is the changes that occur in the manifestation of the said motor quality in boys aged 12 to 14 years.

We applied a variation analysis to the data from the two tests, which allowed us to determine the subsequent tools for their processing. We tested the hypothesis derived and presented earlier in the text by calculating the values of the Student t-criterion for dependent and independent samples, as well as its associated probability guarantee. We established the influence of age-specific growth and developmental characteristics on the reported achievement using one-factor analysis of variance (One Way Anova) and Fisher's F-criterion values.

RESULTS

Analyzing and interpreting the results obtained from the five tests, we will first consider the data from the analysis of variance, whose indicators enable us to create a tentative basis for the present analysis and appropriate selection of the subsequent statistical tools. We present the values of the variance analysis indicators in Table 1.

Table 1. *Results of the analysis of variance of the test data*

Age	Testings	N	R	X min	X max	$\overline{X}$	S	V%	As	Ex
12	2	27	1.97	5.03	7.00	5.87	0.48	8.17	0.456	0.293
13	1	36	1.20	5.10	6.30	5.63	0.33	5.86	0.336	-0.674
	2		1.75	4.45	6.20	5.25	0.48	9.14	0.158	-0.657
14	1	42	1.94	3.99	5.93	4.80	0.47	9.79	0.593	-0.14
	2		1.59	3.71	5.30	4.40	0.41	9.31	0.251	-0.623

Taking into account the specificity of teaching Physical Education and Sport and the requirements of the State Educational Standard for General Education, we are interested in the values of the coefficient of variation (V%), which provide information about the homogeneity of the study group. The values of the coefficient presented in Table 1, which are less than 10% in all the tests performed, indicate the presence of a high level of homogeneity of the results of the group, which can be referred to as a good attestation for the work of the Physical Education and Sport teacher.

The values of the asymmetry coefficients (As) and

(Ex) indicated in the table are in all cases lower than the tabulated values at n = 45 and α ≤ .05, where As = 0.558 and Ex = 0.851. This allows us, in subsequent analyses, to apply parametric criteria in examining the differences in achievement between the selected groups of subjects and in testing the study hypothesis. At the same time, the values of the coefficient of asymmetry (As) in all cases have a positive sign, indicating a clustering of achievement around the weakest scores. This, in turn, provides information about a significant reserve that teachers could use during class work in Physical Education and Sport with the selected contingent of persons.

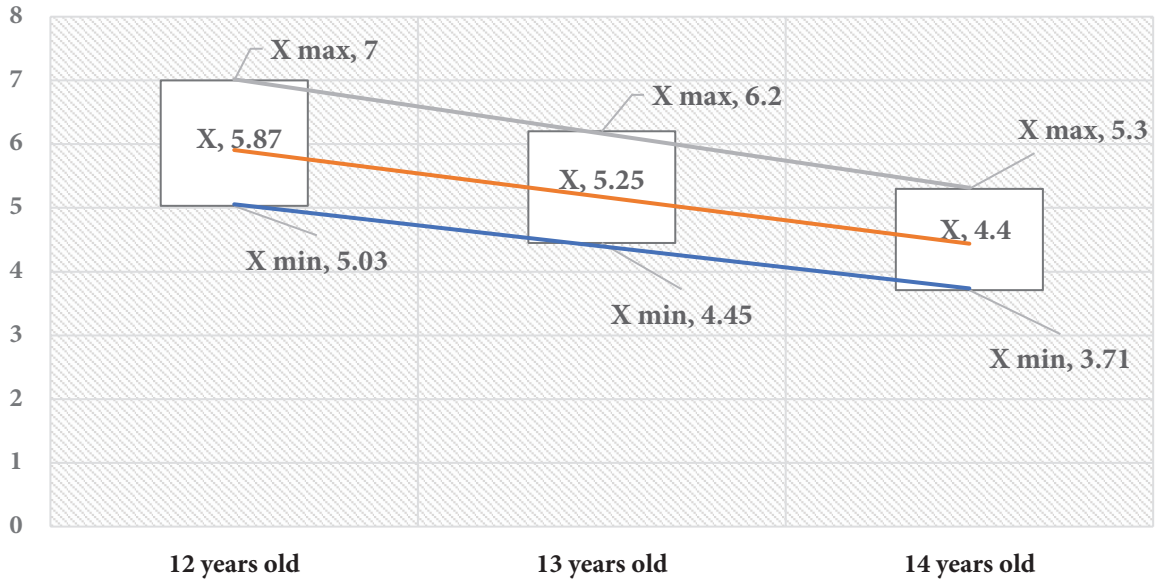


Figure 1. *Minimum maximum and average values for the performance in the tests conducted at the end of each school year*

The results presented in Figure 1 show a clear trend of improvement in average achievement that has continued throughout the entire period studied. The maximum and minimum achievements of the students also change in a similar manner. Examining the results presented, the high value for the difference between the maximum and minimum achievement of the students of V class in the 30-meter run test is clearly evident, being almost 2 seconds. The lowest achievement is 7 seconds, which in this test indicates a very low level of development of the ability to run a section at maximum speed. In the case of this particular student, this may be a consequence of incorrect running technique or poorly developed speed capabilities. Regardless of the cause, however, in either case the teacher should pay attention and assist in the process of correcting the result in question.

To test the influence of age changes on the results recorded, we applied a one-factor analysis of variance, which is appropriate given the above distribution and α values that are greater than .05 in all tests. The results of the applied analysis show a high value of Fisher's coefficient (F) = 93.76 supported by a significance level of α=.000. At the same time, the results of Tukey's test indicate the presence of statistically significant differences in any two comparisons between the three groups of students studied, aged 12, 13 and 14. These results give us grounds to point out the presence of prerequisites for the development of the motor ability speed in students in the age period in consideration, which are due to peculiarities in the age development of students.

Another essential part of analysing and interpreting the results is tracking changes over the school year, which will allow us to determine the impact of work in Physical Education classes on student achievement. Comparisons can be made here between the achievements of students in VI and VII grades, where testing was conducted at the beginning and end of the school year. The achievement comparisons presented in Figure 2 clearly show the presence of statistically significant differences for both VI Grade and VII Grade students. For the younger students, the difference in achievement

between the beginning and the end is 0.38 seconds and is supported by a probability guarantee of P(t)=100%. For the Grade VII students, this difference increases and reaches 0.40 seconds, while the level of probability guarantee is again P(t)=100%. In both cases, the differences in achievement are due to the work done in Physical Education and Sports classes.

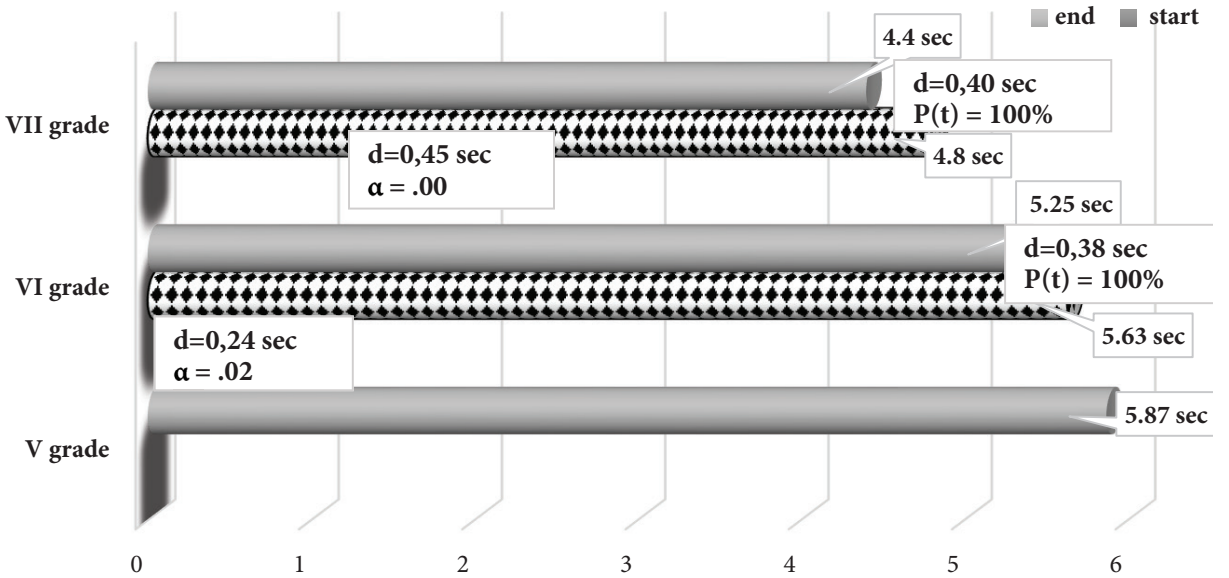


Figure 2. *Average performance in tests conducted at the beginning and end of the school year*

We also tested for statistically significant differences between the non-study periods, which are noted in Figure 2. For the transition from grade V to grade VI, the difference is 0.24 seconds and is supported by a significance level of α = .02. The difference between the achievements at the end of VI Grade and the beginning of VII Grade increases to 0.45 seconds with a significance level of α = .00. Taking into account the lack of targeted work during the summer period, we can confirm the above-mentioned influence of age development characteristics on boys' achievement in the period under consideration.

DISCUSSION

In order to examine the results obtained from the study and indicated in the analysis above, we compared the average achievements with the current physical ability assessment tables for students developed by O. Miladinov et al. (2019). In boys of the V and VI grades, the average achievements shown are within the Good 4 score, which can be described as normal considering the data and the requirements of the statistical indicators through which the normative assessment standards were developed (Miladinov, 2019). These results also indicate the presence of reserves regarding the development of the motor quality speed in students of the V and VI grades. The average result that we report in students of the VII grade, both at the beginning and at the end of the school year, can be evaluated as a Very Good 5, which confirms the positive effect of the work carried out by the teacher of Physical Education and Sport within the school year and. At the same time this confirms the reserve that exists in the direction of developing speed in students at the lower secondary stage, contrary to what is indicated by authors such as (Rachev, 1972, 1999) and (Fomin and Filin, 1975), (Završnik et al, 2017) who point to sensitive periods in the development of the motor quality under consideration.

The averages and differences recorded in the comparisons in the above analysis confirm the results of our previous studies. To this end, we also searched for similar studies to ours Nancheva & Naydenova (2019). We made a comparison of the results of our tested V Grade students with the data presented by Szabo (2019), who conducted research with boys who do not play sports and those who train in football, using the same test. The average achievement of the boys we tested was 5.87 seconds, which is 0.39 seconds worse than that of the boys who train in football and 0.5 seconds better compared to the non-sport practicing.

In conclusion, we can confirm the regularity revealed by Kumar (2006), regarding the changes in the manifestation of the motor quality speed in boys, as established by the test Running 30 meters. This regularity concerns the trend of improvement in performance in parallel with age and as a consequence of purposeful work, supported by prerequisites generated by the peculiarities of age development.

REFERENCES

Angelov, B., M. Kachaunov. (2019). Systoqnie na fizicheskata deesposobnost na uchenitzite ot I do XII klas v SU «Peyo Qvorov", gr. Sliven. *Godishnik na Natzionalna sportna akademiq "Vasil Levski",* Tom 1., 39-46. // Ангелов, Б., М. Качаунов. (2019). Състояние на физическата дееспособност на учениците от I до XII клас в СУ «Пейо Яворов», гр. Сливен. *Годишник на Национална спортна академия "Васил Левски",* Том 1., 39-46.

Borisov, L. (2019). Sravnitelen analiz na fizicheskata deesposobnost na uchenitzi ot progimnazialen etap. *Godishnik na Natzionalna sportna akademiq "Vasil Levski".* str. 62-67. Sofia: NSA PRES. //Борисов, Л. (2019). Сравнителен анализ на физическата дееспособност на ученици от прогимназиален етап. *Годишник на Национална спортна академия «Васил Левски».* стр. 62-67. София: НСА ПРЕС.

Cadoret, G., Bigras, N., Duval, S., Lemay, L., Tremblay, T., Lemire, J. (2018). The mediating role of cognitive ability on the relationship between motor proficiency and early academic achievement in children. Human Movement Science, Volume 57, pp. 149-157. https://doi.org/10.1016/j.humov.2017.12.002.

Grueva - Pancheva, T. (2019). Harakteristika na fizicheskata deesposobnost na uchenitzi ot 5-i do 8-i klas. *Godishnik na Natzionalna sportna akademiq "Vasil Levski",* Tom 1, 105 - 109. //Груева - Панчева, Т. (2019). Характеристика на физическата дееспособност на ученици от 5-и до 8-и клас. *Годишник на Национална спортна академия «Васил Левски»,* Том 1, 105 - 109.

De Giorgio A., Kuvacic, G., Milic, M., Padulo, J. (2018). The brain and movement: How physical activity affects the brain. *J Sports Sci Med*, 7(2), DOI, 10.26773/mjssm.180910, 63-68.

Dimitrova, Tz. (2019). Otzenka na fizicheskata deesposobnost na 7-10-godishni uchenitzi. *Godishnik na Natzionalna sportna akademiq "Vasil Levski":* Tom 1. (str. 87-91). Sofia: NSA PRES. //Димитрова, Ц. (2019). Оценка на физическата дееспособност на 7-10-годишни ученици. *Годишник на Национална спортна академия «Васил Левски*": Том 1. (стр. 87-91). София: НСА ПРЕС.

Fiori, F., Bravo, G., Parpinel, M., Messina, G., Malavolta, R. et al. (15 5 2020 r.). Relationship between body mass index and physical fitness in Italian prepubertal schoolchildren. *PLOS ONE*, стр. https://doi.org/10.1371/journal.pone.0233362.

Fomin, N., Filin, V. (1975). *Vyzrastovi osnovi na fizicheskoto vyzpitanie.* Sofiq: Meditzina i fizkultura.// Фомин, Н., Филин, В. (1975). *Възрастови основи на физическото възпитание.* София: Медицина и физкултура.

Kostova, N. (2019). Systoyanie na fizicheskata deesposobnost pri uchenitzi ot nachalen etap ot osnovnata obrazovatelna stepen. *Godishnik na Natzionalna sportna akademiq "Vasil Levski",* Tom 1, str. 73-91. Sofia: NSA PRES. //Костова, Н. (2019). Състояние на физическата дееспособност при ученици от начален етап от основната образователна степен. *Годишник на Национална спортна академия «Васил Левски»,* Том 1, стр. 73-91. София: НСА ПРЕС.

Kumar, H. (2006). Age Changes in the Speed of Running during 30 meter Sprint Running. *Journal of Exercise Science and Physiotherapy*, Vol. 2, pp. 92-95.

Marinov, T. (2014). Promeni v razvitieto na byrzinata pri uchenitsite v rezultat ot obuchenieto po fizichesko vyzpitanie i sport. *Po nqkoi aktualni problemi na fizicheskoto vyzpitanie i sporta, Sbornik nauch.dokladi.* str. 57-64. Sofia: NSA PRES. //Маринов, Т. (2014). Промени в развитието на бързината при учениците в резултат от обучението по физическо възпитание и спорт. *По някои актуални проблеми на физическото възпитание и спорта, Сборник науч.доклади.* стр. 57-64. София: НСА ПРЕС.

Miladinov, O., et al. (2019). *Sistema za otzenqvane na fizicheskata deesposobnost na uchenitzite ot I do XII klas.* Sofia: NSA Pres. //Миладинов, О., и кол., (2019). *Система за оценяване на физическата дееспособност на учениците от I до XII клас.* София: НСА Прес.

Miladinov, O., Konchev, M. (2019). Metodika za razrabotvane na sistema za otzenqvane na fizicheskata deesposobnost na uchenitzite ot I do XII klas. *Godishnik na Natzionalna sportna akademiq "Vasil Levski":* Tom 1. (Sofia), 22-33. //Миладинов, О., Кончев, М. (2019). Методика за разработване на система за оценяване на физическата дееспособност на учениците от I до XII клас. *Годишник на Национална спортна академия «Васил Левски»:* Том 1. (София), pp.22-33.

Nancheva, D., Naydenova, K. (2019). Study of the impact of the motor characteristics of speed on the age peculiarities. *International Scientific Congress "Applied Sports Sciences", Balkan Scientific Congress "Physical Ed-*

ucationInternational Scientific Congress "Applied Sports Sciences", November 2019, pp. 165-168.

Polevoy, G. (2019). Development the Speed of Movement and Coordination Abilities of Pupils with Use of Exercise Classic's. *Int J Edu Sci,* 26 (1-3), pp. 9-13 DOI 10.31901/24566322.2019/26.1-3.1083

Rachev, K. (1972). *Vyzrastova dinamika i metodika na razvitieto na osnovnite fizicheski kachestva. Problemi na detsko- yunosheskiq sport.* Sofia. // Рачев К. (1972). *Възрастова динамика и методика на развитието на основните физически качества. Проблеми на детско-юношеския спорт.* София.

Rachev, K. (1999). *Optimizirane na podgotovkata na mladite sportisti.* Sofia: Novi znaniq. // Рачев, К. (1999). *Оптимизиране на подготовката на младите спортисти.* София : Нови знания.

Szabo., D. A., Fagaras, P. S., Cileau, L., Sopa, I. S. (2019). Use Of The 30 M Acceleration Test for Predicting Results at Athletic Tests of Speed On 60, 100 And 200 M In Children with A Range of 10 To 11 Years. *Studia Ubb Educatio Artis Gymn.*, LXIV, 4, pp. 43 – 58 DOI:10.24193/subbeag.64(4).29

Završnik, J., Pišot, R., Šimunič, B., Kokol, P., Blažun Vošner, H. (2017). Biomechanical characteristics of skeletal muscles and associations between running speed and contraction time in 8- to 13-year-old children. *Journal of International Medical Research*, 45 (1), https://doi.org/10.1177/0300060516687212, 231-245.

Zlatev, B. (2020). Izsledvane na vliqnieto na izvynuchilishtnite zanimaniq sys sport vyrhu byrzinata i lovkostta na 14-16-godishni momcheta. *Sport i nauka* (Sofia), LHIV, N 1, pp. 166-178. // Златев, Б. (2020). Изследване на влиянието на извънучилищните занимания със спорт върху бързината и ловкостта на 14-16-годишни момчета. *Спорт и наука* (София), LXIV, N 1, pp. 166-178.

Corresponding author:
Dilyana Nancheva, PhD
Department of Theory of Physical Education
National Sports Academy „Vassil Levski"
21, Acad. Stefan Mladenov str.
Sofia, Bulgaria
E-mail: diksiii1@abv.bg

 DOI: 10.37393/ICASS2022/104 195 - 200

POSTGRADUATE EDUCATION AT NATIONAL SPORTS ACADEMY "VASSIL LEVSKI"– RETROSPECTIVE ANALYSIS

Bisser Tzolov,
Aleksandra Haralampieva & Aleksandra Gencheva-Vasileva
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
An important element in the system of educational and scientific activity of the National Sports Academy "Vassil Levski" is the Postgraduate education. This is dictated by both the mission and educational traditions of the Academy, as well as by the needs of Bulgarian society and the legal framework in higher education.
The purpose of the study is to make a retrospective analysis of the Postgraduate studies at NSA "Vassil Levski". The analysis was made by studying historical information included in different reports, Educational-Scientific Council's minutes of meetings, memo reports, references with statistical data, regulatory documents, questionnaires and other documentary sources. Part of the collected data is subject to quantitative analysis and expert-analytical evaluation and summery.
In the retrospective analysis, the Postgraduate studies at the Academy are differentiated into three stages through the prism of political, economic, legal and educational features over time. Some strategic goals, structural units, types and forms of Postgraduate studies are characterized and this is supported by information about the specializations and courses conducted over the years.
The overall analysis, revealing the stages and the trends in the development of Postgraduate education provides opportunities through additional research to derive main perspectives that will serve to make strategic decisions for its expansion and improvement at NSA "Vassil Levski".

Keywords: *educational and scientific activities, postgraduate studies, qualification, specializations and courses.*

INTRODUCTION

During the 80 years of its existence, National Sports Academy "Vassil Levski" has established itself not only as a unique higher education institution in Bulgaria but also as a globally recognized institution for highly qualify specialists in the field of physical education, sport and physiotherapy. The postgraduate education is an important element in the higher education and scientific system at the Academy. Nowadays, the structure that offers this type of education is the Centre for Postgraduate studies (CPS).

AIM AND METHODS OF THE STUDY

The *aim* of the study is to make a retrospective analysis of the Postgraduate studies at the NSA "Vassil Levski".

The *methods* used in the analysis include research of historical information from different reports, Educational-Scientific Council's minutes of meetings, memo reports, references with statistical data, regulatory documents, questionnaires, etc. The collected data is subject to quantitative analysis and expert-analytical evaluation and summery.

RESULTS

The postgraduate education at NSA "Vassil Levski" has half-century history and could be differentiated into three periods through the prism of political, economic, legal and educational features over time. The first period started in 1970 at the Higher Institute for Physical Education "Georgi Dimitrov" (HIPE "Georgi Dimitrov") and continued until 1990 when major political and economic changes took place in Bulgaria. The second prolonged for two decades and started in 1991. At the beginning of this stage, the Centre for postgraduate studies was established as a specialized educational and scientific unit. The third period has started in 2011 and continues until today. Some strategic goals, structure units, forms of postgraduate studies are included in the analysis and are proved by information about conducted courses and specializations.

First Period (1970 – 1990)

In the late 1950's and the early 1960's arose the necessity of a specialized form of education that would provide modern scientific knowledge for the sport specialist. A prerequisite for this was the unified national strategy for the development of Physical edu-

cation, which required improvement of the system for the education of sports and pedagogical specialist. Thus, with the Decree from December 4, 1972 the Unified Centre for Physical Education and Sports Specialists (UCPESS - HIPE "Georgi Dimitrov") was established. The first chairperson was prof. Ivan Staykov (Vitanova, 2016). The Centre centralized the scientific resources in a single structure unit that helped not only for the development of scientific and research work in sports, but also for improving the educational process of students and for training specialists with secondary and higher education.

In 1972 by Order No. 0095/19.01.1972 (Zapoved No. 0095, 1972), based on Decree No. 21/05.04.1967 of the Council of Ministers of Republic of Bulgaria, at the HIPE "Georgi Dimitrov" (current National Sports Academy "Vassil Levski"), the Department of Postgraduate Qualification (DPQ) was founded (Postanovlenie No. 21,1967). In reality, the postgraduate qualification at HIPE "Georgi Dimitrov" starts in June 1970 with the first courses that were held under the auspices of the Committee for Science, Technical Progress and Higher Education. A new position was created at the DPQ – vice-rector of Postgraduate Studies, held by prof. Vasil Tsonkov. In the same year, 13 courses requested by various Ministries and agencies were held. In subsequent years, the number of the organizations that require courses increases. For example, in 1977 were held 17 courses with 288 students. Courses for physical education teachers, courses for coaches with higher education and courses to improve the qualification of teachers, etc. are also held. In order to optimize the system of postgraduate studies, prof. Tsonkov proposes to be created a Council of Postgraduate Education. The first chairperson of the Council is assoc. prof. Tsvetan Zhelyazkov. Thus, three forms of qualification are formed – refresher courses, improvement courses and courses to increase qualification.

The Rules for postgraduate education of physical education specialists were adopted in HIPE "Georgi Dimitrov" in 1977. The unit is designed as "Department for Postgraduate Studies" (DPS), which was headed by Dean and Council. Then head of the department was Metodiy Politov and the two administrative supervisors were Anka Hristova and Anelia Elenkova. In this period the Dean – assoc. prof. Zhelyazkov developed a Comprehensive Program for a five-year period. It derived three main types of qualification: Refresher (15-45 days), Improvement (2-4 months) and Specialization (1-2 years).

The period from 1980 to 1983 was characterized by amendments in the legal-normative base.

With the admission of Decree № 42/24.06.1980 of the Council of Ministers (Postanovlenie № 41, 1980), a Council for Coordinating the Qualification of Personnel was established. With the introduction of the Decree, the "Department for Increasing the Qualification of Personnel" (DIQP) is created at HIPE, which is under the direct authority of the Vice-rector for Increasing Qualification of Personnel (IQP) assoc. prof. Konstantin Nakov, and head of the Department is Metodiy Politov. Later, a Scientific-Methodological Council of the Department is established with the chairperson prof. Nikola Popov. Educational structural units - schools, courses, branches, etc., could be created within the DIQP. Thus, as a part of its structure, with the decision of the Academic Council from December 13, 1982, it was proposed to start a two-year part-time Football School that should start working from the academy year 1983/1984. However, the regulations for the school were discussed in 1988 with which it began its activity.

In the period from 1980 to 1982 the postgraduate education was actively developing. The courses held in 1980 increased from 16 courses with 293 students to 39 with 1180 students. New courses for students with secondary education were launched in 1992.

From 1983 until 1986 were conducted 137 courses: 85 refreshing courses, 10 specializations, 4 prequalification courses and 38 courses for improving the qualification of teachers. The educated students in this period were 4286 in total and the individual specializations were approx. 40. The intensive educational activity continued in the following years, as well. In 1988 were held 37 courses with 755 students. In the same time, the School for increasing the scientific and methodical qualification of teachers from the departments of physical education of universities in the country was established as a part of DIQP headed by senior researcher Boris Marinov. At meetings of the Academic Council was discussed that the contemporary managing specialists need additional qualification. As a result, in August 1989 School for sports Managers was established headed by assoc. prof. Yordan Kalaykov.

Second Period (1991 – 2010)

The political and economic changes in Bulgaria after 1989 had a serious impact on the educational system in the country, which reflected on the postgraduate studies at NSA "Vassil Levski", too. Significant changes in the legal framework also began so the postgraduate education lost some of its positions.

In relation to the new requirements on September 18, 1992 the Academic Council of NSA "Vassil Levski" (Protokol No. 1, 1992) took the decision to be established a Centre for Postgraduate Studies (CPS). In accordance to the Rules of the Centre since 1992 habilitated person should manage it. The Centre has Educational and Scientific council that discusses and accepts Course Curriculum and programs, teaching materials, scientific researches, etc.

At the beginning of CPS's existence, new Curriculum and programs were introduced. The number of the external educational courses increased. Thus, 33 courses and specializations – 18 job specializations, 1 target specialization, 6 requalification courses and 8 courses with 692 students started in 1993. The most popular job specialization was the Football specialization, chosen by 25 students, and the most popular requalification course was the Karate course, chosen by 20 students. In the same year 4 requalification courses for teacher of physical education started with 75 students. The School for Sports Managers held requalification courses, as well. The CPS organized seven external educational courses in different cities in the country as Botevgrad, Stara Zagora and Varna. Three requalification courses for teachers of physical education were held in Plovdiv, Shumen and Stara Zagora in 1994.

With the acceptance in 1995 of the Low on Higher Education and the Ordinance on the Uniform State Requirements for Acquiring Higher Education for the Professional Qualification "Teacher" and other normative documents in 1995, the postgraduate education regained its significance. The interest in the specializations for physical education teachers and physiotherapists was increasing. Therefore, from1993 until 1998 330 students participated in specializations for physical education teachers; 64 students – in courses for gaining teaching qualification degree; 26 students – in physiotherapy specialization; 296 – in short-term physiotherapy course; 150 students – in coach specializations. More than 130 students participated in the courses for sport instructors; more than 900 people take part in the massage courses; 45 students have attended courses for scientific and teaching personnel; 21 specialists have graduated from the School for Sports Managers.

During the 1995/1996 academic year, the Centre conducted 26 group courses and 27 individual specializations with 650 students. Specializations for physical education teachers were held in Shumen, Plovdiv, Veliko Tarnovo, Svishtov and Sofia. In 1998 new Course Curriculum for coaches and physical education teachers was developed. In this and next year, the interest in specializations for coaches in sports as dance Sport, aikido, kick-boxing, basketball, etc. increased. In 2000 began 31 courses with 600 students. In the following year - 2001, individual coach specializations occupied a large place in the activity of CPS, starting 27 such. The Centre expands the number of the cities in which are held external courses. The number of the foreign students increases too. Between 1999 and 2003, 2877 students take part in 185 specializations and courses – 48% of them are requalification courses, and 58% are short-term courses. The year with the most courses is 2001 – 48 with 768 students.

In the following years, the CPS focused mainly on three educational forms – long-term specialization for gaining professional qualification, specialization and short-term course. In 2006 the number of students reaches 1190. Course Curriculum and programs for "Sports Journalism Specialization" and "Specialization for Methodists in Physical Training in the Field of Ministry of the Interior and Bulgarian Armey" were adopted. Scientific work was also active.

The global economic crisis that occurred during the last two years of the period affected the activities of the CPS. At the same time, prof. Dimitar Kaykov retired and prof. Bisser Tzolov was chosen to be the next head of the CPS. The period was accompanied by legislative changes and increasing competitiveness of the sports and educational market. This led to an outflow in some specializations, which was offset by the start of new ones. The number of specializations and courses held in CPS in 2008, 2009 and 2010 was respectively 48 with 902 students, 39 with 897 students and 33 with 976 students.

The vision of the new head includes unifying specializations and courses, increasing the quality of

teaching and expanding its scope and cost savings. This requires improvement of the Centre's organizational structure, so new job positions focused on the marketing and administrative assurance are opened. Due to legal and normative difficulties and the tendency for increasing the number of students with high school diploma that want to participate in the courses for postgraduate education, prof. Tzolov has proposed that at NSA "Vassil Levski" should be crated a professional college.

Third Period (2011 to present)

The period begins with the development of new Course Curriculum and programs, in line with the educational requirements. For the first time the Centre organizes Kudo and Kendo specializations and courses such as "Modern Bulgarian Language for Foreigners", "Anatomy and Physiology", "Theoretical, Medical and Biological Acknowledgments" „Shotgun Shooting, "English and French for teachers", etc.

In 2012 with resolution from the Educational and Scientific Council of the CPS is opened new job position – Marketing Manager. Assoc. prof. Georgi Draganov is the first that has occupied this position and from 2016 to the present marketing manager of CPS has been assoc. prof. Todor Marinov.

The CPS together with the Ministry of Education and Science (MES) held courses as part of the National Program "Qualification" (2014) and "Qualification for Professional Development of Pedagogical Personnel" (2015) with 168 students from sport schools in Bulgaria. The CPS participated in the National Program "Development of Pedagogical Personnel" with developing three study programs in 2016 and held course with 66 teachers. Two more courses were held in 2019, together with the MES – "Initial Training in Chess" with 119 teachers participating and "Physical Activity of Students – content, status and assessment" with 56 participants. Serious difficulties aroused during this period. The specialization in Physiotherapy discontinued due to numerous changes in the regulatory framework. The interest in specializations such as "Sports Journalism" and "Methodist in Physical Education and Sport in Ministry of Interior and Bulgarian Army" was decreasing. Many potential participants enrolled in the Bachelor and Master programs of the NSA "Vassil Levski". Despite the difficulties, CPS managed to start new courses and specializations. Thus, from 2011 to July 2022 an average of 24 courses were held (23 specializations and 19 courses), with the most in 2011 – 54 courses (table 1). (Tzolov & Haralampieva, 2021).

Table 1. *Participants and Courses held by CPS from January 2011 to July 2022*

Year	Specializations	Participants in specializations	Short-term courses	Participants in short- term courses	Total courses	Total participants
2011	**26** (9)	**532** (221)	**28** (24)	**515** (465)	**54** (33)	**1047** (686)
2012	**30** (13)	**531** (230)	**21** (17)	**353** (309)	**51** (30)	**884** (539)
2013	**24** (7)	**402** (87)	**21** (20)	**446** (432)	**45** (27)	**848** (519)
2014	**23** (7)	**410** (171)	**18** (13)	**527** (459)	**41** (20)	**937** (630)
2015	**23** (6)	**395** (90)	**22** (19)	**458** (392)	**45** (25)	**853** (482)
2016	**21** (8)	**366** (175)	**19** (15)	**396** (354)	**40** (23)	**762** (529)
2017	**18** (4)	**340** (77)	**30** (28)	**901** (850)	**48** (32)	**1241** (927)
2018	**19** (10)	**361** (204)	**27** (25)	**725** (673)	**46** (35)	**1086** (877)
2019	**24** (9)	**447** (166)	**23** (22)	**699** (679)	**47** (31)	**1146** (845)
2020	**20** (6)	**421** (136)	**9** (8)	**181** (161)	**29** (14)	**602** (297)
2021	**24** (9)	**463** (151)	**7** (7)	**312** (312)	**31** (16)	**775** (463)
July 2022	**18 (5)**	**369** (141)	**9** (9)	**166** (166)	**27** (14)	**535** (307)
Mean	**23 (8)**	**420 (154)**	**19 (17)**	**473 (438)**	**42 (25)**	**893 (592)**

Statistics shows that an average of 893 students participated annually. The year with the largest number of participants is 2017 – 1241 students attending in 48 courses. The centre supports actively scientific initiatives, researches and conferences. Five scientific proceeding books were published in this period.

In 2015 a new Regulation was adopted for the Structure and Activities of the CPS (Pravilnik za

deynostta na TSSDK, 2015). This helped the next four-year period (2016-2019) to be the most successful from educational point of view, although the CPS worked in the conditions of a highly competitive environment and dynamic changes in the legal and regulatory framework.

Two main documents have a positive impact on the increased interest in the postgrad studies at NSA "Vassil Levski".

The first document is the Ministry of Youth and Sports' (MYS) Ordinance 2 from March 27, 2017 for Professional Legal Capacity and Qualification of Sport and Pedagogical Specialists, current Ordinance 1 from 4th February 2019 (Naredba №1, 2019). It allows expanding the range of organized specializations and courses. New Course Curriculum and programs for "Coach", "Assistant coach", "Sports Instructor" have been developed and numerous courses start. (Tzolov & Tzolova, 2018). The CPS has initiated the admission in Bachelor's degree for acquiring a coaching qualification in sports new to NSA – Yoga, Aikido and Ushu.

The second document is related to adapting the activity of CPS to the requirements of Preschool and School Education Act and the MES's Ordinance 12 from September 1, 2016 (Naredba 12, 2016) current Ordinance 15 from July 22, 2019 (Naredba 15, 2019) for the Status and the Professional Development of Teachers, Principals and Other Pedagogical Personnel. (Haralampieva, 2020; Tzolova, 2017). Courses for obtaining qualification credits aimed at physical education teachers began in February 2017. To date, 43 credit courses have been held on 26 various themes, two of which are organized jointly with Directorate "Sport for Students and Sport Schools" at the MYS. The total number of participants so far is 1870. Sixty courses for qualification credits are held in Varna, Burgas, Sandanski, Plovdiv, Pazardzhik, Stara Zagora, Zlatograd, etc. This actively contributes to the promotion of the Academy's educational programs and the attraction of new students in Bachelor degree. Three seminars on Olympic themes and one-year professional-pedagogical specialization for physical education teachers are organized, too. Four scientific proceeding books have been published.

The 2020 Coronavirus Pandemic has been an extremely difficult period for the CPS. However, the Centre has achieved good results thanks to the rapid adaptive capabilities and the reorganization of the teaching process from face-to-face in distance learning. The total number of students in the conditions of Covid-19 organized by CPS for the two years (2020 and 2021) is 1357, of which 887 are specializations and the rest are short-term courses. For obvious reasons, the number of the qualification courses for physical education teachers has decreased. In line with the expansion of the scope, two courses "Fishing Instructor" are held for the first time at the NSA. The noticed trend is related to the great interest in specializations for physical education teachers. Therefore, and in relation to the changes in the State Requirements for the Acquisition of Teacher Qualification, the CPS has updated the study documentation.

DISSCUSSION

The presented analysis indisputably shows the high importance of postgraduate studies at NSA "Vassil Levski", both for establishing the authority of the institution as a leader in the education of sport personnel, and for increasing their qualification and requalification in accordance with modern educational requirements and innovations in science and practice. Over the years, this has been dictated by both the educational traditions and needs of the Bulgarian society, as well as by some political, economic, educational and legal features of the time. Today and in the future, the opportunities for the development of postgraduate studies are not only inexhaustible, but in contrary, they are becoming more and more significant, determined to the greatest extend by the high socio-economic importance of sport, the intensive development of scientific achievements and the opportunities for wider career realization in sport and related activities.

REFERENCES

Doklad za deynostta na NSA "Vassil Levski" za 2008-2011 (2012)// Доклад за дейността на НСА „Васил Левски" за 2008-2011 (2012).

Doklad za deynostta na NSA "Vassil Levski" za 2012 – 2015 (2015)// Доклад за дейността на НСА „Васил Левски" за 2012 – 2015 (2015).

Doklad za deynostta na NSA "Vasisl Levski" za 2015 – 2019 (2019)// Доклад за дейността на НСА „Васил Левски" за 2015 – 2019 (2019).

Doklad za deynostta na NSA "Vassil Levski" za 2020 (2020)// Доклад за дейността на НСА „Васил Левски"

за 2020 (2020).

Haralampieva, A. (2020). Povishavane kvalifikatziata na uchitelite po fizichesko vazpitanie v usloviata na CPS pri NSA "Vassil Levski", *"Sport i nauka"*, Vol. 1, 2, pp. 157-165// Хараламиева, А (2020). Повишаване на квалификацията на учителите по физическо възпитание в условията на ЦСДК при НСА „В. Левски". Спорт и наука, бр. 1,2, с. 157-165.

Naredba № 0-3 za sleddiplomna kvalifikatsia na spetsialistite s visshe obrazovanie ot (1973) // Наредба № 0-3 за следдипломна квалификация на специалистите с висше образование; (1973).

Naredba № 12 na Ministerstvo na obrazovanieto i naukata za statuta i profesionalnoto razvitie na uchitelite, direktorite i drugite pedagogicheski spetsialisti, promulgated in *Darzhaven vestnik* vol. 75 (September 29, 2016)// Наредба № 12 на Министерство на образованието и науката за статута и професионалното развитие на учителите, директорите и другите педагогически специалисти, обн. в Държавен вестник, бр. 75 (27.09.2016).

Naredba № 15 na Ministerstvoto na obrazovanieto i naukata za statuta i profesionalnoto razvitie na uchitelite, direktorite i drugite pedagogicheski spetsialisti., promulgated in *Darzhaven vestnik*, vol. 61 (July 22, 2019)// Наредба № 15 на Министерство на образованието и науката за статута и професионалното развитите на учителите, директорите и другите педагогически специалисти, обн. в Държавен вестник, бр. 61 (22.07.2019).

Naredba 1 na Ministerstvo na mladezhta i sports za trenyorskite kadri, promulgated in *Darzhaven vestnik*, Vol. 13 (September 12, 2019)// Наредба 1 на Министерство на младежта и спорта за треньорските кадри, обн. в Държавен вестник, бр. 13 (12.09.2019).

Osnovni polozhenia za izgrazhdane na sistema za SDK na spetsialistite s visshe obrazovanie - proekt, (1972)// Основни положения за изграждане на система за СДК на специалистите с висше образование - проект (1972).

Postanovlenie №2 na Ministerski savet za ustanovyavane na edinna sistema za sleddiplomna kvalifikatsia na spetsialistite s visshe obrazovanie, promulgated in *Darzhaven vestnik*, vol. 15 (February 7, 1973)// Постановление 2 на Министерски съвет за установяване на единна система за следдипломна квалификация на специалистите с висше образование, обн. в Държавен вестник, бр. 15 (07.02.1973).

Postanovlenie № 42 na Ministerski savet za edinna natsionalna sistema za povishavane kvalifikatsiyata na kadrite, prolungated in *Darzhaven vestnik,* vol. 67 (June 24, 1980)// Постановление № 42 на Министерски съвет за единна национална система за повишаване квалификацията на кадрите, обн. в Държавен вестник, бр. 67 (24.06.1980).

Pravilnik za ustroystvoto i deynostta na TSSDK (April 2, 2015)// Правилник за устройството и дейността на ЦСДК (02.04.2015).

Protokol №1 na Akademichnia savet na NSA "Vassil Levski" (September 18, 1992)// Протокол №1 на Академичния съвет на НСА „Васил Левски" (18.09.1992).

Tzolov, B., Haralampieva, A. (2021). Aspekti na obrazowatelnata i nauchna deynost na TSSDK pri NSA "Vassil Levski", *"Sport i nauka"*, Vol. 1, 2, pp. 6-18// Цолов, Б., Хараламиева, А. (2021). Аспекти на образователната и научната дейност на ЦСДК при НСА „Васил Левски" за последното десетилетие, Спорт *и* наука, бр. 1,2, с. 6-18.

Tzolova, V. (2017). Opportunities for Acquiring a Teaching Qualification for Physical Education and for Continuing Education. *Journal of Mining and Geological Sciences,* Part IV: Humanitarian Sciences and Economics Vol. 60, pp. 71-74.

Tzolov, B., Tzolova, V. (2018). Postgraduate Studies at NSA "V. Levski" as an Opportunity for Vocational Qualification and Carreer Development, *Journal of Mining and Geological Sciences,* Part IV: Humanitarian Sciences And Economics Vol. 61, pp. 41-45.

Vitanova, E. (2016). Obrazovatelna politika v NSA "Vassil Levski" 1942-2012. Disertatsionen trud, NSA "Vassil Levski"// Витанова, Ем. (2016). Образователна политика в НСА „Васил Левски" 1942-2012.

Zapoved № 0095 na Komitet za nauka, tehnicheski progres i visshe obrazovanie ot (January 19, 1972)// Заповед № 0095 на Комитет за наука, технически прогрес и висше образование (19.01.1972).

Zapoved № 2450 na Ministerstvo na narodnata prosveta – Upravlenie „Visshe obrazovanie" (April 29, 1970)// Заповед на Министерство на народната просвета – Управление „Висше образование" (29.04.1970).

Corresponding author:
Prof. Bisser Tzolov, DS
Centre for Postgraduate Students,
National Sports Academy "Vassil Levski",
Studentski grad, 21, Acad. Stefan Mladenov, Str.,
Sofia, Bulgaria
E-mail: bissertz@abv.bg

CHANGES IN THE LEVEL AND TYPE OF STUDENTS' PHYSICAL ACTIVITY BEFORE AND DURING THE COVID-19 PANDEMIC

Maria Boncheva
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
The current study aims to reveal the changes in the levels of physical activity before and during COVID-19 pandemic among students in 8th to 12th grade. A total of 160 Bulgarian students took part in the study (98 girls – 60%; 62 boys – 40%), with an average age of 16 years. The following methods were used to achieve the set goals: scientific literature review, designing a questionnaire and statistical data analysis with the SPSS software. The Statistical Package for Social Sciences was used for the descriptive statistics, frequencies and revealing significant correlations and differences according to different factors of the subjects in the study. A structured questionnaire was created, which was distributed through the social networks. The obtained results allowed for revealing the main type of physical activity performed before and during the pandemic among the students. The most common physical activity before the pandemic period is the participation in the Physical Education and Sport classes with 51%, and during COVID-19 is the possibility to perform some physical exercises indoors at home – 65%. The study has revealed that after the alleviation of the restrictive measures, a large portion of the students would increase the time for sport and physical activity (54%).

Keywords: *physical education, sport, students, COVID-19.*

INTRODUCTION

In contemporary society it becomes more and more frequent to put physical activity and health of the population in the centre of attention. In many European countries there are many initiatives aiming at increasing the activity, and at the same time a special attention is being directed at the adolescents (Nielsen, Pfister & Andersen, 2011). According to a recommendation of the World Health Organisation, physical activity needs to be at least 150 minutes average or 75 minutes high intensity activity per week (WHO, 2010). For children and adolescents at the age of 5 up to 17 these activities should be at least 60 minutes per day (WHO, 2020a). But all these recommendations were put under test during 2019-2020 year when the respiratory infection, caused by the SARS Cov-2 has caused the declaring of a pandemic. With the aim to avoid the spread of the COVID-19 there were a lot of restrictions put on the mobility of people and their social interactions. This resulted in the closing of the elementary and secondary schools, and the pupils and students were left without access to school physical activities such as the Physical Education and Sport classes, the walking from and to school, etc. (Dunton et al., 2020) The interrupted educational process broke the rhythm of physical education in the adolescents (Burgess & Sievertsen, 2020) because the schools are the main source of extracurricular activities and organised sports for children (Velde et al., 2020). Besides that, the use of the sport and entertainment facilities and halls, swimming pools, and playgrounds was terminated, which limited to a large extent the physical activity of a large number of people (Shahidi et al., 2020; Almonacid-Fierro et al., 2021; Chen et al., 2020; Shepherd et al., 2021). Although the introduced measures for social distancing aimed at slowing down the spread of COVID-19, they probably led to the limitation of the students to be engaged with enough physical activity, which is important for the healthy lifestyle and diseases prevention (Dunton et al., 2020), as well as to the increase of consumption of unhealthy food and increased sedentary behaviour (Blanco et al., 2020; Guo et al., 2021).

The presence of physical activity for students is also linked to its positive effect on health and quality of life, including the prevention of heart diseases and obesity (Velde et al., 2020). The importance of physical activity is supported by organisations such as WHO (WHO, 2020b) and UNICEF (2020), which aim to increase or support physical activity engagement and in the meantime diminish the time of sedentary behaviour during the social distancing period. Regardless of the recommendations, the studies in that area reveal that physical activity has been "*negatively affected by the restriction measures*" (Velde et al., 2020). The changes in the levels of physical activities and in the duration in front of

the screen are presented in Table 1. In addition to the data in the table, similar data has been indicated and for other countries. The situation in Canada is similar, as it is observed that children have increased their time in front of the screens by 87%. In countries such as the Netherlands (42%), South Korea (94%) and USA (36%) the parents report that their children are less physically active during the pandemic (Velde et al., 2020). Other authors, Sheperd et al. (2021), report that in countries, such as Italy and Spain, the physical activity of children has diminished with 85% according to data from their parents, as well as that they have increased their time in front of the screen. According to Rogowska et al. (2020) the level of physical activity in students has also been affected, which report that 58% have been in accordance with the 150 minutes a week, recommended by the WHO.

Table 1. *Changes in physical activity and screen time during the COVID-19 restrictions*

Country	Physical activity	Screen time
China	- 1,03 h/day	+ 4,28 h/day
Italy	- 0,35 h/day	+ 4 h/day
Spain	- 1,43 h/day	+ 2,9 h/day

The effect of the COVID-19 pandemic on adolescents is still under investigation, but the termination or the change in the possibilities for sport, school and entertainment, has significantly affected their healthy life, including their physical activity, social contacts and psychological health. As a result of the aforementioned, we have defined an aim of the study to reveal the forms of physical activity of students from middle and high school age, as well as to follow the changes in that regard that the COVID-19 pandemic has caused.

Tasks of the study are as follows:

1. To reveal the forms of physical activity of students in grades 8 to 12 before and during the pandemic;
2. To reveal the level of the effect of social distancing measures on the physical activity of students;
3. To reveal some characteristics of the opportunities for engaging in physical activities during the restrictive measures;
4. To reveal the possibilities of improving the physical activities of the students.

Subjects of the study:
The study covers 160 school students (grades 8 to 12) of schools in the City of Sofia, big regional cities and smaller towns. Out of them 98 are girls (61%) and 62 - boys (39%). At the time of the study their age is from 13 to 19 years old (M=16,2; SD=1,42). The subjects, or their parents for those under 18 years of age, were informed on the aims and tasks of the study and participated on free will.
The distribution of the studied subjects according to demographics criteria is presented in Table 2.

Table 2. *Distribution of subjects according to demographics criteria*

Indicator	Characteristic	Number of subjects	Relative part	Total count (%)
Gender	Girls	98	61%	160 (100%)
	Boys	62	39%	
Grade	VIII	19	11.9%	160 (100%)
	IX	51	31.9%	
	X	34	21.3%	
	XI	28	17.5%	
	XII	28	17.5%	
Sport Activity	Practise sports	116	72,5%	160 (100%)
	Doesn't practise sports	44	27,5%	
Hometown	Sofia	60	37,5%	160 (100%)
	Major city	56	35%	
	Small town	44	27,5%	

METHODS

A questionnaire on the forms of physical activity - for the needs of the study a special questionnaire was developed that included many items to describe the physical activity before and during the restrictions. Beside the base characteristics such as age, gender, grade, hometown, there are also questions about the level of physical activity, the engagement in sports and the type of the sport. This method has been used with the goal to examine to what extent each of the characteristics is a premise for a change in the physical activity of the students.

The results of the study have been analysed according to the statistical requirements and with the use of the statistical software "SPSS for Windows" v23.0. The data was analysed by frequency distribution, descriptive statistics, and comparative analysis.

RESULTS

The collected results allowed us to understand the main types of physical activity before and after COVID-19, and to analyze the different demographic criteria and their effect.

The possibilities for physical activities of the students before the period of social restrictions are numerous and variable in type. The most reported physical activities are practicing sports and playing with friends in the free time (34%), daily walks (42,5%), and the participation in the PE classes (57%). Interesting is the option for trekking during the weekend and off days, where the reported results are extremely low - just 9,4% of the students have selected that option (Figure 1).

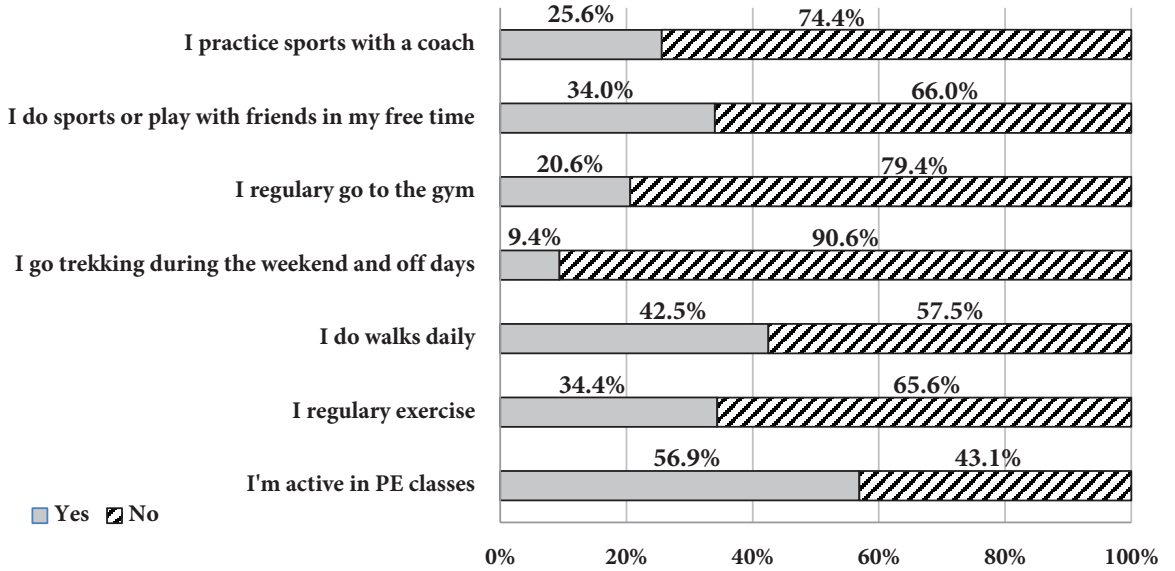


Figure 1. *Forms of physical activities before the restrictions*

Analyzing the results by gender, there are differences in some of the forms of activities. The results were analyzed by the Pearson's Chi-squared test. The girls were more inclined to participate in the PE classes ($\chi^2 = 4.2$; $\alpha = .04$), while the results for going to the gym were in favour of the boys ($\chi^2 = 6.2$; $\alpha = 0.01$).

According to age, there is statistically significant difference for practising sports under the supervision of a coach ($\alpha < .001$), that was tested with Mann-Whitney U test.

Analyzing the rank of the hometown, there are two responses that show significant differences. "I do sports or play with my friends in my free time" decreases with the increase of the rank of the hometown, with a significance level of $\alpha = .012$. The "I regularly go to the gym" shows larger values for the capital in comparison for those in the regional cities and even more - with the smaller towns. The statistical significance of this difference is $\alpha = .022$.

Another important moment of the study is the time that the students have been spending for physical activity (Table 3). For that reason the respondents have reported the total duration, which includes all the activities. The largest percentage of 60.4% are answers of 5 hours or less per week, followed by those of 6 to 10 hours per week (20.2%). Only

7 of the respondents have reported over 20 hours per week (4.4%). With the increase of the time for physical activity, differences by gender are observed. The boys are spending more time than the girls after the 15h/week value. The difference is significant with an α = .02 by Mann-Whitney's U test.

Table 3. *Reported physical activity duration per week*

Weekly duration	Up to 5 hours	97	60,4%
	6 - 10 hours	32	20,2%
	11 – 20 hours	24	14,9%
	21 – 40 hours	5	3,1%
	over 40 hours	2	1,3%

After the declaration of the pandemic and the enforcement of the social distancing measures, that aimed to slow down the spread of COVID-19, there was also a limitation on the possibilities for exercising and physical activities of students. In that aspect, the respondents answered the question "Now, under the restrictions, what are the possibilities for you to practice sports and physical exercises?". Analyzing the listed forms of physical activities, the ones that stand out are the possibility to do some exercises at home indoors (72.5%), to do exercises out in the yard (32.5%), and to participate in the online PE classes (30.6%). You can see the answers, split by rank of hometown, on Figure 2.

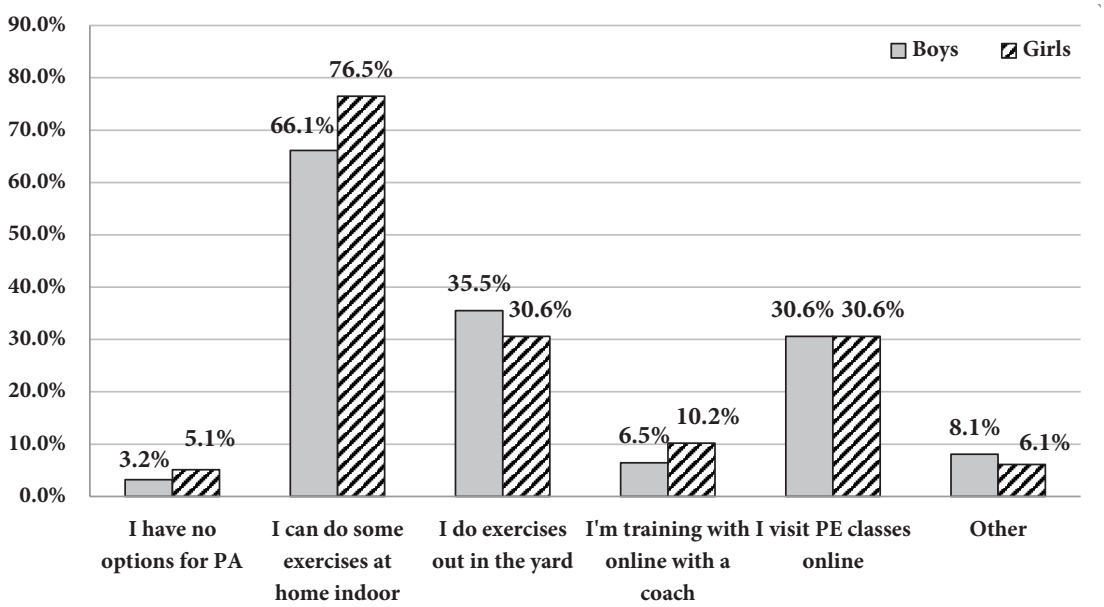


Figure 2. *Distribution of the forms of physical activity during the restrictions by rank of hometown*

The low percentage of respondents that have selected the option to do online training with a coach is also of interest - only 8.8%.

When analyzing the answers by segments, we can find statistically significant differences in the distribution of the "I can do some exercises at home indoor", proven by Mann-Whitney's U test, according to the rank of the hometown (α < 001), and the age of the respondents (α < .001). The percentage is decreasing with the lower ranks of the hometown and there is a peak at around the age of 15.

The other answer that shows significant difference is the "I do exercises out in the yard", where the significance level of the U test is α = .023 according to the rank of the hometown and α = 0.03 according to age. Going up the ranks of the hometowns, less and less respondents select this option. The distribution by age shows a peak at the 16-17-year-olds.

DISCUSSION

There are just a few respondents that select the option for trekking during the weekend and off days, as well as high percentage of students reporting that their physical activity duration per week is less

than 5 hours. That data is alarming, as the models of healthy behaviour from childhood often continue to adulthood (Dunton et al., 2020).

The forms of physical activities before the pandemic reveal differences by gender. The girls are more involved in the PE classes, while more boys report going to the gym. We can assume that this is due to the fact that the boys are more inclined to participate in organized sports and sport activities than the girls. This assumption is being backed by the report by Dunton et al. (2020).

The differences according to the age of respondents suggest that there is a peak of activity of the training with coach supervision at around the age of 15. Close to that age are also the peaks for physical exercises indoors or outdoors during the restrictions. That could be the result of the students participating in organized sports finding ways to continue to be active on their own during the pandemic.

The rank of the hometown characteristics plays a role in the distribution of the "I regularly go to the gym" option for the period before the pandemic, which diminishes with the lower rank of the hometown. Similar is the tendency for exercising indoors during the pandemic. In a reverse tendency exercising outdoors in the yard is increasing with the lower hometown ranks.

These results suggest that the types of physical activities are closely related to the available options. In the large cities there are more options to visit gyms, but there are also fewer houses that have a yard, which forces the respondents to do exercises at home during the restrictions.

The restrictions forced by the COVID-19 pandemic have affected the sport activity of children and adolescents. It also led to the introduction of programs and online services for streaming live or recording sport activities for adolescents, that were distributed on popular channels or platforms, such as YouTube, Instagram, Zoom, etc. (Dunton et al., 2020). In the meantime there are a very small percentage of the respondents selecting the option for online training under the supervision of a coach. The percentage of respondents, which have reported visiting the online PE classes, is also not sufficient. This may be due to the fact, that the study was conducted in the first months of the restrictions, when not all coaches and PE teachers were managing to implement these technologies in their work.

REFERENCES

Almonacid-Fierro, A., Ricardo Souza de Carvalho, Castillo-Retamal, F. (2021) The practicum in times of Covid-19: Knowledge developed by future physical education teachers in virtual modality. *International Journal of Learning, Teaching and Educational Research*. Vol. 20, No. 3, 68-83. https://doi.org/10.26803/ijlter.20.3.5

Blanco, C., Almagro, J., Zafra, M., Fernandez, M., Laguna, M., Martinez, A. (2020). Physical activity and sedentary lifestyle in university students: Changes during confinement due to the COVID-19 pandemic. *International Journal of Environmental research and public health.* Vol. 17, 6567.

Burgess, S., Sievertsen, H. (2020). Schools, skills, and learning: The impact of COVID-19 on education. *VOX, CERP Policy Portal*. https://voxeu.org/article/impact-covid-19-education

Chen, P., Mao, L., Nassis, G.P., Harmer, P., Ainsworth, B.E., Li, F.(2020). Coronavirus disease (COVID-19): The need to maintain regular physical activity while taking precautions. *Journal Sport Health Science*. Vol.9, 103-104.

Dunton, G., Do, B., Wang, S. (2020). Early Effects of the Covid-19 Pandemic on Physical Activity and Sedentary Behavior in Children Living in the U.S. *BMC Public Health* 20, article number 1352. https://doi.org/10.1186/s12889-020-09429-3

Guo, Y., Liao, M., Cai, W., Yu, X., Li, S., Ke, X., Tan, S., Luo, Z., Cui, Y., Wang, Q., Gao, X., Liu, J., Liu, Y., Zhu, S., Zeng, F. (2021). Physical activity, screen exposure and sleep among students during the pandemic of COVID-19. *Scientific Reports.* Vol 11 (8529). https://doi.org/10.1038/s41598-021-88071-4

Nielsen, G., Pfister, G.,Andersen, L. (2011). Gender differences in the daily physical activities of Danish school children. *European Physical Education Review*. 17(1) 69–90. DOI: 10.1177/1356336X11402267

Raiola, G., Aliberti, S., Esposito, G., Altavilla, G., D'Isanto, T., & D'Elia, F. (2020). How has the Practice of Physical Activity Changed During the COVID-19 Quarantine? A Preliminary Survey. *Physical Education Theory and Methodology*, Vol. *20*(4), 242-247. https://doi.org/10.17309/tmfv.2020.4.07

Rogowska, A., Pavlova, I., Kusnierz, C., Ochnik, D., Bodnar, I., Petrytsa, P. (2020). Does physical activity matter for the mental health of university students during

COVID-19 pandemic?. *Journal of Clinical Medicin.* Vol. 9 (3494); doi:10.3390/jcm9113494

Shahidi, S., Williams, J., Hassani, F. (2020). Physical activity during COVID-19 quarantine. *Acta pediatrica* published by John Wiley & Sons Ltd on behalf of Foundation Acta Paediatrica. Vol. 109, 2147-2148. DOI: 10.1111/apa.15420

Shepherd, H., Evans, T., Gupta, S., McDonough, M., Doyle-Baker, P., Belton, K., Karmali, S., Pawer, S., Hadly, G., Pike, I., Adams, S., Badul, S., Yestes, K., Sibley, D., Schneider, K., Cowle, S., Fuselli, P., Emery, C., Black, A. (2021). The impact of COVID-19 on high school students-athlete experiences with physical activity, mental health, and social connection. *Int. J. Environ. Res. Public Health.* Vol 18 (7), 3515. https://doi.org/10.3390/ijerph18073515

UNICEF. (2020). Indoor play ideas to stimulate young children at home.

Velde, G., Lubrecht, J., Arayess, L., Loo, C., Hesselink, M., Reijnders, D., Vreugdenhil, A. (2020). Physical activity behaviour and screen time in Dutch children during the COVID-19 pandemic: Pre-, during- and post-school closures. *Pediatric Obesity.* 2021;16:e12779. https://doi.org/10.1111/ijpo.12779

World Health Organization. (2010). Global Recommendation on Physical Activity for Health; WHO: Geneva, Switzerland, 2010; Vol. 60

WHO. (2020a). Overview of public health and social measures in the context of Covid-19. Interim guidance, May. WHO/2019-nCoV/PHSM_Overview/2020.1

WHO. (2020b). Coronavirus disease (COVID-19): staying active. https://www.who.int/emergencies/diseases/novelcoronavirus-2019/question-and-answers-hub/q-a-detail/be-activeduring-covid-19

Corresponding author:
Maria Boncheva
Department of Psychology, Pedagogy, Sociology,
National Sports Academy "Vassil Levski"
Sofia, Bulgaria
Email: maria.boncheva@nsa.bg
boncheva.dancheva.maria@gmail.com

 DOI: 10.37393/ICASS2022/106 207 - 213

TEACHERS' BEHAVIOR AND STUDENTS' DISCIPLINE

Stefana Masurska, Ina Vladova
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
This study aimed to investigate students' opinions (Grades VII, VIII, IX, X, and XI) regarding discipline in PE and sports lessons and whether it is influenced by the personality, professional qualities, and behavior of their PE teachers. We expected the results to provide information regarding students' discipline from their point of view. The study subjects were 209 students from 4 schools in the cities of Sofia (n=70) and Smolyan (n=139), Bulgaria. Of these, 58. 4% (n=122) were girls and 41. 6% (n=87) were boys, with 28.7% having a female teacher and the remaining students (n=149) conducted their PE lessons with a male teacher. Survey forms and questionnaires were prepared for the students to realize the objective and collect empirical information on the problem. The first subscale contained ten items the surveyed students used to rate their PE teacher (α= .738). The subjects' responses are reflected in a 5-point scale, The Likert Scale type, and indicate the frequency with which the students observe certain behaviors from the teachers. For each listed antecedent, there are two groups of dichotomous closed-ended questions based on alternative choices, YES and NO. The results were processed with mathematical and statistical methods of quantitative processing and analysis: frequency and variance and comparative analysis (Mann-Whitney) - for independent variables, according to a validated statistical procedure - using the statistical program "SPSS 21 for Windows". Ensuring good discipline in lessons depends on the professional skills of sports educators. Statistically, significant differences were observed in some of the indicators. Good discipline is helped by the teacher's rigor and good attitude towards the students. The teacher's friendly attitude, understanding, and support towards the students help to maintain better discipline in the lessons.

Keywords: *physical education and sports, classroom management, student's behavior*

INTRODUCTION

Physical education and sports are part of the compulsory general education in Bulgarian schools from first to 12th grade. To implement the learning tasks in the PE lesson smoothly, it is necessary to have and maintain good discipline throughout the lessons. This is important from a pedagogical point of view and needs to be a priority goal of the school, specifically of each teacher, to ensure a quality educational process. The teacher's personality and behavior, communication style, and the management of the lesson activities are the leading factors for students' well-maintained discipline (Vladova & Hristov, 2017).

Definition and nature of the term "discipline"

The term "discipline" is defined in the Bulgarian dictionary as *"a system of obligatory and established norms of behavior in a collective; awareness of and compliance with these norms"*, and also as *"Compulsory observance of the established order, rules, etc. by members of a group"* - in the Dictionary of Foreign Words in the Bulgarian Language (1982).

The word itself has Latin origins - from Lat. Disciplina, meaning "giving instruction, to teach" (Spokane Regional Health District) – in teaching, educators provide and implement educational influences to ensure students' good and appropriate discipline during the lesson.

Ensuring discipline involves complex interactions among teachers, students, school personnel, and the community (Buzzelli & Johnston, 2001). It is characterized by the fact that it is strictly individual, so it is not observed that all teachers use the same means and methods to achieve it throughout the learning process (Espelage & Lopes, 2013). According to Osher et al. (2010), discipline is one of the major factors influencing the quality and effective learning in a school setting. It is necessary, and students' compliance can often require a lot of energy on the teacher's part, take up a lot of lesson time, and sometimes even lead to the teacher experiencing an emotional breakdown.

Discipline is also seen as the suppression of basic desires (passions) – according to certain norms and requirements, it is a type of regulation of an individual's behaviors (Egleton, 2001).

School discipline: the establishment of order by the teaching and non-teaching staff of the school, incl. the developed and adopted written regulations (the rules of internal order), as well as the students' observance of certain principles and practices of conduct.

School discipline was not taught or studied until 1970. Before then, it was believed that with the accumulation of greater pedagogical experience, teachers would acquire the necessary skills and qualities and would be able to manage students' behavior to maintain discipline during lessons (Dimov, Atanasoska, Trajkovska, 2019).

The teacher is at the center of school discipline. The teacher creates and manages a system of actions and strategies, both preventative and intervening, to control and manage students' behavior (Ivanov, 2004).

Ensuring good discipline on school premises is primarily the teaching staff's responsibility and commitment. Authors from different schools and societies with different cultures share this opinion. They set the rules and parameters, and the students must follow them. Students need to be taught specific rules, precisely following them.

Maintaining good discipline during learning activities is essential because it is a prerequisite for a more complete and qualitative learning and teaching process. In this way, the lesson's objective is not compromised, and its density is not reduced. At the same time, the teacher does not waste valuable time creating order and observing the rules of good behavior on the part of the students. In the presence of good discipline, the relationships between the subjects involved are normal, and there are no conflicts between them.

Factors to ensure good discipline in PE lessons

The personality and the behavior of teachers, incl. authority; the methods and tools used by teachers; their attitude towards students; the professional and personal qualities that teachers possess; communication style; the educational influences implemented, the demands made on students, etc. are factors for good discipline in lessons. According to some authors (Todorina, 2005; Nikolaeva, 2010; Kon, 2011; Gabriel, 2012), it is the teacher who has a role to play in ensuring good discipline - when seen in the context of classroom management, the teacher is the manager of student behavior. Experimentally, it has been shown that there is a direct relationship and positive correlation between the individual manifestations of student discipline and the managerial profile of teachers (Nikolaeva, 2012). For good classroom "management" the teacher needs to have a set of skills and qualities: to control skillfully; to rule; to encourage student behavior and actions; to reprimand the behavior and actions of students; to show empathy and understanding; to be "broad-minded"; to be "open" to novelties and challenges; to manage the moods, attitudes, and relationships in the class; to create a supportive, inclusive environment for 'different' students (Valiavicharska, 2021). In addition to these qualities, we can add specifically for the PE teacher that it is necessary to have well-developed observation, well-developed communication, and emotional resilience, as Tosheva (2012) points out, including with means such as commands, gestures, orders, etc. Dunbar (2004) also maintains that teachers need specific skills to be good classroom managers. This requires them to have several critical skills and competencies: to be able to talk to students about all kinds of topics, befriend them, advise them, and be empathetic to what is going on in their lives. Thus, by establishing a friendship-like connection between the two parties and building trust, the chances of creating good classroom management increase (Dunbar, 2004).

Causes of non-compliance with school discipline: can be grouped as demographic or family reasons (including economic and social reasons); poor interpersonal relationships - "rejecting" some students due to aggressiveness and antisocial behavior; cognitive reasons; lack of conflict management and resolution skills on the part of school personnel (Satchel, 1992).

Aim and objectives of the study

Based on the above, this study aimed to investigate students' views on discipline in PE and sports lessons and whether it was influenced by their PE teachers' personalities, professional qualities, and behavior. We expected the results to inform us about the role of the PE teacher in maintaining good discipline in lessons. The task of the study was to establish the degrees of expression and interrelationships between the personal qualities of sports educators and their influence on the discipline of their students.

Studying this problem is essential because good discipline in lessons is a necessary prerequisite and factor for safe activities in students' active and intensive motor activity. At the same time, poor discipline during PE lessons significantly increases

the noise level in gymnasiums and outdoor playgrounds, which is a serious stress factor for all participants in the learning process. This, in turn, is also a prerequisite and a risk factor for traumatism during lessons.

METHODS

In order to solve the aim and set tasks, a complex empirical research methodology was applied, which included: theoretical and logical analysis of literature sources; methods for empirical data collection through a survey and a questionnaire, and mathematical and statistical tools for quantitative processing and analysis of empirical results. Frequency analysis, analysis of variance, and comparative analysis (Mann-Whitney) were applied for independent variables; internal consistency analysis of the scales (Cronbach's α) - to establish the scale's validity.

The results were processed according to a validated statistical procedure using the statistical program SPSS 25 for Windows.

Procedure

The study procedure was coordinated with school management and PE teachers. A few schools did not consent to be part of the study. For all students included in the survey informed consent from a parent was received for participation in the current study. There were 500 Questionnaires, but due to disagreement from principals, teachers, and parents (who gave their written consent for their child to be included in the study), the study was implemented with fewer than half of the planned participants.

Questionnaire

The questionnaire was conventionally divided into several parts: 5 questions of demographic nature (gender, age, grade, school, and locality) and specifying the gender of the PE teacher but not their age, which could be seen as a limitation of the study. Ten statements were also listed in tabular form to describe the teachers' perceived activities, how these behaviors influenced good discipline, and how much the students liked them. The responses of the subjects were reflected in a 5-point Likert-type scale (The Likert Scale), and the students indicated the frequency with which they observed certain behaviors on the part of their teachers, with 1 – I strongly disagree; 2 - I disagree; 3 - I neither agree nor disagree; 4 - I agree, and 5 - I completely agree. Two dichotomous scale statements are included with each of the ten enthymemes: *'I like this.'* and *'It helps better discipline'*.

Participants in the study

The empirical study included 209 students from two Bulgarian cities - Sofia 33. 5% (n=70) and Smolyan 66. 5% (n=139). The characteristics of the study subjects are presented in Table 1. They were aged between 12 and 18 years (M=14. 8; SD=1. 04). Of these, 58. 4% (n=122) were girls and 41. 6% (n=87) were boys and were students of VII to XI Grade.

Table 1. *Participants in the study*

Index	*Groups*	*Number (n)*	*Relative share (%)*
Gender	Women	122	58.4%
	Men	87	41.6%
Establishment	Sofia	70	33.5%
	Smolyan	139	66.5%
PE teacher	Woman	60	28.7%
	Man	149	71.3%

RESULTS AND DISCUSSION

Cronbach's Alpha = .738, a scale that examines the personality and professional skills of the PE teacher as a predictor of good lesson discipline, had an excellent internal consistency. Table 2 presents the results of the evaluations and the students' opinions on the importance of the teacher as a factor in maintaining good discipline in lessons.

Table 2. *Results of the student evaluation of the professional-personal qualities of the PE teacher*

Meaning	Mean; Standard Deviation	I like it	It helps better discipline
The teacher is honest and fair	M=4.01; SD=1.20	84.2%, (n=176)	80.9%, (n=169)
The teacher is demanding (strict) but good	M=3.60; SD=1.19	84.2%, (n=176)	85.2%, (n=178)
The teacher is demanding (strict) but does not behave well with us	M=2.00; SD=1.37	30.6%, (n=64)	29.7%, (n=62)
The teacher has a sense of humor	M=3.84; SD=1.29	80,9%, (n=169)	73.7%, (n=154)
The teacher is patient	M=3.75; SD=1.29	82.3%, (n=172)	77%, (n=161)
The teacher understands and supports us	M=3.73; SD=1.31	80.4%, (n=168)	82.8%, (n=173)
The teacher conducts interesting and fun classes	M=3.60; SD=1.39	78%, (n=163)	75.1%, (n=157)
Our relationship with the teacher is friendly	M=3.96; SD=1.24	88.5%, (n=185)	84.2%, (n=176)
The teacher is responsive	M=3.69; SD=1.24	81.8%, (n=171)	78.5%, (n=164)
The teacher mocks us	M=1.68; SD=1.24	32.5%, (n=68)	34.4%, (n=72)

An analysis of variance was performed to reveal the degree of expressiveness of the studied variables. According to the evaluations given by the students, their PE teachers were good professionals, and their relationships were good. The results of the descriptive statistics on the individual components showed close means above M=3. 60 for Min=1 and Max=5 (except for statements 3 and 10, which measured negative manifestations). Students had rather friendly relationships with their PE teachers (M=3. 96; SD=1. 24) and stated that they felt their support and understanding (M=3. 73; SD=1. 31). To the greatest extent, the evaluated teachers were honest and fair (M=4. 01; SD=1. 20). They were demanding and strict, but good (M=3. 60; SD=1. 19). According to a small proportion of the students surveyed, their teachers were demanding but did not behave well with them (M=2. 00; SD=1. 37) and a minority felt that teachers made fun of them (M=1. 68; SD=1. 24). These statements are also tied to the question of whether they liked the particular teacher's behavior and whether it helped to improve classroom discipline. Friendly teacher-student relationships also had the highest relative frequency as a behavior that was liked (88. 5% of students said they liked it) and 84. 2% said it contributed to better discipline, confirming Dunbar's (2004) views and Roggers' (2011) theory of the supportive discipline. Teacher demandingness is also a factor in compliance or non-compliance with good classroom behavior. When the teacher is demanding and, at the same time, behaves well with students, this turns out to be the factor that most influences students' behavior - 85. 2% of students thought so. And the opposite tendency - a strict and demanding teacher with a bad attitude toward students turns out to be a factor in non-compliance with good behavior and discipline. From the answers obtained from the students, we have the impression that the PE lessons were relatively interesting for them (M=3. 60; SD=1. 39) and according to 75. 1% of the respondents, this helped to improve classroom discipline. From our analysis of the literature on the issue, we found that when students are interested in the lessons and their discipline is at a reasonable level - interesting learning content and attractive teaching methods attract and hold students' attention (Ivanov, 2004). This was confirmed by this study, too.

As a result of the comparative analysis (Mann-Whitney test), some statistically significant differences were found in the factors of the gender of students, gender of teachers, and locality (Table 3).

Table 3. *Results of the comparative analysis*

	Meaning	Students' gender	Teachers' gender	City
1.	The teacher is honest and fain	-	(U=3360.000, p=.003)	(U=3696.500, p=.002)
2.	The teacher is demanding (strict) but good	-	(U=3132.000, p=.000)	(U=3378.500, p=.000)
3.	The teacher is demanding (strict) but does not behave well with us	(U=4127.000, p=.003)	-	-
4.	The teacher has a sense of humor	-	(U=3448.500, p=.007)	(U=3726.500, p=.004)
5.	The teacher is patient	-	(U=3839.000, p=.096)	(U=4078.000, p=.047)
6.	The teacher understands and supports us	(U=4515.000, p=.056)	(U=2767.500, p=.000)	(U=2801.500, p=.000)
7.	The teacher conducts exciting and fun classes	-	(U=3013.500, p=.000)	(U=3188.500, p=.000)
8.	Our relationship with the teacher is friendly	(U=4260.500, p=.010)	(U=3392.500, p=.004)	(U=3648.500, p=.002)
9.	The teacher is responsive.	-	(U=3583.500, p=.020)	(U=3917.000, p=.017)
10.	The teacher mocks us	(U=4149.000, p=.001)	-	-

The differential analysis of variance reveals the degree of expressiveness of the studied variables in the different groups (Table 4).

Table 4. *Analysis of variance on the factors "gender of the subjects", "gender of the teacher" and "locality of the subjects"*

	Meaning	Girls	Boys
3.	The teacher is demanding (strict) but does not behave well with us	M=1.72; SD=1.11	M=2.40; SD=1.60
6.	The teacher understands and supports us	M=3.60; SD=1.32	M=3.92; SD=1.27
8.	Our relationship with the teacher is friendly	M=3.80; SD=1.27	M=4.18; SD=1.17
10.	The teacher mocks us	M=1.40; SD=0.88	M=2.07; SD=1.53
	Meaning	**Female teacher**	**Male teacher**
1.	The teacher is honest and fair	M=4.37; SD=1.02	M=3.87; SD=1.23
2.	The teacher is demanding (strict) but good	M=4.00; SD=1.21	M=3.44; SD=1.15
4.	The teacher has a sense of humor	M=4.17; SD=1.14	M=3.71; SD=1.33
5.	The teacher is patient	M=4.00; SD=1.27	M=3.67; SD=1.29
6.	The teacher understands and supports us	M=4.28; SD=1.17	M=3.51; SD=1.30
7.	The teacher conducts interesting and fun classes	M=4.13; SD=1.28	M=3.39; SD=1.38
8.	Our relationship with the teacher is friendly	M=4.30; SD=1.11	M=3.82; SD=1.27
9.	The teacher is responsive	M=3.92; SD=1.37	M=3.59; SD=1.18
	Meaning	**Sofia**	**Smolyan**
1.	The teacher is honest and fair	M=4.36; SD=0.98	M=3.83; SD=1.26
2.	The teacher is demanding (strict) but good	M=3.99; SD=1.19	M=3.41; SD=1.15
4.	The teacher has a sense of humor	M=4.13; SD=1.20	M=3.70; SD=1.32
5.	The teacher is patient	M=3.99; SD=1.21	M=3.63; SD=1.31
6.	The teacher understands and supports us	M=4.31; SD=1.12	M=3.44; SD=1.30
7.	The teacher conducts interesting and fun classes	M=4.11; SD=1.32	M=3.35; SD=1.36
8.	Our relationship with the teacher is friendly	M=4.29; SD=1.12	M=3.79; SD=1.27
9.	The teacher is responsive	M=3.89; SD=1.39	M=3.59; SD=1.15

The comparative analysis showed statistically significant differences in the factor "sex of the persons examined". It appears that girls had almost no complaints about the behavior and attitude of their PE teachers. Still, at the same time, boys were more likely to feel that they had friendly relationships with their teachers and were more likely to feel understood and supported.

From the data presented in Table 4, it is noticeable that in the comparative analysis performed, the results for the factors "gender of the teacher" and "location of the subjects" were almost identical. It turns out that 85. 7% of the Sofia students surveyed have a female PE teacher. Compared to male teachers, in this study, women were more patient, honest, fairer, demanding, understanding, supportive, responsive, and with a more pronounced sense of humor. They conduct more engaging lessons and have friendlier relationships with students. Given that we surveyed students, we do not have information on the ages of their teachers, except one of the PE teachers from the town of Smolyan, who is pre-retired. The cross-tabulations revealed that his students were not sufficiently satisfied with their communication with him, and this may be where the observed statistically significant differences in the factors "gender of the teacher" and "location of the subjects" stemmed from.

According to Tarman, it is not only young and inexperienced teachers who face discipline problems but also those with experience (Tarman, 2016). The problems with younger teachers are caused primarily by the lack of sufficient experience, lack of respect and esteem from the students, and the choice of inappropriate methods and means to deal with discipline problems. On the other hand, young teachers are much more motivated and creative. They are more likely to come up with and use more exciting lessons, including innovative games, exercises, and teaching methods that appeal to students. It is common in our country's school education system that teachers with more experience and seniority are also at pre-retirement and retirement age, respectively. They often use outdated teaching methods and include the same games and exercises in their PE lessons. There is also a lack of variety and creativity in the presentation of learning material, which can lead to discipline problems in lessons. In addition, long years of school work are sometimes a risk factor for the manifestation of work stress, the so-called "work stress", "burnout", or professional burnout syndrome. The relationship between burnout syndrome and students' discipline can be two-sided. On the one hand, poor discipline can cause burnout among teachers; on the other hand, the syndrome can affect students' discipline and behavior in class because of teachers' unwillingness to work to maintain it. At this stage, these are only hypotheses, and it is desirable to test them empirically and/or experimentally.

REFERENCES

Buzzelli, C., & Johnston, B. (2001). Authority, power, and morality in classroom discourse. *Teaching and Teacher Education*, Vol. 17, pp.873-884

Dimov, B., Atanasoska, T., Trajkovska, D. (2019). School discipline and school indiscipline, Education – *Journal of Educational Research*, Vol. 1, No 1-2, pp. 92-99

Dunbar, C. (2004). *Best practices in classroom management*, College of Education, Michigan State University, pp. 1-5

Eggleton, T. (2001). Discipline in the Schools, Indiana, pp. 1

Espelage, D., & Lopes, J. (2013). *Indisciplina na escola [Indiscipline in the school]*. Lisboa: Fundação Francisco Manuel dos Santos.

Gabreil, E. (2012). *Classroom management and discipline without distress*, Department of Graduate Psychology & Counseling, Andrews University, p. 3

Ivanov, I. (2004). Disciplinarni modeli. V: *Obrazovanie I izkustvo*, tom I, Shumen, pp. 73-80 (*Иванов*, *И*. (2004). *Дисциплинарни модели*. В: *Образование и изкуство*, *том* I, *Шумен*, *стр*. 73-80)

Ivanov, I. (2010). Upravlenie na povedenieto v klasnata staja. V: *Sbornik materiali ot Purva proletna nacionalna konferencija na tema: "Utvurjdavane I povishavane avtoriteta na uchitelia v suvremenni uslovija"*, Varna, pp. 23-34 (*Иванов*, *И*. (2010). *Управление на поведението* в *класната стая*. В: *Сборник материали от Първа пролетна национална конференция на тема: „Утвърждаване и повишаване авторитета на учителя в съвременните условия"*, *Варна*, *стр*. 23-34)

Kon, A. (2011). *Mitut za disciplinata. Ot poslushani kum sutrudnichestvo,* Iztok-Zapad, Sofia // (*Кон*, A. (2011). *Митът за дисциплината. От послушание към сътрудничество, Изток-Запад*, *София*)

Nikolaeva, S. (2010). *Menidjmunt na klasa (Kakavo znae, moje I pravi uchiteliat kato efektiven menidjur na uchenicheskija klas)*, Sofia// *Николаева*, C. (2010). *Мениджмънт на класа (Какво знае, може и прави учителят като ефективен мениджър на ученическия*

клас), *Унив. изд. «Св. Климент Охридски»*, *София*

Osher, D., Bear, G. G., Sprague, J. R., & Doyle, W. (2010). How can we improve school discipline? *Educational Researcher*, pp. 48-49

Radeva, V. (2022). Bulgarski tulkoven rechnik, Iztok-Zapad, Sofia. // *Радева, В. (2022). Българския тълковен речник*, Изд. Изток-Запад, София.

Rechnik na chujdite dumi v bulgarskija ezik (1982). BAN, Sofia. // Речник на чуждите думи в българския език (1982)). Издателство „БАН", София.

Roggers B. (2011). *Classroom Behaviour:* A *Practical Guide to Effective Teaching, Behaviour Management and Colleague Support*, SAGE Publishing

Satchel, B. (1992). Increasing Prosocial Behavior of Elementary Students in Grades K-6 through a Conflict Resolution Management Program, ERIC, pp.13

Spokane Regional Health District (n.d.) What is Positive Discipline? https://srhd.org/media/documents/What-20is20Positive20Discipline1.pdf (accessed 2 April 2022)

Todorina, D. (2004). *Menidjmunt na klasa*, Interaula (Тодорина, Д. (2004). *Мениджмънт на класа*. Интераула)

Tosheva, Iv. (2012). *Burnout I uchitelskata profesija,* Sofia, Avangard Prima (Тошева, Ив. (2012). *Бърнаут и учителската професия,* София, Авангард Прима)

Valiavicharska, M. (2021). Menidjmunt na klasnata staja v uslovia na priobshtavashto obrazovanie (Валявичарска, М. (2021). Мениджмънт на класната стая в условия на приобщаващо образование, available at: https://azbukari.org/%D0%BC%D0%B5%D0%BD%D0%B8%D0%B4%D0%B6%D0%BC%D1%8A%D0%B%D1%82-%D0%BD%D0%B0-%D%D0%B0-%D0%BA%D0%BB%D0%B0%D1%81%D0%BD%D0%B0%D1%82%D0%B0-%D1%81%D1%82%D0%B0%D1%8F-%D0%B2-%D1%83%D1%81%D0%BB%D0%BE%D0%B2%D0%B8%D1%8F/ (accessed 2 April 2022)

Vladova, I., Hristov, N. (2017). Discipline in the classes on physical education and sport. *Sport and Business Scientific Journal in the Field of Sport and Business. Faculty of Sport „University Union-Nikola Tesla",* Belgrade, Vol. 3, pp. 43-47

Corresponding author:
Ina Vladova, PhD
Psychology, Pedagogy, Sociology Department
National Sports Academy "Vassil Levski"
Sofia, Bulgaria
E-mail: inavladova@nsa.bg

PHYSICAL EDUCATION ONLINE TEACHING MODEL IN SCHOOL EDUCATION SETTINGS

Enis Bellova, Eleonora Mileva
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
Blending learning is a teaching method due to a combination of tradition teaching method combine will information technology communication. The COVID-19 pandemic gave us the possibility to increase the use of this new method to deliver physical education lessons. The purpose of this literature review is to gather information on the advantages or disadvantages of using physical education online teaching model. The collection of literature studies was carried out using a database search tool using keywords such as: COVID-19 pandemic, physical education lesson, teacher perception, blending learning disadvantages. From the research conducted, 45 research articles were identified. In the second phase of the research, the key words were added: motivation and perception. At this final search a total of 10 scientific articles were identified, where it was used in this literature review. Results from this literature review show that physical education online teaching method has a lot of benefits in managing PE classes. The results from this review show that there is no a unique consensus about the percentage of advantage or disadvantages using this PE online teaching method. This method although has a lot of benefits more research finding are needed about the level of self-motivation as from teacher and from students.

Keywords: *online, teaching method, physical education, students*

INTRODUCTION

The COVID-19 pandemic has drastically reduced physical activity (PA) behaviors of many people. Physical education (PE) is considered one of the privileged instruments to promote youths' PA. Blended learning is a teaching style that combines traditional and current technology-based teaching methods. Challenged by the argument around the concept of 'blended' being ill defined, and also given the lack of practical 'blended' experiences in physical education teacher education this paper aims to explore physical education teacher educators' and pre-service teachers' enactment and experiences of an integrated approach to blended learning. A plethora of new terms and digital pedagogies have been making recent headlines in higher education with the promise, or threat, that digital technology will revolutionize the way in which universities operate (Calderón et al., 2020).

Blended learning is part of this digital revolution and institutions of higher education worldwide are increasingly adopting it as a new mode of delivery. The exposure of blended learning as central to mainstream higher education has been heightened exponentially during the COVID-19 pandemic. The Ministry of Education has provided cloud educational resources and private online learning resources, platforms, and tools to schools at all levels (Zheng et al., 2021). According to a United Nations report by the time of mid-April 2020, 94% of learners in more than 200 countries around the world have been affected. The government provides abundant teaching resources, but the implementation of distance teaching in college physical education is still faced with many problems. The state of emergency, as a result of the COVID-19 pandemic, has completely changed the education system in Bulgaria. Physical education and sports training have been transformed into distance and online education and training (Ivanova & Mileva, 2021). The COVID-19 pandemic gave us the possibility to increase the use of this new method to deliver physical education lessons. The purpose of this literature review is to gather information on the advantages or disadvantages of using physical education online teaching model.

METHODS

The electronic search of scientific works was carried out using digital databases such as ScienceDirect, Google Scholar, and PubMed and databases using Jabref software. The search for scientific papers was carried out using keywords that are related to this literature review. In this phase the collection of literature studies was carried out using a database search tool using keywords such as: COVID pandemic, physical education lesson, teacher perception, and blending learning disadvantages. From the research conducted, 45 research articles were identified. In the second phase of the research, the keywords were added: motivation and perception.

In this final search, a total of 10 scientific articles were identified, where it was used in this literature review. Papers that were published in English languages were included in the study.

RESULTS

In this section we are presented the most findings from the authors with the work done within the scope of this literature review.

The study of López-Fernández, et al. (2021) aims to explore high school physical education teachers' perceptions of the potential, advantages, and disadvantages of blended learning. Based on the survey, the high school PE teachers obtained higher mean scores than the mid-point of the measurement scale (4.14 out of 5) with regard to a greater dedication given with the blended learning model than the face-to-face one. Indeed, 127 (72.99%) teachers showed their agreement with a higher dedication, while 31 (17.82%) indicated a perception of neither agreement nor disagreement, and 16 (9.20%) teachers reported their disagreement. These results may guide both present and future policies and procedures for blended physical education in high schools. The authors conclude that more research is needed to analyze the usefulness of blended learning.

The study by André et al. (2021) examines the use of blended professional development (BPD) to introduce a physical education pedagogical model to a primary school physical education teacher. This study sought to contextually describe how a BPD in Student-Designed Games approach was designed and delivered, and identify how the BPD was aligned with O'Sullivan and Deglau (2006) Principles of PD Design and Delivery. Data collection included lesson plans, observations and interviews. Data analysis was undertaken through the BPD in-depth description and systematic process of deductive analysis using O'Sullivan and Deglau (2006) as the theoretical framework. Three key finding emerged relating to empowering the teacher, meaningful learning in contextualized environments, and ongoing support.

The aim of the research by Ivanova & Mileva (2021) was to study the competencies of PE teachers for the implementation of online teaching. The study was conducted on 138 teachers, of whom 100 were female and 38 were male. The teachers were aged from 24 to 68 years old, with different pedagogical experience. A specially developed international questionnaire with closed questions was applied. Results show that teachers rated online teaching in physical education and sport as relatively good (47.1%) and very good (45.7%). There were also 21.5 percent of respondents who stated the current online physical education training was "poor" or "very bad." The challenges that preceded the establishment of online learning at school were most likely not insignificant.

Study by Gobbi et al. (2020) aimed to investigate the effects of lockdown on PE teachers' behaviors promoting their students' out-of-school PA and differences between three European countries. A sample of 1146 PE teachers (59.5% females) from France, Italy, and Turkey answered an online questionnaire. French and Italian teachers increased some behaviors, while Turkish teachers showed opposite trends. The study was developed in accordance with the principles of the Declaration of Helsinki for the protection of human rights. PE teachers' answers were obtained using an anonymous questionnaire and accessed once by participants via a designated link. Results showed that French teachers reported a higher frequency of behaviors guiding students to engage in PA ($p < .01$) compared to those of teachers from the two other countries, which did not differ from each other.

This article (Roe et al., 2021) shed lights on the way Covid-19 impacted the physical education activities of Norwegian school's systems especially in young children in Grades 1-10 across Norway. The authors have investigated the estimated physical activities the children were engaged to, during the homeschooling period. In this study, the authors map the parents and teachers' point of view regarding the challenges and benefits of homeschooling. Based on the parents' survey, 23% of the students in lower secondary school have been physically active for less than 15 min each day during school hours, with the exception of potential physical exercises given by their PE teacher. Students in Grades 1–4 (5–10 years of age) were the most active, and 43% of these parents stated that their child was physically active for more than 60 min each day. The same was true for only 18% of the students in lower secondary school.

The purpose of this study (Rahayu et al., 2020) is to see how students and teachers respond to the

use of blended learning in physical education classes. Three different blended learning designs were tested to see which the best for particular physical education topic was, and then each design was implemented into lesson plans. The total number of participants in this study is 681. The data was collected through in-depth interviews among physical education teachers and high school students in Semarang. Results show that blended learning has many advantages, including flexibility in terms of distance to learn and can provide opportunities for students to interact with teachers and other students. It is able to provide the same learning outcomes even beyond traditional teaching. Regardless the design of blended learning, it takes together blended learning is applicable for physical education learning process as seen in the data that 89% of participant had agree and only 11% disagree.

The study by Williams (2013) sought to describe online secondary physical education instruction through the lived experiences of four teachers who were doing just that. A group of four experienced online secondary PE teachers from three different virtual school organizations made up the participants for this study. The purpose of this study was to describe the practices, experiences, and perspectives of online secondary PE teachers with regard to online PE teaching. All of the teachers interviewed have utilized non-traditional methods of communication and instruction with their online students, from text messages and e-mails to virtual webinar sessions. The participants implicitly shared that they generally frame their online PE teaching around constructivist theories of education practice, and they each gave examples of students' improved health habits and overall course completion successes within the online PE venue due to individualized instructional practices.

The research by Silva et al. (2021) addresses the challenges presented by the coronavirus pandemic in Brazil, questioning the strategies and the dilemmas shown by teacher-researchers in Physical Education in tackling Covid-19 (SARS-CoV2). The main objective of this article is analyzing the pedagogical experiences of teacher-researchers–teachers from state-owned schools and university researchers–in four Brazilian states. The purpose of the intervention project is to collaborate with the practices of Physical Education teachers seeking to prevent, identify, and report on cases of Covid-19 among students and their family members. Teachers in Covid-19 were asked to recreate the pedagogical creations themselves to keep their students' learning pace within the process of schooling. Many teachers highlighted the lack of autonomy for this recreation as the administrative staff does not encourage dialogue to foster teacher collaboration. The Covid-19 pandemic has had significant social impacts, such as the sudden interruption of basic education activities in Brazil, due to the need for social isolation.

This study (Korcz et al., 2020) evaluates the approach of PE teachers across Europe on the online PE model, the advantages and disadvantages as well as the quality of implementing the blended model in primary and secondary schools in Poland, Bulgaria, Kosovo, Croatia, Macedonia and Turkey. The study analysis the time allocation of physical activities per week by making a comparison between the countries. The level of technology used to conduct the PE lessons during homeschooling is also evaluated in this study. The study showed different approaches of PE teachers in different countries. Countries like Poland, Croatia and Bulgaria responded more positively to the online PE model unlike the negative evaluation of PE teachers of Turkey, North Macedonia and Kosovo. Several factors affect this result including prior experience with technology in PE classes, level of technology, country approach to online teaching, etc. Other possible factors are the work experience of the PE teachers, their level of IT knowledge and adaptability to the new technologies as well as the tech equipment at their disposal. The major concerns during online PE teaching were identified in terms students safety, intellectual property of resources, and quality of curriculum delivery.

DISCUSSION AND CONCLUSIONS

Results from this literature review show that physical education online teaching method has lots of benefits in managing PE classes. The results from this review show that there is no a unique consensus about the percentage of advantage or disadvantages using this PE online teaching method. This method although has a lot of benefits more research finding are needed about the level of self-motivation as from teacher and from students.

Regarding teamwork and coordination with other teachers, 83 (47.70%) teachers strongly agreed that

teamwork and coordination with other teachers may have helped teachers to deal with the challenge of blended teaching. As a matter of fact, 42 (21.14%) teachers positioned themselves as neither agreeing nor disagreeing, while 49 (28.16%) teachers disagreed with this point (López-Fernández et al., 2021).

The study (André et al., 2021) presented in this paper demonstrated that PD leaders and the teacher were able to go through different stages when implementing the BPD. This study also reinforces the premise that the teacher as an active learner and ongoing support were key elements for the implementation of the new teaching approach. There is a need to consider the implication of scaling up such projects in order that more teachers can be included in similar PD opportunities. Different age groups or delivering different student-centered approaches could also be explored. Future projects should be more attentive to how students can become part of the relational process of developing, delivering and reviewing similar PD activities.

It should also be remembered that the teachers were working entirely online for the first time, which required significant preparation and adaption to the conditions and educational environment. There is a reduced motivation for work in an online environment by physical education teachers. At the same time, sports pedagogues have significantly improved their skills in working with new technologies during the pandemic (Ivanova & Mileva 2021). Data from the study of Gobbi et al. (2020) showed that Italian teachers increased the encouragement of self-monitoring and reduced guidance, but there was no difference for the promotion of goal-setting. Turkish teachers significantly reduced the frequency of all the three behaviors.

The quantitative findings (Roe et al., 2021) suggest that the students have been less physically active during the period of homeschooling than they usually are when they attend school. The older the students are, the more they have had a sedentary lifestyle involving little or no PA. The teacher survey also confirmed that PE has not been a priority compared to other subjects, suggesting less PA for a majority of the students.

The response of students and teachers to the use of blended learning in physical education (Rahayu et al., 2020) class is answered by four indicators (Ease of using media, of accessing media, of operating media; User satisfaction) determined in this research. Blended learning has accepted very well both by students and PE teachers. Through blended learning methods students are able to increase their social sense towards peers through this learning method compared to traditional learning and full online learning.

The results of this study (Williams, 2013) support the premise that online secondary-level PE instruction has been a viable option for some teachers. Analysis of the data showed that these online PE teachers had similar pathways to the online settings; they provided individualized instruction to their students.

The teachers (Silva et al., 2021) showed common difficulties, such as social distancing, change of their daily teaching routine, and coping with being afraid of the uncertainty. The teachers concluded that there is a lack of activities in Physical Education classes by this method hence this kind of education is not effectively implemented.

The study (Korcz et al., 2020) showed different approaches of PE teachers in different countries. Countries like Poland, Croatia and Bulgaria responded more positively to the online PE model unlike the negative evaluation of PE teachers of Turkey, North Macedonia and Kosovo. Several factors affect this result including prior experience with technology in PE classes, level of technology, country approach to online teaching, etc. Other possible factors are the work experience of the PE teachers, their level of IT knowledge and adaptability to the new technologies as well as the tech equipment at their disposal. The major concerns during online PE teaching were identified in terms students safety, intellectual property of resources, and quality of curriculum delivery.

REFERENCES

Andre, M and Vidoni, C & Fitzgerald, H. (2021). *Blended professional development in physical education: merging long-distance with face-to-face ongoing support. Journal of Physical Education and Sport,* 21 (2). 956-965. DOI: https://doi.org/10.7752/jpes.2021.02119

da Silva, A. J. F., da Silva, C. C., Tinôco, R. de Gois, de Araújo, A. C., Venâncio, L., Neto, L. S., Freire, E. dos Santos & da Conceição, W. L. (2021). Dilemmas, Chal-

lenges and Strategies of Physical Education Teachers-Researchers to Combat Covid-19 (SARS-CoV-2) in Brazil. *Frontiers in Education*, 6 ttps://www.frontiersin.org/articles/10.3389/feduc.2021.583952 DOI=10.3389/feduc.2021.583952

Calderón, A., Scanlon, D., MacPhail, A. & Moody, B. (2021). An integrated blended learning approach for physical education teacher education programmes: teacher educators' and pre-service teachers' experiences. *Physical Education and Sport Pedagogy*, 26:6, 562-577, DOI: 10.1080/17408989.2020.1823961

Gobbi, E., Maltagliati, S., Sarrazin, P., di Fronso, S., Colangelo, A., Cheval, B., Escriva-Boulley, G., Tessier, D., Demirhan G., Erturan, G., Yüksel, Y., Papaioannou, A., Bertollo, M. & Carraro, A. (2020). Promoting Physical Activity during School Closures Imposed by the First Wave of the COVID-19 Pandemic: Physical Education Teachers' Behaviors in France, Italy and Turkey. *Int J Environ Res Public Health*. 17(24): 9431. Doi: 10.3390/ijerph17249431. PMID: 33339228; PMCID: PMC7767079.

Ivanova, V. & Mileva, E. (2021). Competencies of physical education teachers in conducting online education. *Proceedings of CBU in Social Sciences*, 2, 167-171. https://doi.org/10.12955/pss.v2.217

Korcz, A., Krzysztoszek J., Łopatka, M., Popeska, B., Podnar, H., Filiz, B., Mileva, E., Kryeziu, AR. & Bronikowski, M. (2021). Physical Education Teachers' Opinion about Online Teaching during the COVID-19 Pandemic—Comparative Study of European Countries. *Sustainability*. 13(21):11730. https://doi.org/10.3390/su132111730

López-Fernández, I., Burgueño, R., & Gil-Espinosa, F. J. (2021). High School Physical Education Teachers' Perceptions of Blended Learning One Year after the Onset of the COVID-19 Pandemic. *International journal of environmental research and public health,* 18(21), 11146. https://doi.org/10.3390/ijerph182111146

Roe, A., Blikstad-Balas, M. & Dalland, CP. (2021). The Impact of COVID-19 and Homeschooling on Students' Engagement with Physical Activity. *Front Sports Act Living*. 26;2:589227. doi: 10.3389/fspor.2020.589227. PMID: 33585811; PMCID: PMC7873937.

Rahayu, T., Arif Ali, M., Koenen, K., Blume, A., Anggita, G. M., Castyana, B., & Raharjo, H. P. (2020). Blended Learning as The New Innovation in Physical Education Class. *Proceedings of the 5th International Seminar of Public Health and Education,* ISPHE, Universitas Negeri Semarang, Semarang, Indonesia, doi={10.4108/eai.22-7-2020.2300318}

Williams, L. (2013). *A case study of virtual physical education teachers' experiences in and perspectives of online teaching*. University of South Florida.

Corresponding author:
Enis Bellova
Ph.D. Student
Department of Psychology, Pedagogy and Sociology
National Sports Academy "Vassil Levski"
21, Acad. Stefan Mladenov str.
Studentski grad, Sofia 1700, Bulgaria
E-mail: enisbellova@yahaoo.com

A GLANCE OF PHYSICAL EDUCATION TEACHER'S SATISFACTION WITH THEIR PROFESSION IN ALBANIA

Florian Muca
National Sports Academy„Vassil Levski", Sofia, Bulgaria

ABSTRACT
Recognizably the teachers' profession is important in shaping the knowledge and skills of youth. At equal importance is teachers' satisfaction and motivation related to their professional activity for overall quality outcomes in the education process. Certainly, in the past, also in the modern time, the teachers' role is incredibly significant and linked to the prosperity of a nation. The aim of this study was to take a glance in Physical Education (PE) Teachers' satisfaction in relation with their professional activity. Participants in this research study were (N=88) PE teachers from various levels of professional qualification, who led classes in physical education and sports in the Albanian school system. A modified questionnaire with 22 items related to satisfaction with the teaching profession was applied. The statistical instruments for this study were: descriptive analysis, factor analysis principal component analysis.
The following five factors related to the satisfaction of the profession were identified: (a) professional relations, (b) professional development and educational reforms, (c)organization working conditions, (d) social working conditions, (e) salary, and insurance. The items with the highest values were: - professional relations with colleagues, professional relations with school management, evaluation of school management at work, and opportunities to participate in the education and personal development of youth. In contrast, the items with the lowest values were the amount of payment, working conditions and facilities for educational activity, reforms in education, social and health insurance.
This study found that factors related to internal educational setting and professional environment have the greatest impact on teachers' satisfaction. On the other hand, external factors contribute to teachers' dissatisfaction such as salary, health insurance, working conditions, facilities, and reforms in education.

Keywords: *Teacher, Profession, Physical Education, Job Satisfaction*

INTRODUCTION

Worldwide the teachers' role is incredibly significant and key to the prosperity of a nation. The teacher's profession is important in developing the knowledge and skills of youth. Equally important is teachers' satisfaction and motivation related to their professional activity for overall quality outcomes and educational process. Researchers have studied and shown evidence that students of teachers who are pleased with their job, feel better overall. (Collie, Shapka, & Parry, 2012; Split, Koomen, & Thijs, 2011)

Job satisfaction has an enormous impact on employees, the level of their satisfaction has an impact on productivity, and therefore their ultimate performance. Aziri B. (2011) considers job satisfaction as a complex issue that many administrators face when it comes to managing their employees. indicated that job satisfaction is linked to the quality of life and depends on factors that influence the quality of work of the individual.

Evans (1997) defines job satisfaction as "a state of mind determined by the extent to which the individual perceives his/her job-related needs to be met"(p.328).

In addition, Schultz (1982) stated that job satisfaction is related to the psychological attributes of people toward their work. According to, Spector (2003) job satisfaction is expressed by the nature of the work and the feelings of the employees.

However, despite the definitions, the role of teachers toward students' outcomes is globally recognized, and the question whether teachers are satisfied with their working environment is usually overlooked. (Toropova et al., 2021)teacher job satisfaction merits closer attention. Not only is job satisfaction closely related to teacher retention, but it also contributes to the well-being of teachers and their students, overall school cohesion and enhanced status of the teaching profession. This study investigates the relations between teacher job satisfaction, school working conditions and teacher characteristics for eighth grade mathematics teachers. The study employs TIMSS 2015 (Trends in International Mathematics and Science Study. Other studies define teacher job satisfaction in relation to

their professional activity as multidimensional involvement, which contributes directly to the teachers' well-being and makes them less predisposed to stress and burnout. (Kyriacou & Sutcliffe, 1977; Skaalvik & Skaalvik, 2011)

According to Toropova et al. (2021) job satisfaction is closely related to teacher retention, teacher shortage, and turnover which now is an international problem, and it does contribute to harmonizing the teachers' well-being, their students learning, school environment and culture, and an improved status of the teaching profession.

Teachers' well-being may be related to the attrition of qualified teachers from the profession that seems to be a growing problem which is also linked with increased teacher turnover (European Commission, 2018; Ingersoll, 2017).

As shown above, job satisfaction has attracted many researchers to study the phenomenon and the relationship it plays in the social and professional context, in addition, Susnjar& Zirnani 2005, present job satisfaction as a general attitude toward work and based on factors that influence it such as: payment, work, opportunities for promotion, supervisors, and colleagues. Other authors have approached in different constructs to define it, yet job satisfaction remains difficult and ambiguous to define it clearly.

Similarly, Mileva (2020), states that job satisfaction is not only a result, but it also has a significant impact on a person's future activity and his/her personal, social and professional development.

Albanian Education System in the post-communist era has gone through many significant changes and challenges for the creation of a stable political cohesion and a balanced modern economy.

However, struggles for establishment of democratic and economic stability in Albania have provided the conditions for the tenacity of corruption in public life without excluding the education system. Though, despite the concerns and possibilities for corruption in the education system, there is undeniable Government recognition and commitment to the importance of education in Albania. Pre-university education is provided for free to all until age of 16. Most of school education is provided through state/public sector, though there is increased private provision. In higher education, public universities provide most of the university education, and there has a significant growth of private higher education provision. ("The Albanian education system - OECD iLibrary", n.d.)

Although job satisfaction is a multifaced matter, we assume that a variety of factors influence the satisfaction and dissatisfaction of teachers linked with their professional activity. Contributors of those factors and other possibilities that happen in the teachers' social and professional life vary from various circumstances. Therefore, PE teachers as a special subject were the subject of research, and the aim of the study is to take a glance and maybe understand the nature of the factors contributing to their satisfaction and dissatisfaction linked to their professional activity.

METHODS

This study aimed to investigate PE teachers' satisfaction with their professional activity. In this study a sample of (N=88) PE teachers of Albanian education system 30% Female and 70% Male were included. Teachers surveyed were from elementary, lower secondary and secondary classes, and from three main cities (Elbasan, Shkoder, Tirana). Schools and teachers were randomly selected, and respondents were specialists in physical education from elementary (grades 1-5), middle school (grades 6-9) , and high school (10-12) grade level.

The surveyed teachers were in the age range 22 – 62 years old. Teachers were from various levels of experience and qualifications, and many of them 56% were young teachers with 5 years of experience qualified teacher, 25% were specialist teachers with 10-20 years of experience and 18% were more experienced with more than 20 years. Most teachers surveyed in relation to academic achievement had a master's degree 77%, and 16% with bachelor's degree, 7 % did not have a degree yet.

A modified questionnaire developed by Tosheva, (2003) and modified by Ivanova & Mileva (2019), Mileva et al. (2020) with 22 items related to satisfaction with the teaching profession was applied. The Likert scale from 1 to 5 (1 – lowest level and 5 – highest level) for evaluation of various levels of teachers' satisfaction was applied. The items were

focused on various aspects of the profession correlated to the teachers' satisfaction.

The statistical instruments applied for this research were: variance analysis (mean and standard deviation), factor analysis (principal component analysis), and Cronbach's Alpha. The data were processed using SPSS software.

RESULTS AND DISCUSSION

In this study N=88 teachers were involved, 30% female teachers and 70% male teachers. Teachers' job is a regulated profession by law in Albania, however the path to become a teacher is a long way. Nevertheless, many years to become a teacher may contribute to making this profession less appealing for the new PE teacher candidates. Teachers in this study varied in age and educational background, and most of them had master's degree. Most teachers surveyed in relation to academic achievement had a master's degree 80%, and 12% with bachelor's degree, 7 % did not have a degree yet. The number of teachers with master's degree was an expected result and it is related to normative documents and requirement form government which explains that a teacher candidate must finish the master's degree before applying for teacher's license.

The age profile of surveyed teachers was in the range from 22-62 years old. There was somehow a fair distribution of age which nearly 65% where young teachers from 22–40-year-old and over the age of 41 were 35%.

There are three categories of career and professional qualification: (1) "Qualified" Teacher – after 5 years of experience; (2) "Specialized" Teacher – After at least 10 years of practice; and (3) "Master" Teacher after at least 20 years of experience. Such promotion is connected to pay raise to help differentiate the teachers salaries by professional merit.

From a statistical point of view in relation to satisfaction with professional activity, using the factor analysis as principal component analysis with Varimax rotation the following five factors were identified and explained 70.5 % of total variance.

(1) "Professional relations" explained with 41.6 % of the total variance
(2) "Professional development and educational reforms" explained with 9.4 of the total variances
(3) "Organization working conditions" explained with 9.1% of the total variance
(4) "Social Working Conditions" explained with 5.6% of the total variance
(5) "Salary and Insurance" explained with 4.7% of total variance

The results from factor analysis were presented in Figure 1.

Cronbach's alpha was used to assess the reliability of the questions and the analysis for the five items tested showed to have relatively high consistency-Cronbach's alpha = .810

The first scale named "Professional relations" had relatively high reliability level – Cronbach's alpha = .815

The second scale named "Professional development and educational reforms" had high level of reliability - Cronbach's alpha = .876

The third and fourth scale named "Organisation working conditions" and "Social working conditions" had similarly high levels of reliability of Cronbach's alpha = .800, and =810.

The fifth scale named "Salary and insurance" had an acceptable reliability level of Cronbach's alpha = .615

After all the data presented, it shows that teachers were most satisfied with professional relations with colleagues and school management, and relatively well with social working conditions, *duration of holidays, duration of working hours, and possibility to participate in education and personal development of youth.*

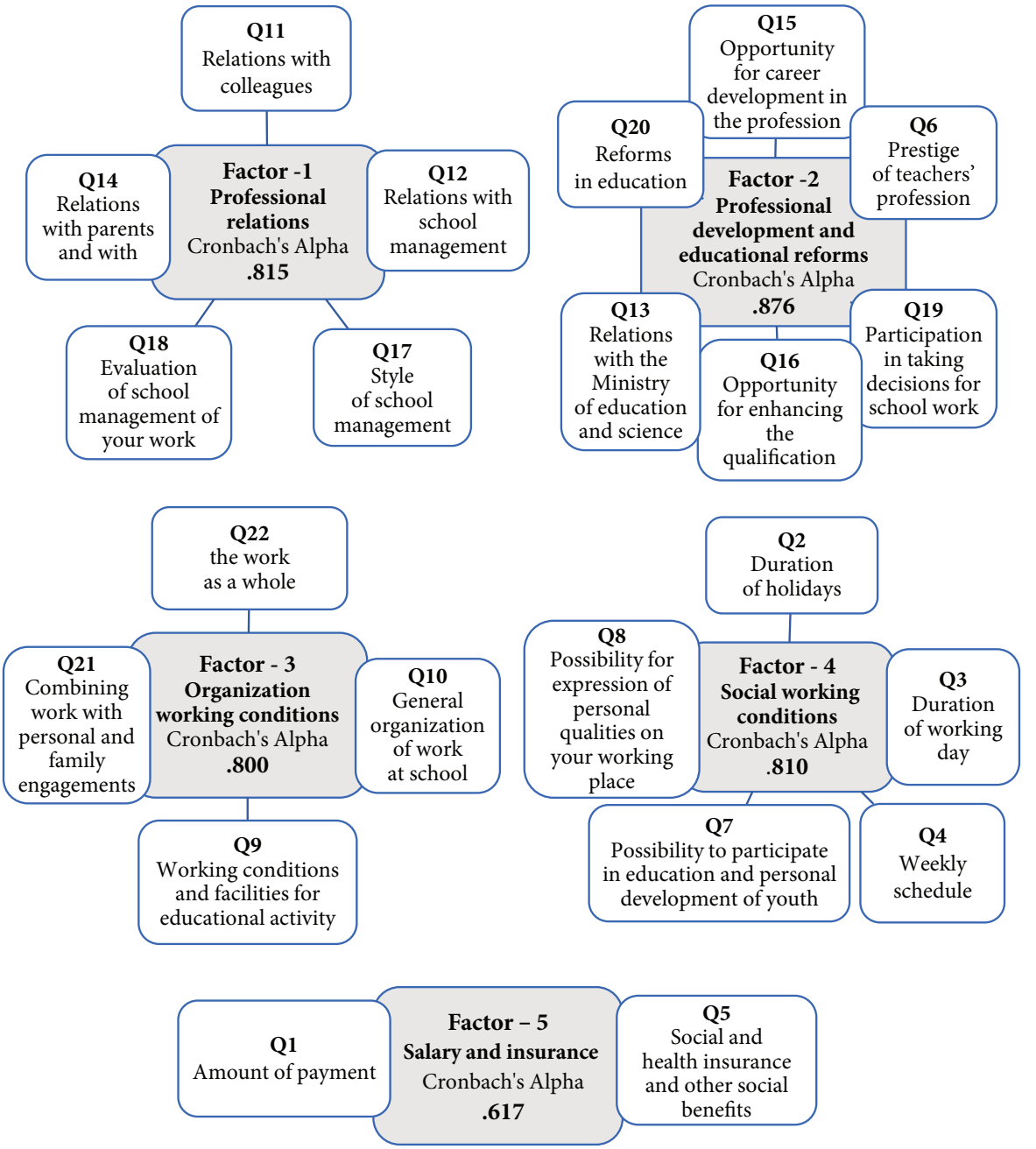


Figure 1. *Explanation of factors connected to teachers' satisfaction with their professional activity*

It was positive fact to see that internal relations and communication in educational environment with colleagues and school administration had a great impact. Such social workplace creates opportunities to work in a cohesive environment which may contribute to the positive wellbeing of the staff, and reduced level of stress.

Other items connected to level of PE teacher satisfaction linked with social working conditions, such; *pedagogical activity and weekly schedule, duration of working day, prestige of teachers 'profession– shows to be nearly average.*

The items with lowest values were those related to *payment of teachers, working conditions and facilities for educational activity, reforms in education, health insurance and health benefits*. All these results may correlate with when they are put in context of the current social and economic situation of the country. Albania continues to struggle for establishment of democratic and economic stability, but recently starting the path and aspiration to join EU, should provide the conditions to resolve the corruption in public life without excluding the education system Similarly, from a study of Gospodinov (2013)

showed relatively good overall level of satisfaction, but the " the payment" was the lowest. The negative influencing factors to job satisfaction of teachers from this study were "their salary".

CONCLUSIONS

This study found that factors related to internal educational setting and professional environment have the greatest impact on teachers' satisfaction. On the other hand, external factors contribute to teachers' dissatisfaction such as salary, health insurance, working conditions, facilities, and reforms in education. The current reforms in education may have their positive outcome in paper, but on the other hand their uncertainty is lacking in implementation. The overall satisfaction of teachers is also linked with incentives of government. Another concern is also the improvement for quality of teaching in Albania, but also the drop out of teachers who leave the country for better life abroad. Therefore, introducing economic incentives such as higher salaries and increased retirement benefits for teachers, better working conditions will contribute to retention of teachers and increasing motivation for their professional activity. Also, professional development through quality training and professional development would increase the confidence and desire for their profession.

REFERENCES

Aziri B. (2011). Job Satisfaction: A Literature Review Management Research And Practice. 3 (4): 77-86.

Collie, R. J., Shapka, J. D., & Perry, N. E. (2012). School climate and social–emotional learning: Predicting teacher stress, job satisfaction, and teaching efficacy. *Journal of Educational Psychology*, *104*(4), 1189-1204. https://doi.org/10.1037/a0029356

European Commission/EACEA/Eurydice. (2018). Teaching careers in Europe: Access, progression and support. Eurydice Report. Luxembourg: Publications Office of the European Union.

Gospodinov, D. (2013). Udovletvorenost ot truda pri uchitelite – resultati ot provedeno empirichno izsledvane. [Teachers' job satisfaction – results of empirical survey]. Bulgarian journal of education, 2, 61-73.

Ingersoll, R. (2017). Misdiagnosing America's teacher quality problem. In G. K. LeTendre & M. Akiba (Eds.), International handbook of teacher quality and policy (pp. 79–96). London: Routledge.

International handbook of teacher quality and policy. (2017). https://doi.org/10.4324/9781315710068

Ivanova, V., & Mileva, E. (2019). Teachers' satisfaction with their professional activities in physical education and sport. *CBU International Conference Proceedings*, *7*. https://doi.org/10.12955/cbup.v7.1400

Kyriacou, C., & Sutcliffe, J. (1977). Teacher stress: A review. *Educational Review*, *29*(4), 299-306. https://doi.org/10.1080/0013191770290407

Mileva, E. (2020). Comparative analysis of primary school teachers' satisfaction with the profession in Bulgaria and Macedonia. *RESEARCH IN KINESIOLOGY*, *48*(1-2), 31-34. https://doi.org/10.46705/rik201-20031m

Schultz D. (1982). Psychology and industry today, New York: Macmillan Company.

Skaalvik, E. M., & Skaalvik, S. (2011). Teacher job satisfaction and motivation to leave the teaching profession: Relations with school context, feeling of belonging, and emotional exhaustion. *Teaching and Teacher Education*, *27*(6), 1029-1038. https://doi.org/10.1016/j.tate.2011.04.001

Spilt, J. L., Koomen, H. M., & Thijs, J. T. (2011). Teacher wellbeing: The importance of teacher–student relationships. *Educational Psychology Review*, *23*(4), 457-477. https://doi.org/10.1007/s10648-011-9170-y

Spector P.E. (2003). Industrial and organizational psychology: Research and practice. New York: John Wiley & Sons, Inc.

Susnjar, S.G., & Zirnanji, V. (2005). Organizaciono ponasanje. [Organizational behavior. In Serbian]. Univerzitet u Novom Sadu, Ekonomski fakultet, Subotica.

Toropova, A., Myrberg, E., & Johansson, S. (2020). Teacher job satisfaction: The importance of school working conditions and teacher characteristics. *Educational Review*, *73*(1), 71-97. https://doi.org/10.1080/00131911.2019.1705247

Tosheva, I. (2012). Burnout and the teacher's profession. Sofia, Avangard Prima.

The Albanian education system - OECD iLibrary. Retrieved October 4, 2022, from https://www.oecd-ilibrary.org/sites/7f73878b-en/index.html?itemId=/content/component/7f73878b-en

Corresponding author:
Florian Muca
PhD Student in Department of Psychology,
Pedagogy and Sociology
National Sports Academy„Vassil Levski",
21, Akad. St. Mladenov Str., Studentski Grad,
Sofia, Bulgaria
E-mail: florimuca@yahoo.com

THE BENEFITS OF THE COURSES IN SNOW SPORTS FOR THE STUDENTS OF THE NATIONAL SPORTS ACADEMY „VASSIL LEVSKI“

Deyan Todorov, Svetoslav Simeonov, Petar Iankov
National Sports Academy “Vassil Levski”, Sofia, Bulgaria

ABSTRACT
The National Sports Academy “V. Levski” – the sports university of Bulgaria, has almost 80 years of history and state accreditation for the education of coaches in more than 76 sports, physical education teachers, kinesitherapy, and sport animation specialists.
The course program includes a total of 12 hours of lectures, and 5 hours of practical seminars per day every day.
The aim of our research was to study the influence of the “Snow Sports” course on the students from the National Sports Academy “V. Levski”, in terms of its social, psychological, physiological, training, and educational impact.
Results:
The research includes an inquiry with students who had already completed their education in the “Snow Sports” course, aged between 19 - 25. The greater part of them had no preliminary experience in Snow Sports, and they made their first steps in skiing and snowboarding at the course. However, after finishing the course, a great number of them chose to continue with additional education in snow sports. The students gave a positive self-evaluation of their physical and mental health after the end of the course, and they reported an improvement in their general well-being.
The study also takes into account the acquired knowledge and skills in snow sports, in safety rules, and in environmental protection requirements. As a result, students gain confidence that they have developed new training and leadership qualities, giving them the opportunity to practice another new profession. On the basis of these results, we have reasons to assume, that this form of education in snow sports has a multi-aspectual impact on the students. This assumption strengthens our conviction, that snow sports could have a wide application, not only in the education and training of young people but also in their socialization.

Keywords: *course, snow sports, impact, education.*

INTRODUCTION

By the authors (Zgurovski, Yankov 2007). Ever since the establishment of the Higher School of Physical Education in 1942, skiing as an educational and methodological course has been included in the curriculum of all majors. The National Sports Academy, almost 80 years old, is accredited by The Bulgarian National Evaluation and Accreditation Agency and produces professional coaches in 76 different sports as well as physical education teachers, kinesiotherapists, and sports animators. Since its very founding, its curriculum has always included a snow sports introductory training course which is compulsory for all students.

The course duration is 14 days, including practical sessions in alpine skiing, classic cross-country skiing, and snowboarding. The lecture classes cover the following topics:

- history of skiing
- accident safety
- teaching methodology
- environment and ecology
- snow sports equipment
- snow sports regulations

According to past studies on the problem under consideration (Zdravcheva, Zgurovski, 2017), snow sports courses have a long-standing tradition in the NSA. They represent an educational format with a wide-ranging educational and educational impact, aimed at building habits for safe behavior in the high mountains and an ecological attitude to nature, to mastering skills in snow sports and key competencies necessary for organizing and conducting a learning process for a large group people under specific conditions.

Each course starts and ends with a 6 km hiking tour with a vertical drop of 850 m, and consists of 5-hour daily practical sessions plus 12 hours of lecture classes in total. The learning outcomes are not only of educational value but also contribute to the interpersonal and emotional development of the participants. These impacts along with the possibilities for optimization are of great interest to the team members involved in planning and conducting the NSA Snow Sports course.

According to past studies on the problem under consideration (Zdravcheva, 2019), the conditions of the ski course are a prerequisite for creating stressful and anxious conditions in the students. On the one hand, the stress caused at the very beginning with the march from the village of Zheleznitsa to the high-altitude base (Todorov, Zanev. 2019) is connected with overcoming a significant unevenness, which for unprepared students is a real challenge and a test of willpower.

We believe that an up-to-date research approach in a snow sports course would be useful in establishing the benefits for the students of Vasil Levski National Sports Academy and the skills acquired during the course.

Research objectives

Evaluating the Snow Sports introductory course's impacts on NSA students in social, psychological, physiological, educational, and character-building aspects.

METHODOLOGY

Graduate exit survey among students who have taken the Snow Sports introductory course.

The survey was divided into 11 sections:

- demographic data
- previous experience
- physical activity level
- physical health status
- mental health status
- overall well-being
- social interactions
- knowledge and skills
- career opportunity

In order to obtain more extensive information, each section consisted of sub-questions.

The present study is part of an ERASMUS+ project (Erasmus Plus EAC-A04-2015-579840) where the types of outdoor sports activities and the benefits they provide are explored.

The survey was carried out with NSA students at the end of their studies, all of them having taken the Snow Sports introductory training course.

RESULTS & ANALYSIS

As the collected demographic data show, 73.5% of the 380 surveyed students studied to become professional coaches, and 24.7% studied to become physical education teachers. The respondents' age was between 19 to 25 years, with male to female sex ratio 2. Most of them reported that it was their first-time skiing and snowboarding experience, and a significant number of them decided to attend further training courses after the introductory one.

Previous Experience

Almost 75% of the surveyed students had no previous experience in snow sports, 17% had little (up to 5 days) experience and only 8% had practiced regularly before attending the course. Upon its completion, 13% of the students decided to attend further training.

Physical Health

The respondents were asked to describe their self-assessed health status. More than half of them – 58.20% – claimed that their physical health improved after the course.

Physical Activity Before and During the Course

65.8% of the survey participants worked out between 60 to 90 minutes a day or up to 4 times a week at a medium or high-intensity level (active athletes). During the course and despite its busy schedule 20-30% of the students worked out between 30 to 40 minutes a day.

Psychological health

We asked the survey respondents 7 questions on the way they felt during the course – 5 questions on positive and 2 on negative emotions. 63.85% of the students reported feeling positive emotions, e. g. self-confidence, satisfaction in themselves, and emotional connection with other course participants. 73.43% reported that they did not experience negative emotions such as frustration with their performance, depression, etc. (Figure 1).

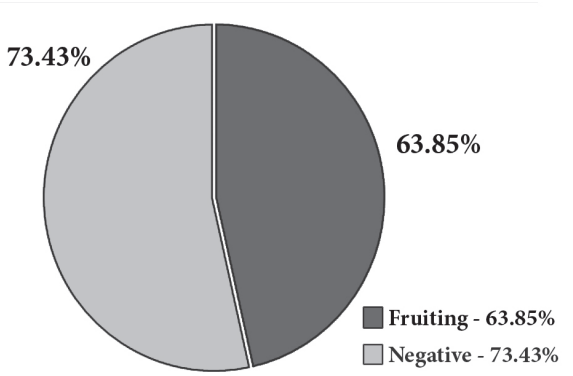


Figure 1. *Psychological health*

Considering these results, it can be concluded that the NSA Snow Sports introductory course has a positive impact on students' mental health as the emotions it causes are predominantly positive. Therefore, the respondents view their general well-being after the course in a positive way. This has been confirmed by the 6th section: according to 85.7% of the survey participants, the training course had a positive impact on their general well-being.

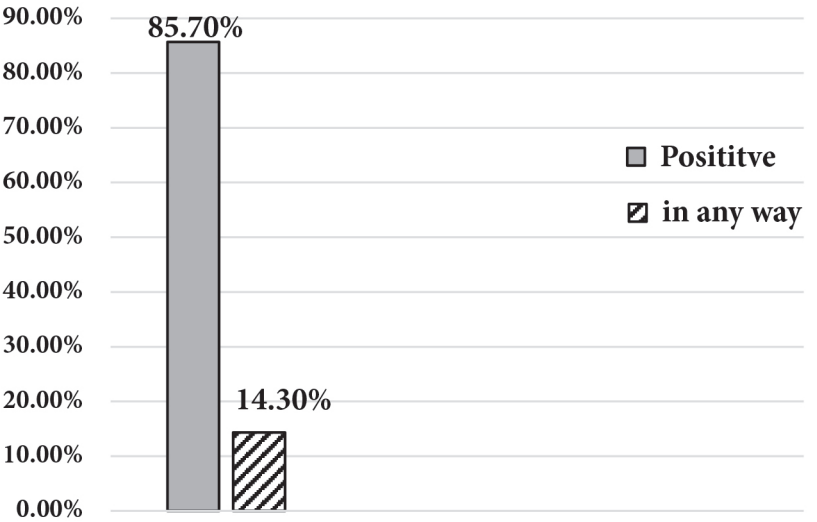


Figure 2. *General well-being*

Social interactions are a significant aspect of the course's educational impact on participants, and the many positive answers on this matter are clear evidence of success. This subject is explored in section 7, where most of the questions refer to the interpersonal relationships built during the course, and 85% of the surveyed students gave positive answers to all.

Sections 7, 8, and 9 were designed to capture the students' opinions on the new knowledge and skills gained from the course. The results are very convincing: over 91% of respondents report

that they gained essential knowledge of snow sports safety, teaching snow sports, event management, and environmental protection. Almost exactly the same percentage say they

improved their skiing and snowboarding techniques and learned more about snow sports equipment selecting and using, winter hiking, and alpine emergency.

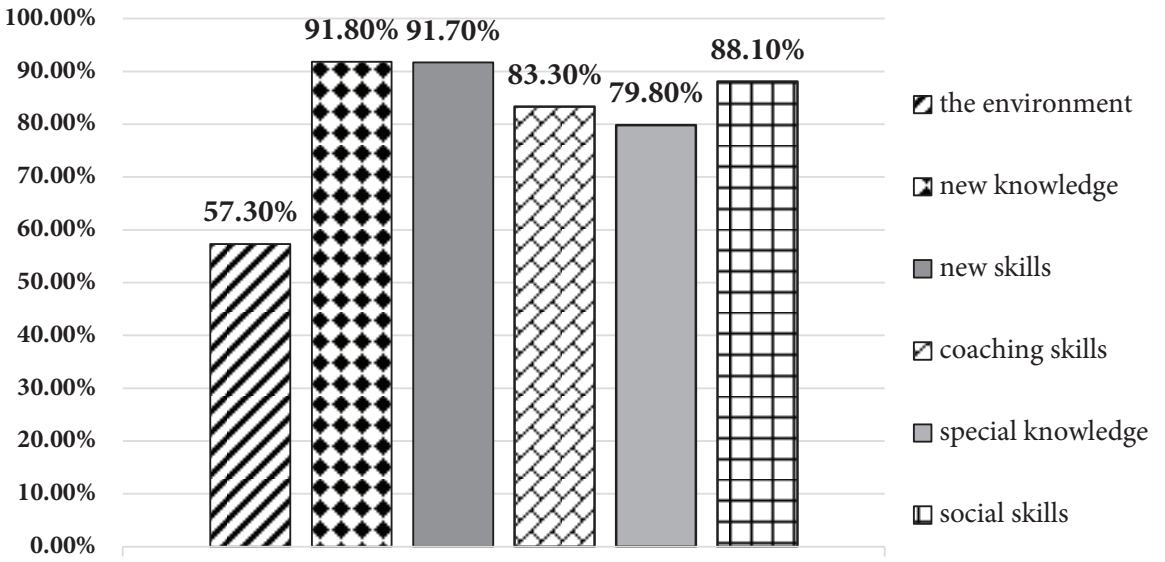


Figure 3. *New skills and knowledge*

The course is not exclusively focused on introducing basic snow sports skills, but also on cultivating environmental awareness and attitude toward nature. The above diagram shows that the respondents strongly recognize the obtained knowledge on this matter (Figure 3). As seen in the results, over 57% of the respondents felt more connected to nature and changed their attitude towards it after the course.

In respect of the acquired practical skills, 83.3% of the survey participants believe that they have improved their coaching and leadership skills (Figure 3), and 56% see the course as a great or significant opportunity to learn a new profession (Figure 4).

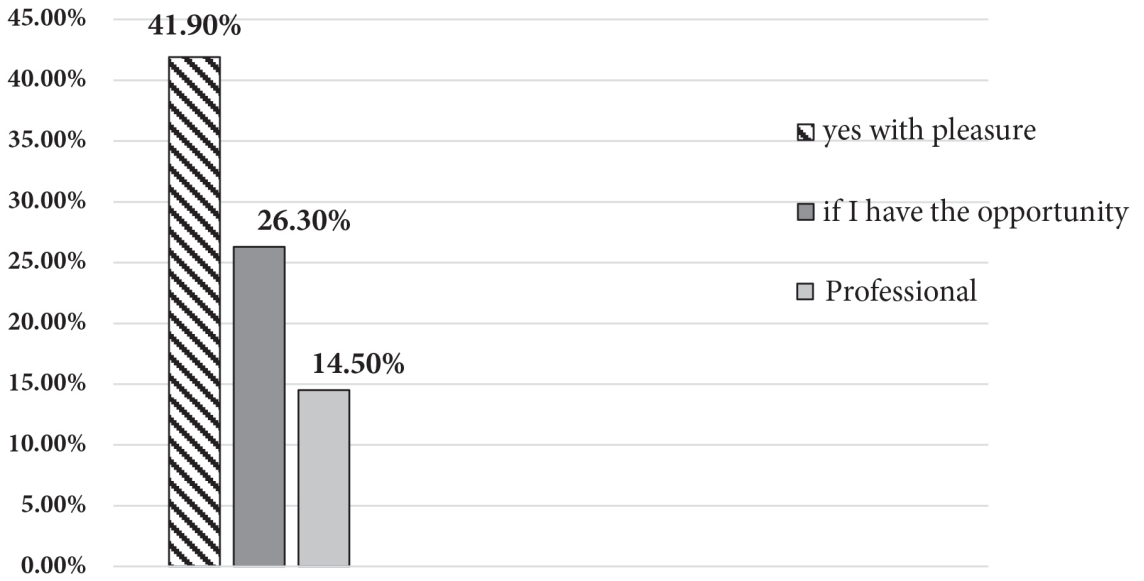


Figure 4. *Future practice and profession*

CONCLUSION

The courses are a long-standing tradition and an important part of the curriculum since the inception of the University of Physical Education. The NSA Snow Sports introductory training course offers an excellent opportunity to promote snow sports among students. It positively impacts their mental and physical health, builds their character development, and makes an excellent basis for skill development. After the course, a significant

part of the students decides to master their skills and become ski/snowboard instructors. The survey results also show that participating in sports activities in the mountains greatly changes young people's attitudes towards the environment. Thanks to the courses, students have had the opportunity to interact more and create new friendships not only with colleagues from their group, but also students from other groups, faculties and even another course of study.

Based on the above, we highly recommend this teaching format as it has multiple positive impacts on students.

Acknowledgments
Thanks to the students of Vassil Levski National Academy of Sciences for voluntarily participating in the survey for the snow sports training course.

REFERENCES

Erasmus Plus EAC-A04-2015-579840. Benefits of Outdoor Sports for Societies

Todorov, D., Zanev, K. (2019). Analysis of the training hike in winter conditions of students from NSA "Vasil Levski"- Coaching faculty from. Zheleznitsa to PUSB "Prof. Ivan Staykov". *Collection of papers from scientific conference „Tourism and sport"* . NSA Press. Sofia. p. 26-32.

Zdravcheva, M. (2020). Analysis of the stressors affecting the student learning process in snow sports course. *Annual of National Sport Academy "Vasil Levski"*. Vol. 1. p. 419-422.

Zdravcheva, M., Zgurovski, K. (2017). Study of situational anxiety in snow sports courses., *INTERNATIONAL Scientific Congress on Applied Sports Sciences*, Sofia, Proceeding book, p.214-217.

Zgurovski, K., Yankov, P. (2007). *Alpine ski technique*. Sofia.

Corresponding author:
Deyan Todorov, PhD
Snow Sports Department
National Sports Academy "Vassil Levski"
Studentski grad, Sofia 1700, Bulgaria
E-mail: deyan_todorov1@abv.bg

 DOI: 10.37393/ICASS2022/110 229 - 235

SOME ASPECTS OF IN-PERSON AND ONLINE PHYSICAL EDUCATION AND SPORT

Nadezhda Kostova
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
It is an indisputable fact that the Covid 19 pandemic at the beginning of 2020 negatively impacted the life and health of people and changed the social, public, and economic situation around the world. The education system was also strongly affected and suffered a great number of changes. The measures taken for social isolation lead to a general reorganization of the education process. The lessons in physical education and sport - a compulsory subject of students' general education also had to be transformed in the emergency situation. The direct form of interaction between the teacher and the students during in-person lessons (the traditional style) had to be reorganized in an online form. Because of the specificity of the subject, namely the motor-cognitive activities of the students during the physical education and sports lessons, learning new knowledge and developing motor skills and habits in an online environment proved to be a great challenge both for students and teachers.
Aim of the study: The aim of the present study is to reveal some basic aspects of in-person and online learning in the school subject of physical education and sport.
Methods of the scientific study: The following methods for gathering empirical information were applied in the realization of the aim of the study – system approach, content approach, and SWOT analysis.
Results of the study: A theoretical model was developed for the achievement of the aim of the study, specifying some aspects of face-to-face and online education. An attempt to compare and analyze the peculiarities of face-to-face and online education is made; the advantages and disadvantages of traditional and online classes in physical education and sports at secondary school are presented.
Conclusions: The results from the present study can be used as a basis for future experimental work concerning traditional (in-person) and online education with a focus on the effectiveness of the learning process in physical education and sport and its strategic optimization.

Keywords: *physical education, in-person, online*

INTRODUCTION

In the history of humanity, the year 2020 will be remembered with the Covid 19 pandemic. The aggressive and contagious virus negatively affected people's life and health and changed the world's social, public, and economic situation.

The system of education proved to be among the most strongly impacted. The social isolation led to the complete reorganization of the education process at the secondary schools. The global pandemic-imposed changes in the traditional in-person form of education, introducing the alternative variant of online learning (Jin et al., 2021). As part of the compulsory general education programs for students at all secondary school levels, teaching physical education and sport also faced many challenges. The transition from in-person to online education proved to be a key factor for the development of new approaches for learning new knowledge and developing motor skills and habits (Taylor, 2001)

Undoubtedly, the most reasonable combination of traditional and innovative teaching methods had to be used in the educational process in order to achieve the specific purposes of physical education at school (Wu, 2014; Pizzi, 2014). Innovative technologies were the only possibility to organize education and training activities during that period.

There are a lot of definitions characterizing the education process. According to one definition: "education is a process where students under the guidance of the teacher learn consciously, systematically, thoroughly and permanently, acquire scientific knowledge, develop skills and habits for independent learning and implement their knowledge into practice, develop their mental and physical abilities" (Petkov, 2018). There are multiple classifications for defining the ways and methods of learning. Generally, considering the place, means, and methods by which it is realized, education is categorized into two basic types: in-person (face-to-face) and online (distance). Education in-person is defined as a process where both subjects interact (teacher and student). They are physically at the same place, while in online education, the teacher and the student are not at the same place physically (Singh et al., 2009)

The introduction of online learning at all levels of education is an unprecedented fact. In the last decades, we have witnessed the rapid application of information and computer technologies on a global scale. They have changed the way people acquire knowledge in various fields (Singh et al., 2009). The use of technological and electronic tools has imposed new trends in the process of education. Globally online education may be defined as a revolutionary approach having the potential to subject the acquisition of knowledge entirely to computer technologies (Nichols, 2008). According to other authors, online education could be defined as a process of presenting educational materials from internet sites, platforms, and audio and video files (Waits, Lewis, 2003).

Comparing the essential characteristics of in-person and online education, views vary considerably. Some basic characteristics of the two forms (regimes) of learning (Wu, 2014) are presented in Figure 1.

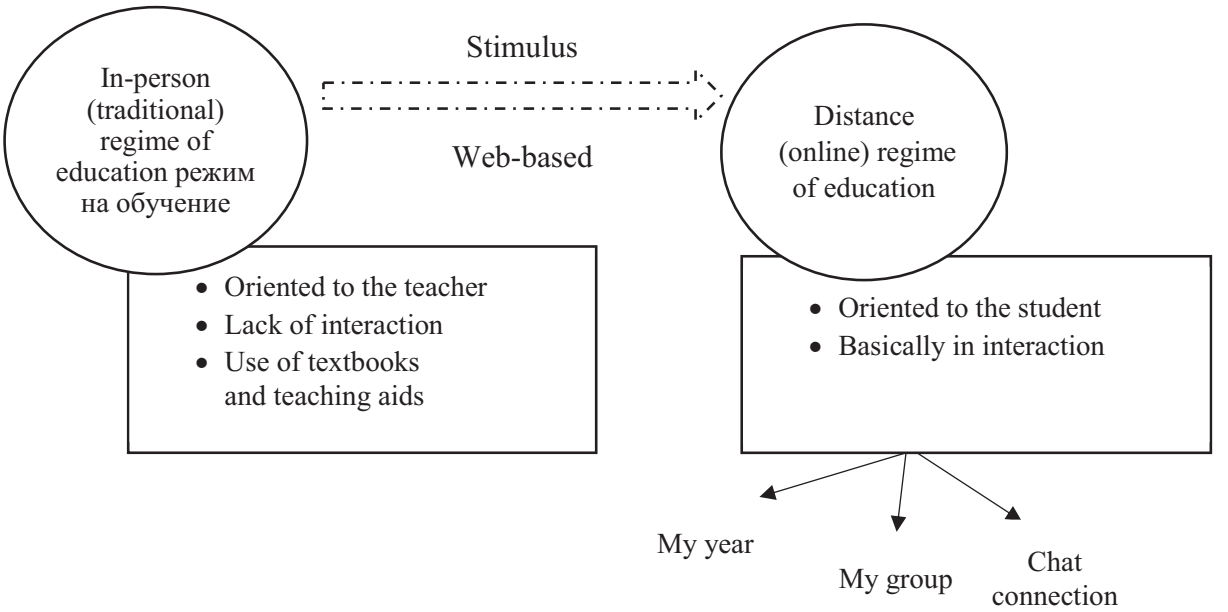


Figure 1. *Comparison of the in-person and online regime of education (J. Wu model, 2014)*

According to the author J. Wu, in-person education is orientated towards the teacher, and the pedagogue can impress by knowledge, qualities, competence, and professional skills. On the other hand, in online education, the richness and variety of the means (resources) for education have a stimulating effect on the motivation and willingness of the students to learn (Wu, 2014). The statements above could be accepted as accurate. However, we have the right to say that the indicators related to in-person education refer most of all to theoretical disciplines.

However, this is not the case with physical education and sport teaching. The specific aspects of the subject, characterized by the performance of motor-cognitive activities and the development of motor skills and qualities, require a different approach when categorizing the basic characteristics of the respective education regime.

A more detailed presentation of some aspects of in-person and online education is provided in the theoretical model of the scientific study.

Aim of the study: The aim of the present study is to reveal some basic aspects of in-person and online learning in the school subject of physical education and sport.

Tasks of the study:

1. Theoretical study of literature sources and normative documents on the issue.
2. Development of theoretical models of some aspects of in-person and online education.
3. Analyzing the peculiarities of in-person and online education in physical education and sport, revealing their strong and weak sides, advantages, and disadvantages.

METHODS OF SCIENTIFIC RESEARCH

The following scientific research methods are applied to realize the research's aim and tasks: a study of literature sources on the issue, system approach, content analysis, and S.W.O.T. analysis.

For the research, an author's theoretical model is developed to outline some basic aspects of in-person and online education (Figure 2). A comparison is made of the peculiarities of each of the two forms: in-person and online learning. Some advantages and disadvantages of traditional and online education in physical education and sport at the secondary school are analyzed.

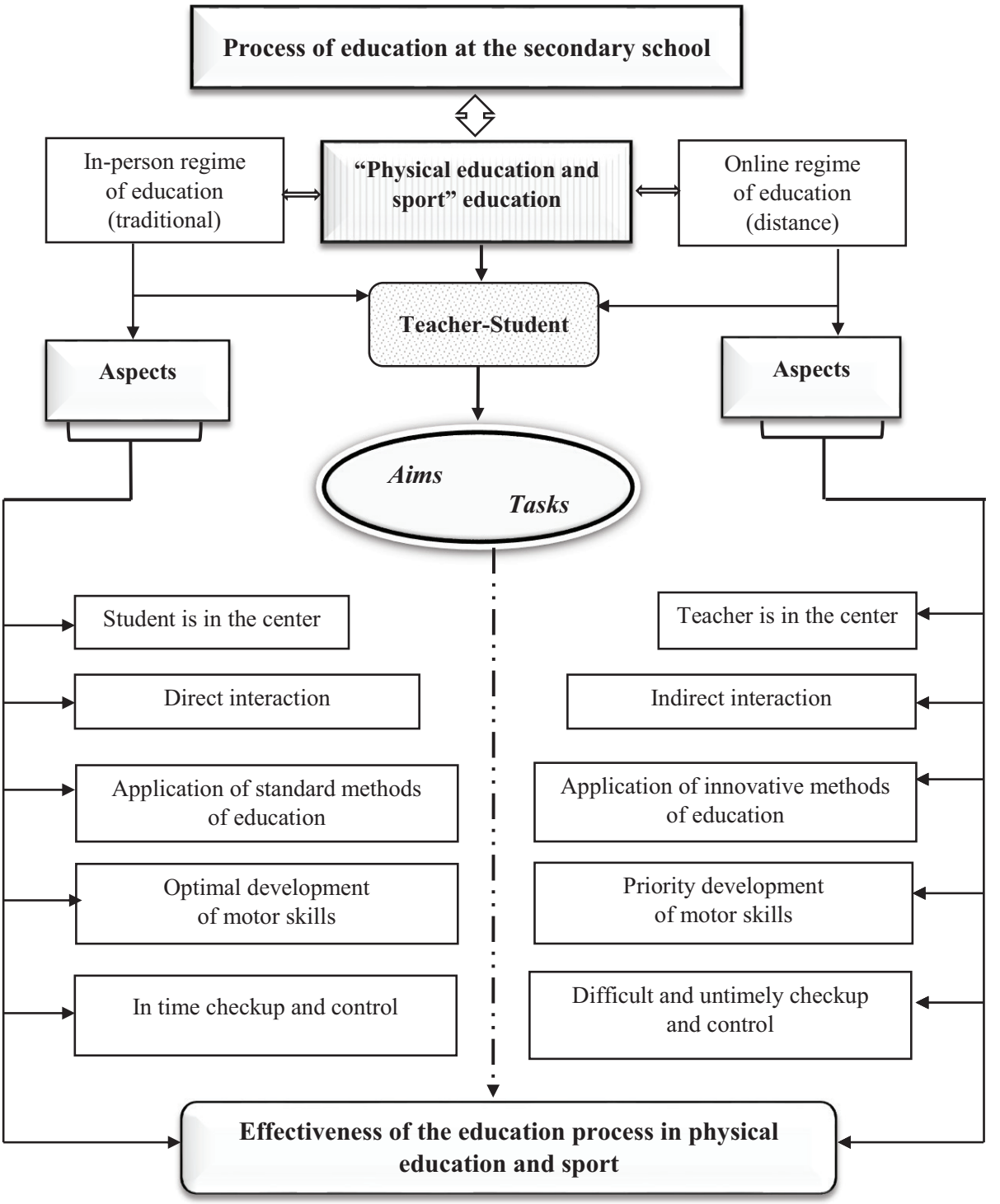


Figure 2. *A theoretical model of some aspects of the in-person and online education*

RESULTS

The process of education in physical education and sport is a complicated and lengthy process of teaching and learning knowledge and skills related to optimal physical development and good health status of children and adolescents. Section IV of the Pre-school and School Education Act defines some basic forms of education, part of which are the "in-person" and "distance" forms (PSEL, 2016). Both forms are focused on achieving the purposes and tasks of the general education preparation in physical education and sport, directly corresponding to the effectiveness of the education process. The differences, such as the place of realization of the education activities, ways of interaction, methods, control, and evaluation, are among the important aspects predetermining the specificity of the respective form of teaching and learning.

Some aspects of in-person education in physical education and sport at the secondary school are selected as a starting point of the analysis (Figure 2). The students are at the center of education during the classes. By applying the education methods in the class, the teacher has the possibility for direct contact and an individual approach. There is a direct opportunity for the teacher to show the physical exercises and motor activities to the students, observe students' performance, to control and evaluate their work. The physical load exerted during physical education and sports classes, and its purposeful regulation is still another reason showing that the direct interaction between teacher and student is of essential importance. The complex development of motor skills and qualities is another aspect predetermining the effectiveness of the in-person form of education in physical education and sport. Planning school activities is based on the improvement of the separate motor skills of the students, such as speed, strength, flexibility, agility, and endurance at various stages of secondary school (Nancheva, Naydenova, 2019; Dimitrova, 2019). On the other hand, learning and adapting new ones by resorting to the wide variety of motor activities of the kinds of sports set up in the educational content is of essential importance.

The USA National Association of Sport and Physical Education (NASPE) presents some basic prerequisites determining the advantages of the in-person educational process in Physical Education and Sport, namely:

- optimal coverage of all students;
- maximum possibilities for practical activities during the classes;
- optimal application of all means and methods for developing motor habits and qualities, which provides that the lesson is well designed;
- adding out-of-class activities, supporting the work in class;
- regular observation, evaluation, and monitoring of the education of students at all levels (NASPE, 2009).

The aspects of the online education regime in physical education and sport are treated as another direction of the analysis. Applying online education in physical education and sports lessons created new possibilities and challenges. Enlarging the traditional (in-person) teaching regime, that type of education provided opportunities for applying the full range of technologies in teaching new knowledge related to physical education and sport.

As presented in the theoretical model of the study, attention is focused on the leading role of the teacher. It is important to note that, unlike the in-person form, in online teaching, the teacher is set in an environment that differs from the students' environment. At the same time, the teacher has the major task of engaging, directing, motivating, and inspiring the students in online classes. Other authors also share similar views, adding to the student's responsibility, initiative, enthusiasm, and creativity in online education (De Moura et al., 2021; Julia et al., 2021).

Indirect interaction between teachers and students, realized primarily by online means, plays an essential role in applying innovative means and methods of education. A team of authors has established that education in physical education and sport using technical innovations is becoming more and more attractive for the young generation (Ozbay, Ulupınar, 2018). Similar views are expressed by other authors, too; they find that in a considerable number of countries in Europe (and not only there) at present, physical activities and sports also prove to be the favorite activity for students of various age and social groups (Kırkbir, 2017).

Priority focusing on theoretical knowledge rather than on physical skills or physical activities is another important aspect of online classes in physical education and sport (Daum, Buschner, 2012). Acquiring knowledge connected with the healthy way of life and related to motor activity and healthy food, accepting a complex of special knowledge about physical education and sport, and conscious and rational management of students' own motor activities represent only part of the theoretical basis of the subject of Physical Education and Sport (Rachev, 1998).

The application of S.W.O.T. analysis of in-person and online education to reveal their strong and weak sides, advantages, and disadvantages is still another direction of the study. That type of analysis within the school environment is applied predominantly for planning, recording, and analyzing the status of the school and the education process, making strategic decisions, etc.

Tables 1 and 2 present some aspects of the strong and weak sides, advantages, and disadvantages concerning in-person and online education.

Table 1. *S.W.O.T. analysis of in-person classes in physical education and sport*

Strengths	**Weaknesses**
In-person education	***In-person education***
✓ Availability of appropriate material and technical base for physical activity and sport ✓ Favorable and creative atmosphere ✓ Direct interaction "teacher-student" ✓ Optimal planning and realization of the activities from the obligatory and additional fields of the educational contents ✓ Full-size development of motor skills, habits, and qualities ✓ Rational application of classical methods of education, checkup, control, and evaluation ✓ Possibilities for realizing out-of-class and out-of-school activities ✓ Fight against increasing levels of motor inactivity in adolescents	✓ Students' low interest in practicing physical activity and sport ✓ Rising number of overweight children ✓ Seeking new methods and approaches for incorporating parents into an active way of life ✓ Not interested and inactive parents, unwilling to take part in the school sport life ✓ Lack of a well-planned sports calendar to organize the sports events of the students ✓ Lack of partner relationships with multi-sport clubs, organizing sports activities for students
Opportunities	**Threats**
In-person education	***In-person education***
✓ Enriching the traditional methods of education by adding innovative ones ✓ Organizing sports events at school for the selection of children with motor qualities ✓ Increasing the motivation of teachers for work and professional development ✓ Enlarging and varying the choice of extracurricular activities ✓ Holding campaigns for popularizing sports and an active way of life ✓ Exchange of sound pedagogical practices and experience	✓ Students' and parents' attitudes toward discipline at school ✓ Demographic factors ✓ Growth of immigration from the country ✓ Neglecting the benefits of practicing physical activities and sport

Table 2. *S.W.O.T. analysis of the online classes in physical education and sport*

Strengths	Weaknesses
Online Education	***Online Education***
✓ Application of new educational models ✓ Innovative teaching practices ✓ Application of various means and methods (innovative) providing information ✓ Enlarged theoretic preparation within the conditions of that type of education ✓ Possibility for rational distribution of time ✓ Prerequisite for increasing the creativity of the students	✓ Lack of direct interaction between teacher and student ✓ Insufficient skills of the teachers for using and creating electronic educational resources ✓ Difficult control of the students' activities ✓ Lack of organized extracurricular activities
Opportunities	**Threats**
Online Education	***Online Education***
✓ Alternative variant of educating physical education and sport at school ✓ Taking a well-deserved place as a modern and innovative practice of teaching and learning ✓ Manifestation of a creative approach for planning and monitoring the educational work of the teacher ✓ Enriching and globalizing the learning process in physical education and sport in line with the development of the information technologies	✓ Dependence on the availability of electronic tools, Internet, and quality of the video connection ✓ Lack of motivation on the side of the teachers ✓ Lack of motivation on the side of the students ✓ Ineffectiveness of the application of the respective methods and approaches

DISCUSSION AND CONCLUSION

The present study tried to outline and analyze concrete aspects of in-person and online education in physical education and sport. Through the theoretical model of the research, some essential aspects of the two forms of education are presented. Some of them are in common for both forms, while others differentiate them. The literature review analysis on the scientific problem showed that there are a lot of studies related to general education. However, there is a deficit of publications in the field of physical education and sports education. It can be summarized that the results of the study present a basis for future experimental studies on traditional (in-person) and online learning in physical education and sport. The basic aim of these studies could be the achievement of greater effectiveness of the education process, combining various forms of teaching and learning, strategic management, and optimization of learning and training in physical education and sport.

REFERENCES

Daum, N. & Buschner C. (2012). The status of high school online physical education in the United States. J*ournal of Teaching in Physical Education,* 31(1): pp. 86–100.

De Moura, V. F., De Souza, C. A., & Viana, A. (2021). The use of massive open online courses (MOOCs) in blended learning courses and the functional value perceived by students. *Computers & Education,* pp. 161.

Dimitrova, N. (2019). Harakteristika na testa na skorostnite vazmozhnosti na detsa ot preduchilishtna varzast. *Sport & Nauka*, br. № 1, 2, pp. 157-162. Димитрова, Н. (2019). Характеристика на теста на скоростните възможности на деца от предучилищна възраст. *Спорт & Наука*, бр. 1, 2.

Jie Wu (2014). Physical education learning model and construction mechanism in online learning environment. Bio Technology, *An Indian Journal,* Vol. 10 Issue 21

Jin, Y., Lin, C.L., Zhao, Q., Yu, S.W. & Su, Y. S. (2021). A study on traditional teaching method transferring to E-Learning under the Covid-19 pandemic: from chinese students' perspectives. *Frontiers in Psychology*, vol.12.

Julia, K., Peter, V. R., & Marco. K. (2021). Educational scalability in MOOCs: Analysing instructional designs to find best practices. *Computers & Education,* pp. 161.

Kırkbir, F. (2017). Investigating the effect of mental imagery on the success of athlete students at Trabzon University, Turkey. *Eur. J. Phys. Educ. Sport* Sci., 3, pp. 286–293.

Nancheva, D. & Naydenova, K. (2019). Study of the impact of the motor characteristics of speed on the age peculiarities. *International scientific congress "Applied Sports Sciences"*, Sofia, Bulgaria, pp. 165-168

NASPE (2009). Resource brief: Quality physical education. Reston, VA: AAHPERD

Nichols, M. (2008). E-learning in Context. E-Primer Series, Laidlaw College, Auckland, New Zealand.

Ozbay, S. & Ulupınar, S. (2018). The effects of regular exercise on the body composition are different in trained athletes with and without fasting. *Net Journal*., pp. 60–68.

Petkov, I. (2018), Noemvri, 5. Obuchenie – ponyatie. Pedagozi БГ [in Bulgarian]. Петков, И. (2018) Обучение - понятие. Педагози БГ. Retrieved September 26, 2022, from https://pedagogy-bg.blogspot.com/2018/11/obuchenie.html

Retrieved September 26, 2022, from https://pedagogy-bg.blogspot.com/2018/11/obuchenie.html

Pizzi, M. A. (2014). BL pedagogy: the time is now! Occupational therapy in health care, 28(3), 333–338.

Pre-school and School Education Act (01.08.2016), pp. 31. ЗПУО (01.08.2016), p. 31.

Singh, A. K., Amaluddin Y., M. & Win, N. (2009). A Comparative Study between Traditional Learning and E-Learning, in T & L Centre, CSM (ed), TLOF, pp. 1-7.

Taylor, J. (2001). Fifth generation distance education, Paper presented in 20th ICDE World Conference On Open Learning And Distance Education, Düsseldorf, Germany

Waits, T. & Lewis, L. (2003). Distance Education at Degree-Granting Postsecondary Institutions: 2000-2001. Washington, D.C.: U.S. Department of Education, National Center for Education Statistics.

Corresponding author:
Nadezhda Kostova, PhD
National Sports Academy "Vassil Levski"
1700, Sofia, Bulgaria
E-mail: sugareva_n@abv.bg

SUCCESS RATE OF NSA STUDENTS IN THE ATTENDANCE AND ONLINE BASKETBALL EXAMS

Georgi Brestnichki, Mariana Borukova
National Sports Academy "Vasil Levski", Sofia, Bulgaria

ABSTRACT
After the declared state of emergency in Bulgaria and the world because of the Covid-19 pandemic, from the 2019/2020 school year, the students from the National Sports Academy "Vassil Levski" went into an online form of teaching in the platform of the university, where the semester exams were also conducted. The basketball exam includes a test of 20 closed questions. However, students from the Faculty of Pedagogy also take an exam on the Methodology of Teaching in writing and oral form. Still, during the pandemic, this exam was also adapted to a test form of 20 questions with closed questions.
This study aims to establish and compare the success rate of students in taking a basketball exam in attendance and online forms.
Methodology of the study: the "e-student" provided us with the marks of the students from the attendance form of the exams, and the distance learning platform has been used for gaining the marks of the students from the online exam. The subject of the study is the success of the students taking the basketball exam. The evaluation marks are the subject of research. The results of 1428 students from the faculty of sport and 548 from the faculty of pedagogy were examined. The methods applied to realize the study's goal and tasks are: overview study of specialized literature, analysis, synthesis, and comparison.
Math-statistical results of the study were processed with SPSS 23 using frequency analysis and comparative analysis with the Student's t-test for independent samples and dispersion analyses.
The results showed that students received a lower average score when taking a basketball exam online than on the attendance test. We can summarize that few students are willing to study, make an effort, and receive higher grades in attendance and online environments, while the majority of them just want to pass the exam.

Keywords: *students, basketball, online, exam, marks*

INTRODUCTION

The global Covid-19 pandemic has affected the entire world. According to UNESCO statistics, more than 165 countries have been affected by this pandemic, which has changed our daily lives and the work process in one way or another. Since the declaration of a pandemic situation, schools and universities have rapidly changed their working regime from being online. This happened both with the study activities and with the exams. According to the International Health Organization, this was necessary to take anti-epidemic measures related to COVID -19, which of course, affected education for two years, during which life lasted but differently.

Online learning has not been created since the appearance of this global pandemic. It has been introduced to education much earlier and is constantly evolving. Online learning is related to the entry of technology into our daily lives. The emerging pandemic has accelerated its development, and the question of the effectiveness and benefits of this training will be the subject of many future studies. Many researches show the positivity in online training, as students have more control over the learning process and the pace of teaching and learning. (Picciano, 2017; Wang, Pi & Hu, 2019).

In the online assessment of the knowledge, this mostly means the same questions, albeit shuffles, that are given on the computer instead of the paper (Holister, Berenson,2009).

The technology-based assessment now has the opportunity to examine observations and evidence to understand learning in ways that were not possible before (Murias, de Miguel, Rodriges, 2008).

Formative assessments are important to get an overview of how the training has been completed at the end of the learning unit or school year, namely, they are necessary for the teacher for feedback and for improving the teaching and learning process in online or attendance training rooms (Kuleva, 2022).

One of the easiest ways to establish the level of perception and learning of the material is by conducting exams or testing knowledge.

METHODS

Before the emergency situation, theoretical examinations were conducted in the form of a written examination with one or two questions on which the student had to lay out his or her knowledge. With the move into an online environment, conducting an exam in such a form was unthinkable, so tests were created to test students' knowledge.

The purpose of this study is to analyze and compare the level of exam results of university students in an attendance environment and online form (exams).

The research subject is the level of knowledge in the subject - basketball, of the students from the National Sports Academy "Vassil Levski".
The subject of the study is the quantitative marks of the exam results of the students in an attendance environment and the online form (exams).

The study included the exam grades of students from the two faculties of NSA – Sport and Pedagogy, in the three courses of study – first, second and third, in which basketball discipline is studied. The number of university students from the sports faculty is 1428 students and 548 university students from the pedagogy faculty.

The basketball exam for first-year students in the sports faculty includes a test of 20 questions with closed answers. However, students from the pedagogy faculty are examined on this same test, as well as on the methodology of teaching in writing and oral form. During the pandemic, the second part of this exam (the written form) was also adapted to a test form of 20 closed questions.

The methods applied to realize the study's goal and tasks are: overview study of specialized literature, analysis, synthesis, and comparison.

Math-statistical results of the study were processed with SPSS 23 using frequency analysis, comparative analysis with the Student's *t*-test for independent samples, and dispersion analysis.

RESULTS

The analysis of the results for the performance of students over the years and the impact of the pandemic on the training and their results will begin by presenting the results to students in the first year of sports faculty, where the only change in the exam is whether it was conducted in attendance or online form.

Table 1 and Figure 1 are presented the results of students' first year of sports faculty when taking the basketball exam in different years. Looking at the bottom row of the table representing the average success of students over the years, we find no significant difference. However, with insight into the different grades over the years, there are already obvious differences in their performance in an attendance form and online environment.

Table 1. *Percentage and quantitative distribution of examination grades of Faculty of Sport students (2017-2022)*

Year	**2017**	**2017**	**2018**	**2018**	**2019**	**2019**	**2020**	**2020**	**2021**	**2021**	**2022**	**2022**
Mark	n	%	n	%	n	%	n	%	n	%	n	%
Poor	53	20.15%	94	33.33%	50	18.66%	73	25.35%	125	39%	71	26.30%
Middle	55	20.91%	37	13.12%	54	20.15%	79	27.43%	81	25%	51	18.89%
Good	97	36.88%	104	36.88%	102	38.06%	83	28.82%	69	21%	101	37.41%
Very good	54	20.53%	44	15.60%	51	19.03%	43	14.93%	33	10%	43	15.93%
Excellent.	4	1.52%	3	1.06%	7	2.61%	13	4.51%	13	4%	4	1.48%
Total	263		282		264		291		321		270	
Average	3.53		3.31		3.59		3.46		3.16		3.40	

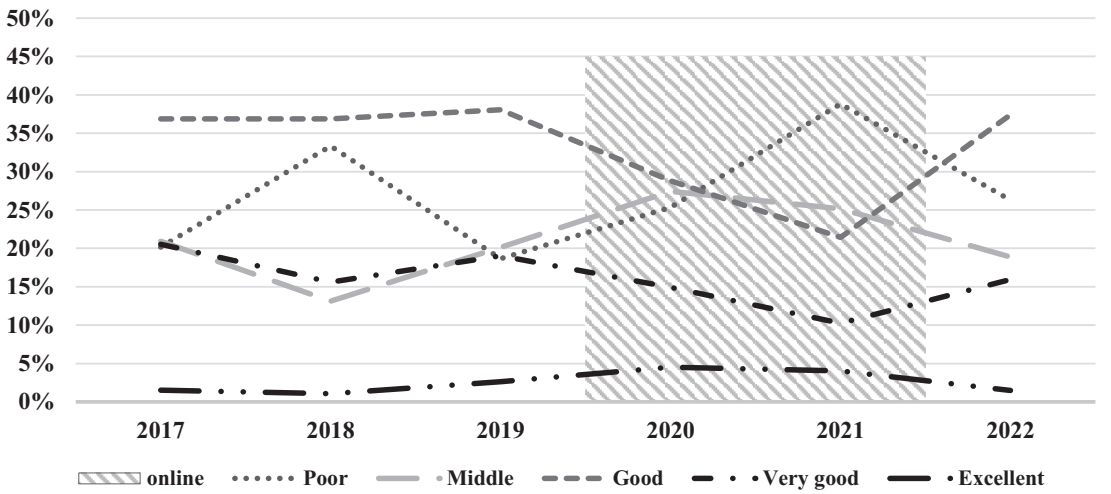


Figure 1. *Assessments of students from faculty Sport over the years*

When analyzing Figure 1, we found that the percentage of students who received poor marks (2) in different years was wavy. This wavy line peaked in the second year of the online exams (2021), where 39% of all students who took the exam were poorly graded. While the previous year, 2020, which was the first for online exams, this rate was 25%. We found an increase if we compare this result with the previous year 2019 (18.66 %). This fact largely tells us that students either underestimate online testing or it is a lack of stable preparation in order to be able to take their exams successfully.

The situation is similar for those who have successfully passed the exam with a minimum grade of an average – of 3. Before the pandemic, the percentage of those who received an average of 3 was between 13 and 20%. Moreover, during the online exams in 2020, it jumped to 27%, and in 2021 it is 25%. Then, in 2022, attendance testing fell below 19%.

A similar picture is seen in students receiving "good" and "very good" grades. The percentage of "good" grades obtained during online training and, accordingly, when checking knowledge through the exams has deteriorated. From 2017 to 2019, the percentage of "good" 4 grades is almost constant at 36-38%. In 2020 and 2021, it falls to 25-27%. For students with very good grades, the picture is wavy. Moreover, the students with excellent marks slightly increase in their percentage during the online exams.

From the thus presented numbers and percentages, we can summarize that the online teaching for a large part of the students was not good for their participation in the basketball exam. We can explain this with two facts – one is an underestimation of the exam and the other, which may be the more warning, insufficient preparation and understanding of the material and thus weaker results.

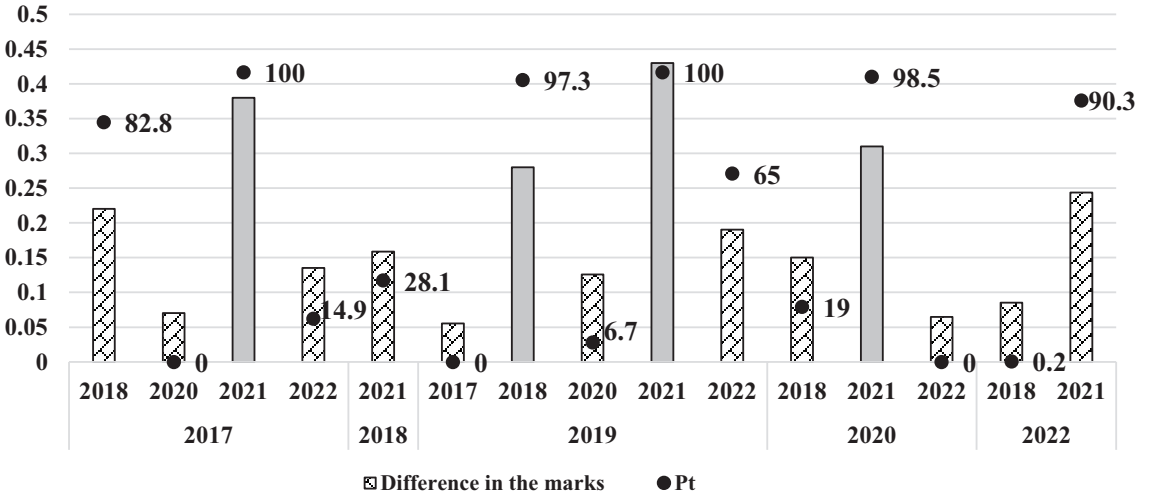


Figure 2. *Differences in grades over the years for Grade II students compared to the Student's t-test*

Comparing the results obtained over the years compared to dispersion analyzes (Figure 2), it is noted that there are significant statistical differences in student exam results in 2017 compared to those obtained in 2021. Such a difference is also noted in 2019 and 2020, compared to the results of 2021. This leads us to the conclusion that the prolonged period of the pandemic has indeed negatively affected the grades received by students in the last year of the pandemic. This may be due to the more difficult learning of the material and possibly the lower level of preparation before the exam. However, the materials that were provided to students in the teaching platform were very comprehensive and made it as easy as possible to perceive the content of the basketball subject.

The exam grades of the third-course students studying a new specialty – teacher of physical education and sports at the faculty of pedagogy in attendance form and online environment are presented in Table 2 and Figure 3.

Table 2. *Third-course, Pedagogic Faculty – new specialty*

Year	**2018**	**2018**	**2019**	**2019**	**2020**	**2020**	**2021**	**2021**	**2022**	**2022**
Marks	n	%	n	%	n	%	n	%	n	%
Poor	11	40.74%	14	28.00%	15	33.33%	23	25.84%	41	26.97%
Middle	5	18.52%	12	24.00%	13	28.89%	24	26.97%	42	27.63%
Good	5	18.52%	8	16.00%	9	20.00%	27	30.34%	56	36.84%
Very good	3	11.11%	7	14.00%	6	13.33%	13	14.61%	13	8.55%
Excellent.	3	11.11%	9	18.00%	1	2.22%	2	2.25%	0	0.00%
Total	27		37		40		89		91	
Average	3.31		3.84		2.71		3.40		3.27	

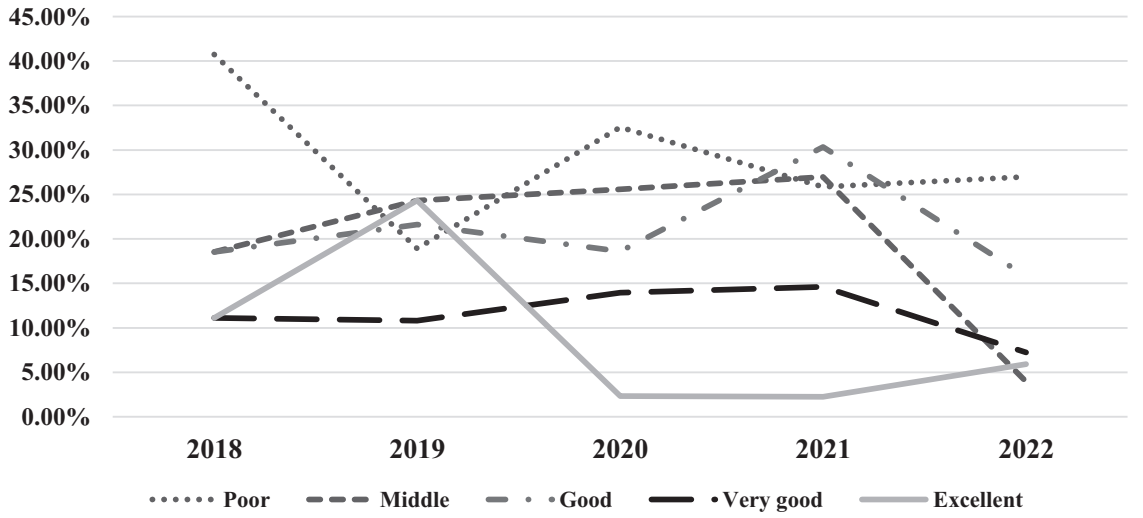


Figure 3. *Assessments of students from pedagogy faculty, a new specialty over the years*

As mentioned in the methodology, the exam in attendance form is in writing and provides an opportunity for the student to present his or her knowledge on a subject by picking theses randomly from the presented ones. In an online form, the exam takes the form of a test of 20 questions involving subjects from all learning content, which are divided into three areas. The software offers the possibility of random rotation of questions in different areas, so you can never get the same question, which requires from the students' good preparation and knowledge level to pass the exam.

The table and the figure show that the third-course students during the online exams gained low grades (2) decreased compared to previous years in the attendance exam - from 40% in 2018 to 27% in 2022.

For students who successfully took the exam, the average 3 gradually increased in the first 3 years from 18% to 29%. Furthermore, over the past 3 years, it has remained within the range of 26-28%.

A rise in the percentage of students getting a mark

of "good 4" has increased over the years. As this increase during the online test is by 10-15%, which is a significant jump in the number of students with such marks.

For students with a "very good 5" mark, the percentage has been about the same over the years, regardless of the test form. It ranges from 11% to 14%, and in the last year alone, 2022, it has fallen to 8.5%.
A decrease in the last 3 years has been observed in the students who successfully received an "excellent" mark. This suggests that students are not preparing enough, and their knowledge is mediocre.

In summary, we can say that for students from 3rd-course pedagogy faculty (new specialty), the online test has helped to increase the marks of mediocre students with "average" and "good" grades but has negatively affected the number of good students receiving "very good" and "excellent" grades.

When comparing the period of 5 years through dispersion analysis and looking for significant differences between different results during the years analyzed, it is clear that the students' results in 2019 outperformed the rest. However, these results were not confirmed with the necessary significance. The percentage is close to 95 by 2020 and 2022 but remains below the required guarantee probability, and therefore we may consider them as random results. Students' grade test results in 2020 are the lowest over the examined years, although we have confirmation from the Student's *t*-test in none of the compared years. After that, students' performance during the online exams in 2022 is the least, but again we do not have confirmation of these results with the guaranteed probability we need. Therefore, we cannot claim with certainty that the performance of students from the 3rd-course pedagogy faculty in one form or another of testing is different.

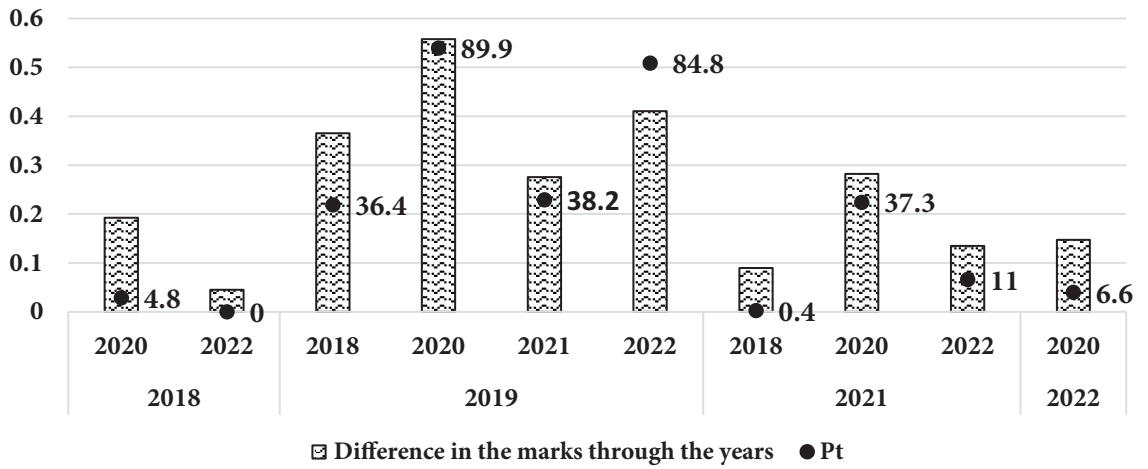


Figure 4. *Differences in grades over the years for 3rd-year students compared to the Student's t-test*

Table 3 and figure 5 present the students' results of the second-year pedagogy faculty in their performance of the basketball exam in the presence and online environment in 2019 and 2021.

Table 3. *Second-course Pedagogic faculty*

	2019	2019	2021	2021
Middle	7	4.14%	10	10.53%
Good	98	57.99%	50	52.63%
Very good	55	32.54%	33	34.74%
Excellent	9	5.33%	2	2.11%
n	169		95	
Aver	4.39		4.28	

Comparing success rates in different grades, there was a relatively constant level. There has been a slight increase in the percentage (4.14-10.53 %; 32.54-34.74%) of students rated "average 3" and "very good 5" in an online environment, as well as a slight drop in student percentage (57.99-52.63%;

5.33-2.11%) successfully received a "good 4" and "excellent 6."

In summary, we can say that from the data presented on the success of the second-year students at the faculty of pedagogy, we do not see significant differences in what form they will take their basketball exam, which tells us that the form of testing is not essential, but rather the student's preparation for the given exam is important.

Confirming this claim is the comparison of the average student success in both forms of testing using the Student's t-test. From the results obtained, we find that students have higher success grades in attendance form of testing (4.39) than the success achieved in online exams (4.28). This result was confirmed by 94,4 % confidence, which is very close to the guarantee level but remains below it. Therefore, we cannot specify in which form of testing students perform better.

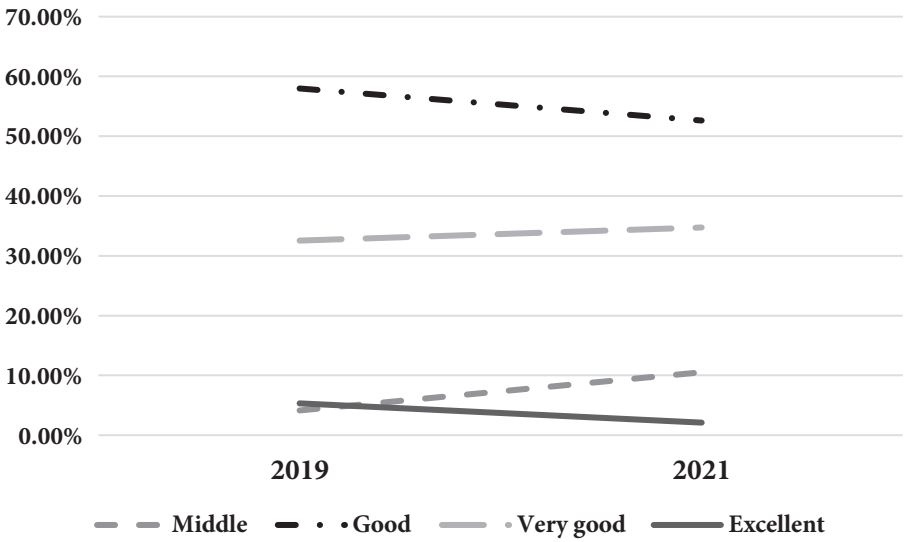


Figure 5. *Assessments of students from sophomore faculty Pedagogy*

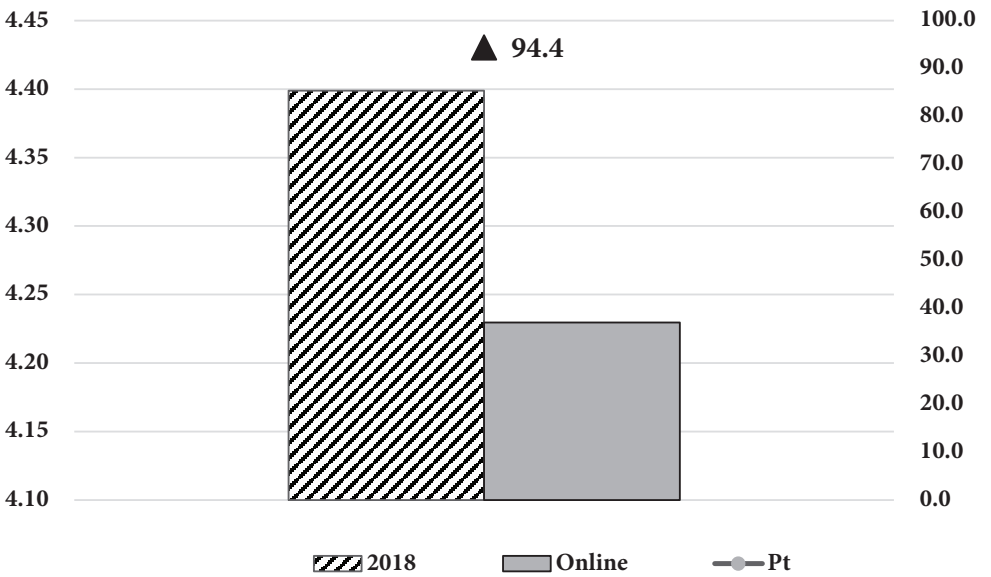


Figure 6. *The difference in grades in attendance exam sessions and online compared with the Student's t-test*

DISCUSSION

The success results in online exams largely depend on the effectiveness of online learning itself (Miladinov, Kuleva, Konchev, 2022).

In traditional teaching in universities, students have direct contact with teachers, which gives them security and facilitates them, but in the asynchronous form of distance learning, students have no contact

with the lead teacher (Alexieva, Borukova, 2021).

A survey among students from the National Sports Academy "V. Levski" from bachelor's degree at both faculties "Sport" and "Pedagogy" conducted by Borukova shows that on the question: "How do you determine the degree of difficulty of the learning material in basketball?", the answers show that for 45.3% the degree of difficulty is average, about 29.2% is high, and about 3.8% is very high. Accordingly, 50.9% of students did not have difficulty in learning the presented educational material and understood everything (Alexieva, Borukova, 2021).

The grades obtained during the online examination sessions in the distance learning platform "virtual.nsa.bg" comply with the statistical norms and are adequate to the knowledge shown by the examed students. Conducting test exams in the online platform does not increase the possibility of obtaining more high marks (Miladinov, Kuleva, Konchev, 2022).

From the analysis of the gained exam results of the NSA students by both faculties, we can summarize that when taking an exam in an online form, the number of mediocre students has increased, these are those who receive grades of "average 3" and "good 4". At the same time, the number of excellent grades has decreased, those who receive "very good" and "excellent". For the successful completion of the basketball exam, preparation for the exam is important, and the materials provided to students are available on the "virtual.nsa.bg" and on the Internet. Unfortunately, in the online form of the exam, there is an underestimation of the exam itself by the students and so there are a significant proportion of them who fail the exam at the first attempt. Having already experienced how the exam proceeds, students are mobilized and prepared significantly better for the second (correctional) exam session, in which the majority of them pass successfully. This shows that untaken exams increase students' motivation for knowledge and for better performance.

The comparative analysis of exam scores conducted in attendance and online environment shows that in both ways of testing, students receive roughly the same grades, suggesting that their level of knowledge is the same. Therefore, regardless of where the basketball exam takes place – online or in attendance form, a decisive factor is the level of self-preparation before the exam.

REFERENCES

Aleksieva, M., Borukova, M. (2020). Obuchenieto po basketbol na studenti ot Velikotarnovskiya universitet i Natsionalnata sportna akademiya v usloviyata na izvanredno polozhenie. *Pedagogicheski almanah,* VTU „Sv. sv. Kiril i Metodiy", broy 2, str. 157-168. https://doi.org/10.54664/CBQT5637 // Алексиева, М., Борукова, М. (2020). Обучението по баскетбол на студенти от Великотърновския университет и Националната спортна академия в условията на извънредно положение. Педагогически алманах, ВТУ „Св. св. Кирил и Методий", брой 2, стр. 157-168. https://doi.org/10.54664/CBQT5637.

Kuleva, M. (2017). Determining Criteria for Evaluating the Efficiency of the Education in a Distance Learning Platform, *Proceeding book of the International Scientific Congress "Applied Sports Sciences" 1 – 2 December*, pp. 424 – 427, doi:10.37393/icass2017/87

Kuleva, M. (2022). *Online obuchenie. Razvitie, pedagogicheski podhodi, perspektivi*. NSA Pres, Sofia, ISBN 978-954-718-686-6// Кулева, М. (2022). Онлайн обучение. Развитие, педагогически подходи, перспективи. НСА Прес, София, ISBN 978-954-718-686-6.

Miladinov, O., Kuleva, M., Konchev, M. (2022). Uspevaemost na studentite ot Natsionalnata sportna akademiya „Vasil Levski" v usloviyata na Sovid-19 pandemiyata. *Strategies for policy in science and education*, Volume 30, Number 4, https://doi.org/10.53656/str2022-4-4-suc // Миладинов, О., Кулева, М., Кончев, М. (2022). Успеваемост на студентите от Националната спортна академия „Васил Левски" в условията на Covid-19 пандемията. *Strategies for policy in science and education*, Volume 30, Number 4, https://doi.org/10.53656/str2022-4-4-suc //

Hollister, K., & Berenson, M. (2009). Protected Versus Uproctored Online Exams: Studying the Impact of Exam Environment on Student Performance. *Decision Sciences Journal of Innovative Education,* 7 (1), 271-294. Doi: 10.1111/j.1540-4609.2008.00220.x.

Murias, P., de Miguel, J., & Rodriges, D. (2008). A composite indicator for university quality assessment: The case of Spanish higher education system. *Social Indicators Research*, 89 (1), 129-141.doi: 10.1007/s11205-007-9226-z.

Wang, H., Pi, Z. & Hu, W. (2019). The instructor's gaze guidance in video lectures improves learning. *Journal of Computer Assisted Learning,* 35(1), 42 – 50. https://doi.org/10.1111/jcal.12309

Picciano, A. G. (2017). Theories and frameworks for online education: Seeking an integrated model. *Online Learning Journal*, 21(3). https:// doi.org/10.24059/olj.v21i3.1225

Rumbley, E. L. (2020). Coping with COVID-19: International higher education in Europe. The European Association for International Education (EAIE).

Borukova, M., Brestnichki, G., Tzankov, Tz., Tzankova, M. & Asparuhov, Q. (2020). Distanzionno obuchenie po basketbol v NSA. *Godishnik na Nazionalna Sportna Akademiq „Vassil Levski"*, Vol 1, Sofia: NSA Pres, pp. 289 – 298 // Борукова, М., Брестнички, Г., Цанков, Ц., Цанкова, М., Аспарухов, Я. (2020). Дистанционно обучени по баскетбол в НСА. Годишник на НСА „Васил Левски", Том 1, София: НСА Прес, 289 – 298.

Gigova, V. (2002). Statisticheska obrabotka I analiz na Danni, Sofia, NSAIPB. // [In Bulgarian]

Khan, B. (2005). Managing E-learning: Design, delivery, implementation and evaluation. 1 ed. Hershey, PA: Hershey PA: Science Information Publishing.

Corresponding author:
Georgi Brestnichki, PhD
Department "Basketball, Volleyball, Handball"
National Sports Academy "Vassil Levski"
Sofia, 1700, Bulgaria
E-mail: georgi.brestnichki@nsa.bg

TRANSLATION COMPETENCE IN THE SPECIALIZED LANGUAGE COURSES FOR SPORTS STUDENTS

Tatiana Hristakieva
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
Introduction. International activities in physical education, sport, and kinesitherapy are connected with the translation of materials or oral interpretation. Translation is considered the art of choosing the right words to transfer information from one language to another (Steiner, 1998). Translation of specialized materials requires language skills and knowledge in the respective field (Grego, 2010). Sports students often use materials or have contacts with colleagues from other countries – at training camps, competitions, conferences, etc. Translation competence is an important part of their education and professional development.
Methods. The research aimed to establish how students from the National Sports Academy "V. Levski" deal with translation and oral interpretation in their fields - physical education, sport, or kinesitherapy, and whether they would like to have more translation and interpretation activities as part of their specialized language courses at the Academy. The subjects of the study were 44 students from the three faculties of the Academy. A survey was conducted at the end of the spring term of 2021-2022. The subjects completed a questionnaire with 11 closed-ended questions. Survey data were processed with alternative analysis and a chi-square test (x^2).
Results and discussion. The acquired results show that more than half of the respondents need to translate documents or written materials. 68% of them rely on their own language skills. 63% also use translation tools and services but do not find them very reliable. Most of them would like to have more translation tasks and interpretation exercises as part of their language courses at the Academy.
Conclusions. The study results show that sports students need to improve their competence in translation and interpretation in their field of specialization, and the language courses at the Academy should try to offer more opportunities for that.

Keywords: *translation competence, sports terminology, kinesitherapy*

INTRODUCTION

Translation is an important part of global communication. Business, cultural, sports, and other international contacts very much rely on the correct translation of written materials and oral interpretation of statements at formal meetings and public events. It depends on the professional experience, personal skills, and talent of the translator to convey the correct meaning of a text or statement using the most appropriate language forms. Hence, translation is also considered the art of choosing the right words to transfer information from one language to another (Steiner, 1998). Although translation has been practiced for centuries, there is no universally accepted definition for it. The reason is that translation is a multi-aspectual phenomenon. It involves not only language skills but also knowledge about history, philosophy, social and cultural background, psychological preparation, etc. (Grego, 2010). Each of the two major types of translation – oral or written, requires specific qualifications. Both theoretical knowledge and practical experience are very important for success in the career - professional translators seem to have a very long period of "apprenticeship" before they become recognized and "widely respected". (Baker, 2001).

Translation of specialized materials also involves language competencies and expertise in a particular area – e.g., medicine, economics, computer technologies, sport, etc. According to the Common European Framework of References for Languages (CEFR, 2001, p.9), "competencies are the sum of knowledge, skills, and characteristics that allow a person to perform actions". Language use involves a range of competencies - *general* and *communicative language competencies*. General competencies are not specific to language but "are called upon for actions of all kinds, including language activities", while communicative language competencies "are those which empower a person to act using specifically linguistic means". Communicative competencies comprise several components: *linguistic* - including lexical, grammatical, syntactical, and other aspects of language; *sociolinguistic* – which refers to the sociocultural aspects of language use; *pragmatic* - related to the functional aspects of language use (CEFR, 2001).

Translation has been used in language learning since ancient times. Learning languages was important for the administrative purposes of multilingual societies, such as ancient Egypt and the Roman empire. Translation techniques including word lists and some grammar rules for text translation were applied then for learning Latin and Greek. Those were the main languages for international communication until the Renaissance period when teaching modern languages became important (Howatt, 2004). Translation was at the core of the Grammar-Translation method, which dominated foreign language teaching "from the 1840s to the 1940s" (Richards & Rodgers, 1992). Original or slightly adapted texts were translated from and into the target language, as the basic techniques for learning new grammar and vocabulary. The method was abandoned by the second half of the XX century with the introduction of the Direct method and the Audio-Lingual method, propagating the predominant use of the target language in class for direct communication and explanation of words and rules. Translation had to be avoided. (Richards & Rodgers, 1992; Shopov, 2013). The Communicative Approach in language learning provided the theoretical foundation for the development of several language methods, based on the concept of "communicative competence" (Hymes, 1972), and translation was to be used in language teaching only when necessary. Still, some of these methods included elements of translation - e.g., in Suggestopedia the target language texts used in the language courses were also translated into the students' native language. Other methods also included some translation in the course of study (Shopov, 2013).

In contemporary language pedagogy, there are arguments for and against using translation as a working technique in language learning (Koletnik, 2019). Among the main arguments against the use of translation is that students should be exposed to the target language as much as possible to enhance language acquisition (Ellis, 1985; Cook, 2001). According to other specialists, translation can be a useful tool in language learning, because it can help in clarifying vocabulary and grammatical issues, comparing and contrasting native and target language forms, and improving language translation/interpretation skills (Harmer, 2013; Samardali, 2017).

The current processes of globalization provide a lot of opportunities for international contacts and translation/ interpretation competencies becomes a natural element of communication in our multicultural society. Within the context of higher education, foreign language teaching is currently focused on "the development of pragmatically relevant competencies in the language" (Cañado, 2013, p. 24). A competency-based approach requires the selection of linguistic content, relevant to the communicative competencies, which students will need, using the language in a specific context (Cañado, 2013).

Language learning at the National Sports Academy "Vasil Levski" is specialized in the areas of physical education, sports, and kinesitherapy. Sports students often use materials or have contacts with colleagues from other countries – at training camps, competitions, conferences, etc. So, the need for translation or oral interpretation becomes part of their practical experience. Translation competence involves the application of language knowledge and skills for the realization of a concrete translation task. Consequently, appropriate translation and oral interpretation activities could be selected and introduced in the language curriculum for the development of translation competencies in compliance with the specialization of the courses.

METHODS

The aim of the research was to establish how university students from the National Sports Academy "V. Levski" deal with translation and oral interpretation in their fields - physical education, sport, or kinesitherapy, and whether they would like to have more translation and interpretation activities as part of their specialized language courses at the Academy. The subjects of the study were 44 students (27 men and 17 women) from the three faculties of the Academy – the Faculty of Sport, the Faculty of Pedagogy, and the Faculty of Public Health, Health Care, and Tourism. A survey was conducted at the end of the spring term of 2021-2022. The subjects completed a questionnaire with 11 closed-ended questions. Survey data were processed with alternative analysis and a Chi-square test (x^2).

RESULTS AND DISCUSSION

To the first question of the survey, *whether they need to translate documents for work or for their education*, 34.1% of the respondents replied that they often need to translate documents from or into another language, and 45.5% answered that they rarely need to do that, and 20.5% have pointed that

they do not need to translate documents. These results show that more than half of the subjects of the study sometimes need to translate documents for their education or for work.

To the second question in the survey, *whether they need to do written translations of specialized materials for their work or education*, 25% of the subjects specified that they often have to translate materials connected with education or work in their field – physical education, sport or kinesitherapy; 47.7% have answered that they rarely need to translate specialized materials in their field, and 27.3% have replied that they do not need to do translations (Figure 1). Again, the acquired results lead to the conclusion, that more than half of the respondents sometimes need to do translations of specialized materials for their work or study.

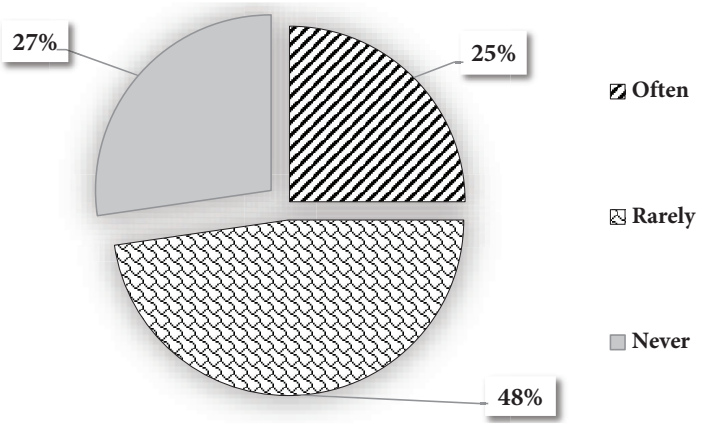


Figure 1. *How often students need to translate specialized materials*

The third question about *how they managed to do the translations when they needed to*, was a multiple-choice question and the respondents gave more than one answer. So, 68.2% replied that they did the specialized translations using their own language knowledge, 25 % answered that they relied on friends and relatives with good language skills, 63.6% pointed out that they used Google translate and other online translation facilities, and only 2.3% stated that they used the services of translation firms (Figure 2). The fact that more than half of the respondents rely on their own language skills and use internet facilities to help them in the translation of specialized materials, leads to the positive conclusion that for a good number of students, language translation has a practical application in their job or education.

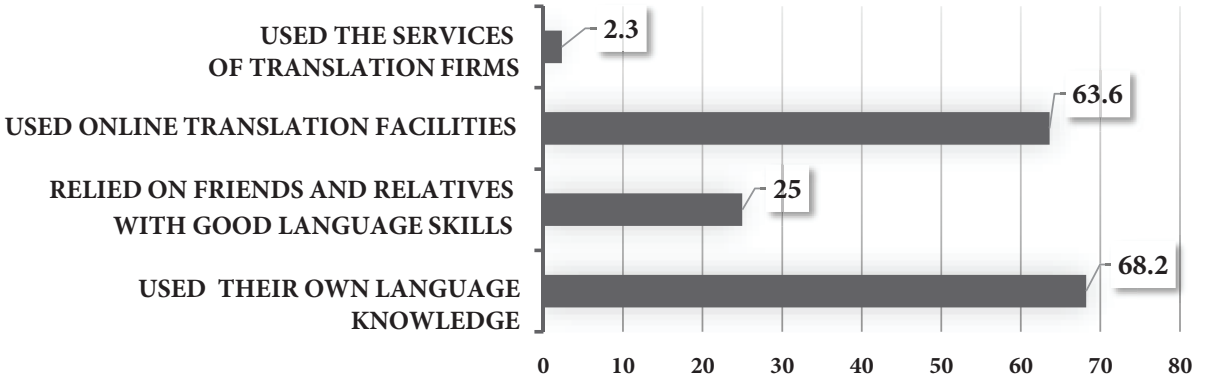


Figure 2. *How students managed to do the translations they needed*

To the fourth question, about *the reliability of online translation services* – Google translate, machine translation, etc., 38.6% of all the respondents have stated that they are not reliable, 56.8% consider them quite reliable, and 4.5% replied that they are very reliable. In other words, more than half of the

subjects feel confident using online translation services and maybe refer to them for support when doing their own translations. At the same time, another big group still does not find it reasonable to rely on online translation for important documents and materials.

To the next question, *whether they would trust online translation* (Google translate, machine translation, etc.) *in case they did not speak a foreign language*, 13.6% answered that they would trust online translation completely, 34.1% stated that they would rely on online translation to a great extent. However, 52.3% stated that they would not rely on online translation (Figure 3). Again, almost half of the respondents are inclined to trust online translation services, while the other half do not find them trustworthy.

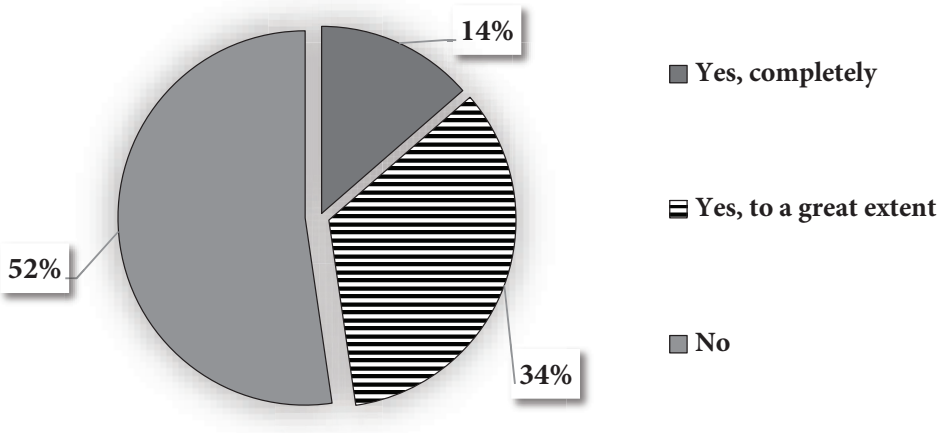


Figure 3. *Whether students would trust online translation in case, they did not speak a foreign language*

To question number six, *whether they need to do oral translations (interpretations) from or into another language in connection with their job or education*, 34.1% of the subjects have announced that they often have to do oral translations, 38.6% have stated that they rarely have to do oral translations, and 27.3% have pointed that they do not have to do oral translations. These results lead to the conclusion that the greater part of the respondents sometimes needs to do oral translations in their work or studies, which again points to the fact about the usefulness of specialized language learning and its direct practical applications.

To the question *whether they consider it necessary to have more activities in their foreign language course aimed at developing written translation skills in the fields* of *sport, physical education, or kinesitherapy*, 63.6% of the respondents answered positively, and 36.4% gave negative answers. To the following question, *whether they consider it necessary to have more foreign language activities to develop oral translation skills in their fields* of *study*, 81.8% of the respondents gave positive answers, and 18.2% answered negatively. There is a slight preference for oral translation over written translation practice among the respondents. Probably the subjects find it more beneficial to do oral translation activities for practical purposes, i.e., in professional communication. Actually, oral translation is more challenging. There is not much time to think or check for the right words, for example – during more formal professional talks or meetings. Also, some people have to overcome their shyness or stage fright to translate in public. Anyway, the acquired results clearly demonstrate students' interest in introducing more translation activities in the specialized foreign language course programs. Obviously, the research subjects find it useful and important to develop their written and oral translation competencies in the fields of physical education, sport, and kinesitherapy.

Pearson's Chi-square test (x^2) at $p \leq 0.5$ was applied to the criterion of gender, but no statistically significant differences were found. In terms of age, the biggest group of subjects - 52.3% are at *the age 18-20*, the second largest group - 27.3% are *the subjects aged 21-25*, followed by the representatives of *the group aged over 30 – 15.9%*, and finally the subjects in *the 26-30 age group* - 4.5%. These results confirm that the greater part of the students, no matter their age or gender, would like to have more translation tasks and interpretation exercises as part of their language courses at the Academy.

CONCLUSIONS

The study results show that sports students need to improve their competencies in translation and interpretation in their field of specialization, and the language courses at the Academy should try to offer more opportunities for that in the form of oral interpretation exercises and written translation materials in the fields of physical education, sports training, and kinesitherapy.

REFERENCES

Baker, M. (2001). *In Other Words. A Course Book on Translation*, Taylor & Francis e-Library.

Cañado, M. L. P. et al. (2013). *Competency-based Language Teaching in Higher Education,* Springer, ISSN 1572-0292.

CEFR, (2001). *Common European Framework of References for Languages: Learning, Teaching, Assessment.* Cambridge: CUP/Council of Europe.

Cook, V. (2001). *Using the first language in the classroom*. The Canadian Modern Language Review, 57(3), 402-423, DOI: 10.3138/cmlr.57.3.402.

Grego, K. (2010). Specialized Translation. *Theoretical Issues, Operational Perspectives, Polimetrica,* ISSN 1974-0670 Electronic Edition.

Howatt, A.P.R. & H.G. Widdowson (2004). *A History of English Language Teaching*, OUP.

Hymes, D. (1972). *On Communicative Competence, Linguistic Anthropology*, edited by A. Duranti, 2001, Blackwell Publishing. pp. 53-73.

Koletnik, M. **&** Frœliger, N. (2019). *Translation and Language Teaching: Continuing the Dialogue*, Cambridge Scholars Publishing, ISBN (10): 1-5275-3462-6.

Richards, J. & Rodgers, Th. (1992). *Approaches and Methods in Language Teaching,* Prosveta & Cambridge University Press.

Samardali, M.F.S. & Ismael, A.M.H. (2017). Translation as a Tool for Teaching English as a Second Language, *Journal of Literature, Languages and Linguistics,* Vol. 40, 2017. www.iiste.org.

Shopov, T. (2013). *Pedagogy of Language*, St. Kliment Ohridski Univwrsity of Sofia.

Steiner, G. (1998) *After Babel. Aspects of language and Translation*, Open Road, New York.

Corresponding author
Tatiana Hristakieva, Ph.D.
Foreign Language Section
Department of Language Learning
and Information Technologies
National Sports Academy "Vassil Levski",
Sofia, Bulgaria
E-mail: hristakieva@yahoo.com

 DOI: 10.37393/ICASS2022/113 249 - 254

ATTITUDE OF YOUNG PEOPLE IN BULGARIA TO ACADEMIC DISHONESTY BEHAVIOR

Eleonora Mileva, Vladimir Chernev
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
Academic dishonesty refers to committing or contributing to dishonest acts by those engaged in teaching, learning, research, and related academic activities, and it concerns not just students, but everyone in the academic environment. Academic dishonesty could take many forms, which could be broadly classified as cheating, plagiarism, falsification, and sabotage. Academic dishonesty could have very negative effects on higher education. Consequently, it could cause serious problems unless specialists utilize measures to detect and prevent it. Students' attitudes are a major factor influencing academic dishonesty. The aim of the research was to study the attitude of young people in Bulgaria toward academic dishonesty behavior. The subjects of the study were 299 Bachelor's, Master's, and Doctoral degree students from different Bulgarian universities. 203 (67,9%) respondents were female and 96 (32.1%) were male. The main method used was the Academic Dishonesty Scale (Bolin, 2004). It consisted of 10 items to measure engagement in academically dishonest behavior. Cronbach's Alpha, factor and variation analysis, Mann-Whitney, and Kruskal-Wallis criteria were used for statistical data processing. The test showed very good internal consistency (Cronbach's Alpha = .907). The analysis of the results established a relatively low level of attitudes toward academic dishonesty behavior of the young people in the country. The sex indicator revealed differences in the individual items of the test (Mann-Whitney test, $p < .05$). Attitudes toward dishonest academic behavior among students at Bulgarian universities were not clearly expressed. It should be noted that the study involved students from different types of universities and this determined the specifics of the results obtained.

Keywords: *academic dishonesty, students, attitude, universities, scale*

INTRODUCTION

Academic dishonesty is a fundamental issue for the academic integrity of higher education institutions and one that has lately been gaining increasing media attention. One of the key roles of higher education institutions is to create an environment focused on learning that will produce graduates who not only are highly skilled and technically competent but also demonstrate high standards of honesty, ethical responsibility, and commitment to practice their relevant profession and serve society well. Academic misconduct directly undermines this process and continues to put pressure on academics and institutions in terms of managing it.

Academic dishonesty refers to committing or contributing to dishonest acts by those engaged in teaching, learning, research, and related academic activities, and it applies not just to students, but to everyone in the academic environment (Cizek, 2003; Whitley & Keith-Spiegel, 2002).

The universities consider academic dishonesty a serious offense, regardless of whether it was committed intentionally or not (NIU, 2022). According to Northern Illinois University's undergraduate and graduate catalog „good academic work must be based on honesty" (NIU, 2022). Promoting honesty in academic work requires understanding the definition of academic dishonesty, its different types, and its causes and consequences.

Academic dishonesty can take many forms, which can be broadly classified as follows (Whitley & Keith-Spigel, 2002; Stern & Havelick, 1986; Brimble & Stevenson-Clark, 2011): Cheating, Plagiarism, Fabrication or Falsification, Sabotage.

Cheating involves the unauthorized use of information, materials, devices, sources, or practices in completing academic activities (NIU, 2022). For example, copying during an exam that should be completed individually is an unauthorized practice and, therefore, is considered cheating. A student who allows another student to copy from his or her work is considered to be facilitating or contributing to cheating.

As discussed by Lupton, Chapman & Weiss (2000), student cheating presents two obvious problems at the institutional level. Firstly, it threatens the equity and efficacy of instructional measurement, so that students' relative abilities are not accurately evaluated; and secondly, students who cheat probably reduce their level of learning, so they are less prepared for advanced study or application of the ma-

terial presented in a course. At the broader societal level, it is likely that students who do not respect academic integrity while at university will not respect integrity in their future professional and personal relationships.

An empirical study conducted by Nonis & Swift (2001) found a high correlation between the frequency of cheating at university/college and the frequency of cheating at work, suggesting that dishonest behavior is not situation specific. The maintenance of academic integrity within educational institutions thus becomes a fundamental issue in terms of ensuring an environment where knowledge and understanding can be advanced and applied to the maximum benefit of individuals, the economy, and society in general.

The NIU Student Code of Conduct states that the term „cheating" includes, but is not limited to:

- Use of sources beyond those authorized by the instructor in writing papers, preparing reports, solving problems, or carrying out other assignments.
- Acquisition, without permission, of tests or other academic material belonging to a member of the university faculty or staff.
- Engagement in any behavior specifically prohibited by a faculty member in the course syllabus or class discussion" (NIU, 2022).

Plagiarism is a type of cheating in which someone adopts another person's ideas, words, design, art, music, etc., as their own without acknowledging the source or, when necessary, obtaining permission from the author (Popov & Hristova, 2016). For example, copying and pasting a website's material into your document without proper citation is considered plagiarism.

The term "plagiarism" includes but is not limited to the use, by paraphrase or direct quotation, of the published or unpublished work of another person without full and clear acknowledgment. Plagiarism also includes the unacknowledged use of materials prepared by another person or agency engaged in the selling of term papers or other academic materials (NIU, 2022).

Fabrication or falsification involves the unauthorized creation or alteration of information in an academic document or activity (NIU, 2022). For example, artificially creating data when it should be collected from an actual experiment or making up a source of information that does not exist is considered fabrication or falsification.

Sabotage involves disrupting or destroying another person's work so that the other person cannot complete an academic activity successfully. For example, destroying another person's artwork, experiment, or design is considered sabotage. Failure to contribute as required to a team project can also be considered academic sabotage.

Academic dishonesty is a pervasive problem that could have very negative effects on higher education. Consequently, academic dishonesty is likely to be a problem unless specialists utilize measures to prevent and detect it.

Students' attitudes are a major factor influencing academic dishonesty. Grimes (2004) studied dishonesty in academics and business through a cross-cultural evaluation of students' attitudes. The results indicate that academic cheating is a common activity in all of the countries surveyed. Even though most students reported fearing the punishment of being caught, substantial numbers of students indicated that academic cheating is socially acceptable and not ethically wrong. When asked to rate their perceived degree of dishonesty with respect to behavior in an academic setting relative to analogous behavior in a business setting, students viewed dishonesty in a business context more severely than dishonesty in an academic context (Grimes, 2004).

Schmelkin, Gilbert & Silva (2010) investigated the perceptions of academic dishonesty among high school students, utilizing an innovative methodology, multidimensional scaling (MDS). Two methods were used to gather data: a sorting task, which was used to indirectly assess the students' perceptions, and a rating scale task, which was used to externally validate the results of the sorting task. Two dimensions emerged: Seriousness and Papers versus Exams. Implications for future research regarding high school students' perceptions of academic dishonesty are discussed.

According to a study by Stern & Havlicek (1986), 82% of the surveyed undergraduate students admitted to engaging in some form of academic misconduct during their college careers. Few differences in cheating patterns were related to the year in class or gender, and students differed on the impact

that changes in environment and procedure were expected to have on cheating. Attempts to research the problem are also observed in Bulgarian science, but such research and publications are too insufficient (Popov & Hristova, 2016).

METHODS

The aim of the research was to study the attitude of young people in Bulgaria toward academic dishonesty behavior. The subjects of the study were 299 Bachelor, Master, and Doctoral students from different Bulgarian universities. 203 (67,9%) of the respondents were female and 96 (32.1%) were male. The main method used was the Academic Dishonesty Scale (Bolin, 2004). It consists of 10 items to measure engagement in academically dishonest behavior. A 5-point Likert-type scale was used for evaluation, with 1 - never and 5 - many times.

Cronbach's Alpha, factor analysis, variation analysis, Mann-Whitney, and Kruskal-Wallis non-parametric criteria for statistical data processing were used.

RESULTS AND ANALYSIS

The socio-demographic characteristics of the studied persons, presented in Table 1, are interesting.

Table 1. *Socio-demographic characteristics of respondents*

Sex	***Educational level***	***Place of living***	***Use of Internet***	***Marital status***
Male 67.9%	Bachelor 86%	Capital 31.2%	over 20 hours a week 57.2%	Unmarried 79.3%
Female 32.1%	Master 13.4%	City between 100 and 500 thousand inhabitants 23.7%	between 11 and 20 hours a week 22.7%	Married 20.7%
	Doctorate 0.6%	City between 20 and 100 thousand inhabitants 21.4%	between 5 and 10 hours a week 16.1%	
		Small town or village 23.7%	less than 5 hours a week 4%	

In terms of gender, it must be emphasized that there are twice as many women as men – 203 (67.9%) to 96 (32.1%). This is explained by the fact that most students are representatives of pedagogical and socio-economically focused specialties in higher schools in Bulgaria.

Depending on the degree of education, it is logical that the greatest part are students in the bachelor's degree courses - 86%, followed by students in the master's degree - 13.4%, and the smallest group are those studying in the doctoral educational and scientific degree courses - 0.6%.

By place of residence, the respondents are relatively evenly distributed as follows:

- from the capital – 31.2%;
- from a city between 100 and 500 thousand inhabitants – 23.7%;
- from a city between 20 and 100 thousand inhabitants – 21.4%;
- from a small town or village – 23.7%.

The distribution of the young people who participated in the study regarding the weekly use of the Internet is very interesting. The highest relative share is the group of students who use the Internet more than 20 hours a week - 57.2%. The share of those using the global network between 11 and 20 hours a week is lower - 22.7%, as well as between 5 and 10 hours a week - 16.1%. Very few young people use the Internet for less than 5 hours - only 4%.

For the analysis of the results, it is important to point out that the statistical procedure follows the following basic steps and algorithm:

1. Applying Cronbach's Alpha to establish the validity of the test for Bulgarian conditions, the internal consistency of the scale, and the relationship between the individual items within the scale.
2. Applying factor analysis by the method of principal components with Varimax rotation.
3. Applying variation analysis by determining the mean values, standard deviations, and minimum and maximum values for each item separately.

As a first step in the psychometric characteristics of the academic dishonesty scale, Cronbach's Al-

pha was applied. After applying Cronbach's Alpha it was found that the Bulgarian variant of the scale showed very good internal consistency (Cronbach's Alpha = .907). Therefore, the correlations between the individual items within the scale for academic dishonesty were high.

The next step was to apply a principal component factor analysis with Varimax rotation and an eigenvalue of at least 1. The factor analysis resulted in a one-factor solution, with all ten items included in it. The factor explains 56.45% of the variation, with the single factor of academic dishonesty combining all variables with a factor weight equal to or above 0.300, grouped in a logical manner. The correlation coefficient between the individual items is over 0.560.

The variation analysis of the results established a relatively low level of attitudes toward academic dishonesty behavior of the young people in the country. The individual indicators of the scale varied from M = 1.33; SD = 0.81 ("turned in work done by someone else") to M = 2.33; SD = 1.38 ("collaborated on an assignment when the instructor asked for individual work") (Table 2).

Table 2. *Variation analysis of scale for academic dishonesty*

N	*Item*	*Mean (M)*	*SD (SD)*	*Minimum (Min)*	*Maximum (Max)*
1	Copied material and turned it in as your own work	1.74	1.13	1.0	5.0
2	Used unfair methods to learn what was on a test before it was given	1.61	1.07	1.0	5.0
3	Copied a few sentences of material from a published source without giving the author credit.	2.17	1.35	1.0	5.0
4	Helped someone else to cheat on a test	2.02	3.36	1.0	5.0
5	Collaborated on an assignment when the instructor asked for individual work	2.33	1.38	1.0	5.0
6	Copied from another student during a test	1.71	1.18	1.0	5.0
7	Turned in work done by someone else	1.33	0.81	1.0	5.0
8	Received substantial help on an individual assignment without the instructor's permission	1.63	1.12	1.0	5.0
9	Cheated on a test in any way	1.75	1.19	1.0	5.0
10	Used a textbook or notes on a test without the instructor's permission	1.94	1.31	1.0	5.0

The indicator "collaborated on an assignment when the instructor asked for individual work" has the highest value even though the rating is on the low part of the scale. (M =2.33; SD = 1.38).

It is a fact that when assigned individual work, students sometimes resort to interaction and collaboration with other learners. This is a widespread practice and apparently, young people do not consider such behavior to be a violation of academic ethics.

The indicator "turned in work done by someone else" has the lowest value (M = 1.33; SD = 0.81). It becomes clear that such behavior is not particularly popular among students. This is logical, taking into account the specific characteristics of the academic environment. It can be argued that students rely on their own knowledge and abilities to solve the tasks and meet the exam requirements.

The following statements are also presented with a low degree of significance regarding academic dishonesty:

- Copied material and turned it in as your own work (M = 1.74; SD = 1.13).
- Used unfair methods to learn what was on a test before it was given (M = 1.61; SD = 1.07).

- Copied from another student during a test (M = 1.71; SD = 1.18).
- Received substantial help on an individual assignment without the instructor's permission (M = 1.63; SD = 1.12).
- Cheated on a test in any way (M = 1.75; SD = 1.19).

From the results presented, it can be concluded that the mentioned approaches, which are part of academic dishonesty, are not a frequent phenomenon and are not popular among young learners. Students do not rely on them to pass exams and test assignments.

With a slightly higher average value are the following statements:

- Copied a few sentences of material from a published source without giving the author credit (M = 2.17; SD = 1.35).
- Helped someone else to cheat on a test (M = 2.02; SD = 3.36).
- Used a textbook or notes on a test without the instructor's permission (M = 1.94; SD = 1.31).

It becomes clear that the given statements are also not a common phenomenon and do not constitute a violation of academic ethics. This can be interpreted as a positive result that points to compliance with the norms and rules of academic ethics and established academic behavior.
The sex indicator revealed differences in the individual items of the test (Mann-Whitney U test, $p < .05$). Men were more prone to dishonest academic behavior than women.

DISCUSSION AND CONCLUSIONS

Academic dishonesty is a multifaceted phenomenon. It represents a significant problem for the academic community, which is to some extent underestimated and insufficiently researched, especially in Bulgarian science. In this relation, the academic dishonesty scale of Bollin (2004) is a reliable instrument for measuring the phenomenon.

In general, a positive trend is emerging among Bulgarian students regarding academically dishonest behavior. Attitude toward dishonest academic behavior among students at Bulgarian universities was not clearly expressed. A certain difference in the tendencies towards academic dishonesty by gender was found, with men being more inclined to violate academic ethics.

It should be noted that the study involved students from different types of universities which determined the specifics of the results obtained.

Overall, the study's findings confirm the significance of the issue of academic dishonesty within the higher education sector.

We suggest that university people need to examine this issue closely in order to develop mechanisms for managing and curtailing the level of academic misconduct, since a failure to do so may lead to a further undermining of the academic integrity of higher education.

Future resolution of the problem requires new research and more in-depth practical studies, as well as the development and implementation of reliable methodologies for the study of academic dishonesty.

REFERENCES

Bolin, A. (2004). Self-Control, Perceived Opportunity, and Attitudes as Predictors of Academic Dishonesty. *Journal of Psychology*, 138(2), 101-114, https://doi.org/10.3200/JRLP.138.2.101-114.

Brimble, M. & Stevenson-Clark, P. (2011). Perceptions of the Prevalence and Seriousness of Academic Dishonesty in Australian Universities. *Australian Educational Researcher* 32(3), doi: 10.1007/BF03216825

Cizek, G.J. (2003). *Detecting and Preventing Classroom Cheating*, Corwin Press.

Grimes, P.W. (2004). Dishonesty in Academics and Business: A Cross-Cultural Evaluation of Student Attitudes. *Journal of Business Ethics*, 49, 273–290. https://doi.org/10.1023/B:BUSI.0000017969.29461.30

Lupton, R., Chapman, K. & Wess, J. (2000). International Perspective: A Cross-National Exploration of Business Students' Attitudes, Perceptions, and Tendencies Toward Academic Dishonesty. *The Journal of Education for Business,* 75(4), 231-235. doi: 10.1080/08832320009599020

Nonis, S. & Swift, C. (2001). An Examination of the Relationship Between Academic Dishonesty and Workplace Dishonesty: A Multicampus Investigation. The Journal of Education for Business 77(2), 69-77, doi: 10.1080/08832320109599052

Northern Illinois University Academic Catalog (2022). Northern Illinois University.

Popov, G. & Hristova, V. (2016). Plagiatstvoto – vapros na moral, etika ili prestaplenie. Research Gate. doi: 10.13140/RG.2.1.2360.6163.// Попов, Г. & Христова,

В. (2016). Плагиатството – въпрос на морал, етика или престъпление. Research Gate. doi: 10.13140/RG.2.1.2360.6163.

Schmelkin, L. P., Gilbert, K. A., & Silva, R. (2010). Multidimensional Scaling of High School Students' Perceptions of Academic Dishonesty. *The High School Journal*, *93*(4), 156–165. http://www.jstor.org/stable/40865056

Stern, E. B., & Havlicek, L. (1986). Academic misconduct: results of faculty and undergraduate student surveys. *Journal of allied health*, *15*(2), 129-142.

Whitley, B. & Keith-Spiegel, P. (2002). *Academic dishonesty: an educational guide* (eBook): Mahwah, N J: Lawrence Erlbaum.

Corresponding author:
Eleonora Mileva, D.Sc.
Dept. of Psychology, Pedagogy, and Sociology
National Sports Academy "Vassil Levski"
21, Acad. Stefan Mladenov str.
Studentski grad, Sofia 1700, Bulgaria
E-mail: mileva@nsa.bg

KINESITHERAPY STUDENTS' SATISFACTION WITH ENGLISH LANGUAGE CLASSES DURING COVID-19 PANDEMIC

Zshivka Zsheliaskova-Koynova & Tatiana Hristakieva
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
Introduction: Students' satisfaction is a major issue in a language learning course. The main task of the specialized English course for kinesitherapy students is to provide language knowledge and skills, and stimulate oral production, using interactive learning techniques, reading and listening materials on human anatomy, and health care for students' future careers.
Methods: The aim of the research was to study students' satisfaction with the specialized English course held during the Covid-19 pandemic (spring semester, academic 2021-2022). The subjects were 51 students from the Faculty of Public Health, Health Care, Kinesitherapy and Tourism at the National Sports Academy "V. Levski". They completed anonymously a Questionnaire of Student Satisfaction with Speaking Classes (Asakereh, Dehghannezhad, 2015), consisting of 6 scales: Linguistic related items; Psychology related items; Socially related items; Course book related items; Instructor related items and Educational system and facilities-related items. A 5-point Likert-type scale was used for evaluation of students' satisfaction. Students also completed a survey, including questions about their gender; age; type of high school they finished; preference for the type of education (online, face-to-face or blended).
Results and discussion: The results indicate that student's satisfaction with the English course was high, irrespective of gender or age. Students from language or science schools were less satisfied by language communication with their colleagues, compared to students from other schools (t_{50}=2.39, p=.021). Most students prefer face-to-face education (54.9 %), least prefer online education (13.7%) and about one third prefer blended education (31.4%).
Conclusion: The results of the study show that students need to communicate directly in person on professional topics, and that learning specialized terminology is useful and important to them.

Keywords: *satisfaction, language teaching, kinesitherapy*

INTRODUCTION

Students' satisfaction is one of the main objectives in any course of study. It is an important indicator in higher education because it reflects the extent to which students' needs and expectations are met in the process of their education (Zsheliaskova-Koynova, Mileva, 2019). Addressing students' needs and interests, providing a good "campus climate" and "instructional effectiveness" are considered as key factors for students' satisfaction, which can help universities recruit and retain their students (Elliott & Healy, 2001). Students' satisfaction in higher education has also been defined as "a short-term attitude resulting from an evaluation of students' educational experience, services, and facilities" (Weerasinghe et al., 2017). According to some studies (Butt & Rehman, 2010; Douglas et al., 2006; Solinas et al., 2012), the quality of teaching and learning, and the selection of education courses, are the most important factors for university students' satisfaction, with reference to their future professional realization. Other researchers on the topic (Weerasinghe et al., 2017) agree that students' satisfaction is influenced by a number of factors, which could be divided into two groups - personal and institutional. Personal factors include age, gender, average academic achievements, preferable learning styles, job opportunities, etc. The most important institutional factors include the quality of teaching, the learning materials, and the relations between students and lecturers. Next in importance come the conditions in the lecture halls, the technical provision, the flexibility of the learning programs, the opportunities for personal development, the prestige of the academic institution, the general atmosphere at the university, the university building and facilities, etc. It could be summarized that the most important factors for students' satisfaction are the professional skills and qualifications of the lecturers, the good relations and feedback between students and lecturers, the learning materials, the technical facilities, and the conditions in the lecture halls (Hristakieva, 2019).

METHODS

An earlier study on kinesitherapy students' attitude to specialized language learning showed that students need to improve their speaking skills, and to

learn specialized terminology in the field of medicine, healthcare and kinesitherapy. Using interactive learning techniques, such as team work, presentations and games in the process of specialized language learning was also appreciated by the subjects of the study (Hristakieva, 2020).

So the aim of the present research was to study students' satisfaction with the English course for kinesitherapy students, which was upgraded with reference to students' wishes and preferences. The course was held during the Covid-19 pandemic in the spring semester of the academic 2021-2022. The subjects were 51 second-year kinesitherapy students (22 men and 29 women) from the Faculty of Public Health, Health Care, Kinesitherapy and Tourism at the National Sports Academy "V. Levski". The main objectives of the course were to provide the students with opportunities to learn and practice specialized language in the field of anatomy, physiology, nursing and physiotherapy and to improve their speaking skills, using interactive techniques to share information with their colleagues. The course materials included books on nursing and physiotherapy, audio-visual and written materials on human anatomy and physiology (Grice, 2011; Evans et al., 2015; Jones & Jones, 2000). The language level of the students was A2-B1, according to the Common European Framework of Reference (CEFR).

At the end of the course the subjects of the research completed anonymously a tested and validated *Questionnaire of Student Satisfaction with Speaking Classes* (Asakereh, Dehghannezhad, 2015). The *Questionnaire* includes 38 questions for evaluation of students' satisfaction, organized into 6 scales: Linguistic related items (accuracy and fluency in speaking, etc.); Psychology related items (self-confidence in speaking, etc.); Socially related items (opportunities and ability to communicate, etc.); Course book related items (the quality of books and materials); Instructor related items (motivation, teaching methods, etc.) and Educational system and facilities related items (number of students, learning conditions, technical facilities, etc.). A 5-point Likert-type scale was used for measuring students' satisfaction, where 1 was the lowest degree of satisfaction and 5 was the highest degree.

The subjects of the research also completed a *Survey*, including questions about their gender; age; type of the high school they finished; preference for the type of education - online, face-to-face or blended learning. The subjects' questionnaire and survey answers were processed and analysed with SPSS statistical package.

RESULTS AND DISCUSSION

The statistical analysis of the results from the *Questionnaire of Student Satisfaction with Speaking Classes* shows that the respondents' satisfaction is generally high – between M=3.96 (on *Facilities* scale) to M=4.31 (on *Instructor* scale), which is a positive evaluation of the specialized English language course for kinesitherapy students as a whole (Table 1). These positive results are also confirmed by the high final marks, which the students received in the written test and oral presentations on the covered material at the end of the course (M=5.34, where 6.00 is the highest mark).

Table 1. *Descriptive statistics*

Scales	N	Mean	SD	Min	Max	Range
Linguistic	51	4.15	0.66	1.71	5.00	3.29
Psychology	51	4.05	0.80	2.50	5.00	2.50
Social	51	4.06	0.61	2.40	5.00	2.60
Materials	51	4.12	0.88	1.00	5.00	4.00
Instructor	51	4.31	0.68	1.47	5.00	3.53
Facilities	51	3.96	0.72	1.80	5.00	3.20

The respondents gave high values on the *Linguistic related items* (accuracy and fluency in speaking, etc. (M=4.15) and on the *Psychology related items* (self-confidence in speaking, etc. (M= 4.05) - Table 1. These results lead to the conclusion that during the course, the subjects of the research gained greater confidence in using the language in the field of medicine and kinesitherapy. Communication is important for the future professional development of kinesitherapy students. However, developing speaking skills is complicated, because it requires language knowledge (vocabulary, grammar, culture, etc.) and an appropriate environment - mutual respect and a positive atmosphere for active com-

munication in the group (Brown, 1994; Harmer, 2013).

The items on the *Socially related scale* (opportunities and ability to communicate, etc.) also receive high evaluation (Table 1), except item No 14. "The proficiency level of your classmates" (M=3.69). The lower value on this item is due to the fact that language levels of the students in the groups are not very homogeneous, some of them are closer to level B2, while others are closer to A2, according to the CEFR. This is a matter of group restructuring, which is difficult to achieve currently for various reasons, for example - the complicated weekly program in Kinesitherapy, which does not allow for big reorganizations of the basic student groups. A possible solution to the problem is for the English lecturer to focus mainly on introducing more language activities for mixed-ability groups.

The *Course book related items* (the quality of books and materials) also receive high evaluation (M=4.12) - Table 1. Obviously, the subjects of the research are satisfied with the books and audio-visual materials used in the course.

The items from the *Instructor-related scale* (motivation of the instructor, teaching methods, etc.) have the highest values on average (M=4.31) - Table 1. For example, item 17. "Your instructor's motivation for teaching", receives the highest value in the questionnaire (M=4.63); item 18. "The help of your instructor when you face speaking problems" also receives high evaluation (M=4.53); item 29. "Your speaking instructor's methods of teaching" and item 32 "The encouragement you get from your instructor to speak" also have high values (M=4.45 and M=4.49 respectively). These results show that the subjects of the study are satisfied with the work of the English lecturer and the teaching methods, applied in the course of study. Interactive techniques - teamwork, oral presentation, audio-visual activities, games and translation of specialized texts, are accepted well and considered useful by the respondents.

The last in the *Questionnaire* is the *Educational system and facilities related scale* (number of students, learning conditions, technical facilities, etc.). This scale receives relatively lower values by the subjects of the research (M=3.96 - Table 1), for example, item 37. "The time when your speaking classes are held" (M=3.75). These results are due to the complicated weekly program in kinesitherapy, as mentioned above, where English classes have to be held in inconvenient hours for the students (very late afternoon or early morning sessions, etc.). Again, these are problems to be resolved with the Academy administration in the future.

The *Survey* results indicate that the respondents' satisfaction with the English course was high, irrespective of gender or age. However, the students who graduated from secondary schools specializing in languages or science were less satisfied by language communication (*Social* scale) with their colleagues, compared to the students who graduated from other secondary schools (t_{50}=2.39, p=.021) – Table 2. This is due to the fact that students graduating from language or science schools have more language classes and relatively higher language level, compared to that of students graduating from other kinds of secondary schools.

Table 2. *Type of schools and satisfaction by language communication with colleagues*

Type of secondary school	N	Mean	SD	t	p
Language or science schools	33	3.98	0.61	2.39	.021
Other schools	17	4.33	0.42		

Note. Only one student graduated fom sport school and was removed from the sample for the purposes of this analysis.

With reference to the question about students' preference for the type of language education, most of the respondents prefer face-to-face education (54.9 %), least prefer online education (13.7%) and about one third prefer blended education (31.4%). These results reveal students' need of in-person communication when it comes to specialized foreign language learning. Blended learning is also pointed as a good option by a number of students. The explanation for that choice, as noted in previous studies (Slavova et al., 2019), is that blended learning provides a flexible approach, combining online and face-to-face learning.

A comparative statistical analysis of the results from the *Questionnaire* and the *Survey* between the polar groups (online and face-to-face learning) reveals that the preference for online learning (compared to the preference for face-to-face learning from the *Survey),* is related to the significantly lower values on *Questionnaire* scale *Psychologically related items* (referring to self-confidence to speak English (t_{35}=2.2, p=.035) – Table 3. In other words, students who do not feel confident in using the language in class prefer the online form of education, where they could be mostly listeners, or will not be watched by their classmates when speaking. These observations have to be taken into account by the language lecturer, and students lacking in confidence about their language skills should be encouraged to contribute more actively in the work of the group.

Table 3. *Preferred types of learning and self-confidence to speak English*

Preferred types of learning	N	Mean	SD	t	p
Online	7	3.57	0.61	2.20	.035
Face-to-face	28	4.27	0.78		

Finally, we compared the results from the present research, and those from a pedagogical experiment, introducing interactive learning techniques in an English course for bachelor students, specializing in Physical Education and Sport (Hristakieva, 2019). The experimental course was organized in the academic year 2016/2017 with second-year students from the Faculty of Pedagogy of the NSA "V. Levski". The same *Questionnaire of Student Satisfaction with Speaking Classes* (Asakereh, Dehghannezhad, 2015) was applied in the research to find out about students' satisfaction with the application of the experimental English course. The analysis of the results showed that the PE students were also satisfied of the experimental course and the following three of the 6 scales received the highest values – *Psychology related items* (self-confidence in speaking, etc.); *Course book related items* (the quality of books and materials) and *Instructor related items* (motivation, teaching methods, etc.).

The acquired results in the present research show that the bachelor kinesitherapy students were also very satisfied with the specialized English course using interactive techniques, and the scales receiving the highest values are also: the *Instructor related items* (motivation, teaching methods, etc.); the *Psychology related items* (self-confidence in speaking, etc.) and *Course book related items* (the quality of books and materials).

These similar results for the two different faculties of students are a confirmation that both groups of students are satisfied with the contents of their English language courses using interactive learning techniques and focusing on specialized language, with reference to kinesitherapy or physical education and sport, respectively.

Conclusion: The results of the study show that kinesitherapy students are satisfied with the specialized English language course, the materials offered and the work of the lecturer. Using interactive learning techniques to communicate in–person on topics connected with their specialty in English, and learning terminology in their field is important to them.

REFERENCES

Asakereh, A., & Dehghannezhad, M. (2015). Student satisfaction with EFL speaking classes: Relating speaking self-efficacy and skills achievement, *Issues in Educational Research*, available at: http://iier.org.au/iier25/asakereh.pdf (accessed July 2022).

Brown, H.D. (1994). *Teaching by Principles. An Interactive Approach to Language Pedagogy*, Prentice-Hall. Inc. USA.

Butt, B., & Rehman, K. (2010). A study examining the students' satisfaction in higher education, *Procedia. Social and Behavioral Sciences*, 2 (2010), pp.5446-5450.

Douglas, J., A. & Barnes, B. (2006). Measuring student satisfaction at a UK university, *Quality Assurance in Education,* Vol. 14 No. 3, pp. 251-267.

Elliott, K, & Healy, M. (2001). Key Factors Influencing Student Satisfaction Related to Recruitment and Retention. *Journal of Marketing for Higher Education,* Vol. 10, Issue 4, pp. 1-11.

Evans, V., Dooley, J. & Hartley, S. (2015). *Physiotherapy, Career Paths, Express Publishing.*

Grice, T. (2011). Nursing, Oxford English for Careers, OUP.

Harmer, J. (2013) The Practice of English Language Teaching, fourth edition, Pearson Education Limited.

Hristakieva, T. (2019). Satisfaction of Students from the National Sports Academy with the Use of Interactive Techniques in Teaching English for Special Purposes, *Sport & Science,* Vol. 3-4, 2019, pp. 124-135, ISSN 1310-3393.

Hristakieva, T. (2020). Kinezitherapy Students' Attitude to Foreign Language Learning in Pandemic Conditions, *Pedagogy,* vol.92. No7s, special issue, pp. 252-259, Sofia.

Jones, M., & Jones, G. (2000) Biology, Cambridge Coordinated Science, Cambridge.

Slavova, V., Hristakieva, T. & Marinoiva, N. (2019). Study of Students' Satisfaction in Blended Foreign Language Environment, *International Congress of "Applied Sports Sciences" Balkan Scientific Congress "Physical Education, Sports, Health", 15-16 November, 2019*, Sofia, Bulgaria, Proceeding Book, pp. 423 – 426, ISBN: 978-954-718-601-9(CD).

Solinas, G., Masia, M. D., Maida, G. & Muresu, E. (2012). What Really Affects Student Satisfaction? An Assessment of Quality through a University-Wide Student Survey, *Creative Education,* Vol.3, No.1, 37-40.

Weerasinghe, S., Lalitha, R. & Fernando, S. (2017). Students' Satisfaction in Higher Education, Literature Review, *American Journal of Educational Research,* vol. 5, No. 5 (2017), pp. 533-539,

Zsheliaskova-Koynova, Zsh., & Mileva, E. (2019). Students' Satisfaction with Pedagogy Teaching, *Trakia Journal of Sciences,* Vol. 17, Suppl.1, pp 832-837, ISSN 1313-7069 (print).

Corresponding authors:
Zshivka Zsheliaskova-Koynova, Ph.D.
Department of Psychology, Pedagogy, and Sociology
National Sports Academy "Vassil Levski",
Sofia, Bulgaria
E-mail: zshivka@gmail.com

THE FORMATIVE ROLE OF ACTIVE SPORTS ACTIVITY FOR THE MORAL STATUS OF ADOLESCENTS

Donka Zheleva-Terzieva
Tracian University, Stara Zagora, Bulgaria

ABSTRACT
The general goal of family and educational environment is to prepare the rising generation for public practice by gaining social experience and building a moral culture of behavior. Although they are different, both institutions are responsible for the upbringing of children. Part of the extracurricular work in physical education and sport are also sports activities organized and conducted by sports clubs in a certain type of sport.
The article conducts a study on the impact of training and sports competition activities on the formation of morally responsible behavior in adolescent football players. Certain indicators are derived from each criterion being analyzed in order to determine the moral status of the contestants. The methods of pedagogical research discourse, inquiry, and expert evaluation, applied to two age groups (total respondents – 280 competitors, 22 coaches, 18 referees, and 4 football delegates) during the football championship 7 of the 2021/22 sports competition year in Stara Zagora region. The opinion of the coaches and delegates, the actions of the referees regarding disciplinary control, the behavior of the players before the start, during, and after the end of football matches, numbering 300, have been examined. The statistical methods for processing empirical data for the purpose of analyzing and presenting the results of the study are variational, correlational, comparative, and descriptive analyses, Van der Waerden test, and processing of textual information from matches played. The results obtained found positive and statistically analyzed changes in the behavior of the contestants according to the criteria and indicators studied and prove the formative impact of active sports activity on the moral culture of the personality. The inquiry analysis carried out by place of residence shows that the research effect on the behavior of contestants has greater values for those living in larger cities.

Keywords: *sports activity, football, adolescent, moral education.*

INTRODUCTION

The admission of children to the school does not diminish the role of the family, but the functions of the two institutions should not be identified. The interaction between them is important for the moral education of students, although there is no specific system for educational work alone and for the one in interaction (Laleva, 1991). The specialists in the field are united around the opinion that the formation of moral norms is achieved by acquiring certain knowledge and practical experience, being the foundations the personal value system is built on. The process is strictly individual and depends on the social environment. According to Babalova (1991), socio-moral regulation takes place on three levels – macro-social environment, immediate environment and personal level. The moral norm reaches the personality primarily through the second level, namely the microenvironment, which is accepted as a natural translational relationship. Individual moral behavior is built (ibid.) through the interaction of the individual with the other members of the social group.

During the training process, adolescents do an activity, which, through a variety of interpersonal relationships, build socio-moral behavior. Human behavior evolves from the beginning to the end of life, going through different stages of development, but it is mostly developed during the school period. Education is defined as "a targeted, organized, humane activity carried out by the family, the school and other educational entities to build and validate such qualities in the child's personality that will contribute to the formation of the child`s view of life and value system" (Petrov, 2007), "a specific human phenomenon accumulating the culture of mankind" (Babalova, 1991), "a special kind of interconnected human activity, which differs from other types of activities mainly with the conscious (pedagogical) impact, as a result of which changes occur not only in the psyche but also in the behavior of graduates" (Dimitrova, 2016). As S. Chavdarova-Kostova (2016) points out, the adults, respectively the institutions responsible for the rising generation, are expected to apply all meaningful varieties of education – moral, intellectual, aesthetic, labor, civil, environmental, health, etc. According to E. Popova and E. Hristova (1990), the formation of moral consciousness in pedagogy means to build moral notions, concepts, opinions, judgments, assessments, and then moral beliefs, i.e. to properly

educate the understanding of good and bad, moral and immoral. The main methods of forming moral consciousness in the way of persuasion are the verbal impact and the personal example by which adolescents can be directed to adherence the generally valid norms of behavior.

There is no doubt that physical activity gives opportunities for acquiring of certain ethical norms and rules. On this basis, adolescents are taught virtues that will be the basis for future behaviour in society (Babalova, 1991). One of the functions of education is the preservation of humanity through the development of the individual as a member of society, and one of the objectives of physical education training in the educational system is the educational, through which it directly affects the personality of the student (ibid.).

Training and sport competitive activities are types of extracurricular physical education activities in the field of after-school activities. Using the means and methods and applying the principles of physical education, in the process of sports activity, the main tasks of training (instructive, healing and educational) are decided in unity. As an educational component, sports activity has all the characteristics of the educational process: complexity, organization, purposefulness, contradictivity and pedagogical leadership (Dimitrova, 2016).

Planned extracurricular activities can improve student's attention and concentration, and participation in sports teams can stimulate the pursuit of education and self-improvement (Echeva, Ignatov, 2021). In another study by the same authors (Ignatov, Echeva, 2021) the direct relationship between school's success and participation in extracurricular activities is proven.

OBJECTIVE AND TASKS OF THE RESEARCH

The author's team **aims** to explore the educational effect of the training and sport competitive activities the development of personality. The objective thus set is realized through the following *tasks*:

1. Study of the behavior of adolescent footballers before, during, and after the end of official championship matches and taking into account the weaknesses in this regard.
2. Drawing up an action plan to eliminate and implement identified gaps.
3. Measurement and reporting of results.

RESEARCH METHODS

The total number of persons surveyed was 280 football players, divided into two age groups – born in 2011 and born in 2012. All respondents participated in the Football Championship 7, administered by the BFU-Stara Zagora, during the 2021/22 sport and competition year. The number of football clubs participating with one or two teams was 15 out of 8 cities in South-eastern Bulgaria: Stara Zagora, Yambol, Dimitrovgrad, Haskovo, Sliven, Svilengrad, Chirpan and Kazanlak. The invited experts (competent persons) were 22 coaches and 4 football delegates, all conducting direct monitoring of the behaviour of the persons surveyed. The opinion of the coaches and delegates is determined through the method of pedagogical research, and through technical processing of documentation – the disciplinary control established by 18 football referees. The number of processed protocols from football matches is 300.

During and after the end of the autumn half-season, a number of weaknesses in the behaviour of the contestants were identified, namely: a significant number of penalty cards received for unsportsmanlike or improper conduct (disputes, controversies, protests, expression of disagreement through words and actions, etc.); low level of personal and public hygiene; absence from official meetings. During the winter holiday between the two half-seasons, the RC of the BFU carried activities to reduce and/or eliminate these gaps. A priority work was started, through a group of committee representatives formed at the RC and the coaches of the teams, to strengthen the educational impact of sports football on the behavior of the players. Working with adolescents is a challenge for every educator, including a sports one, the main duties of whom are to train and educate and through this, to develop the child`s personality (Naydenova, 2020).

The behavioral criteria and indicators to be tested are presented in Table 1, where listed also is the toolbox for their diagnosis, and justified below the table is the selection of the author's team against the criteria chosen for the research.

Table 1. *Behavioral criteria and indicators and diagnosing toolbox*

Criteria		Indicators	Toolbox
Behavior/Attitude	to teammates	shows respect, mutual assistance	Processing of records of games played
	to competitors	demonstrates sportsmanship	
	to functionaries and officials	show respect, follow the instructions greets adopts the decisions	Observation, expert evaluation, discourse
Self-expression	maintenance of personal and public hygiene	clear and welcoming look, cleaning of the technical area after the end of the meeting	
Responsibility	to the team	regular participation in the training and competitive processes	
Discipline		efforts to carry out tasks assigned	

Moral upbringing is a set of moral manifestations *(relationships)* of man expressed through thoughts, feelings, habits, and actions. The degree of moral upbringing is the result of comparing behavior with generally accepted moral criteria. Forms of *self-expression* are manifested by verbal and non-verbal actions. They are types of ways to declare yourself or what you want with or without using the organs of speech. The manifestation of personal responsibility is indicative of the presence of high consciousness. Such people are not indifferent in their behavior towards others. A balance is created in the microenvironment through the *responsible behaviour* of everyone, which in turn creates states of peacefulness and common prosperity. Each individual act depends on its value for the common good, the consciousness of responsibility controls and disciplines the person and directs his/ her strength towards the manifestation of moral valour in private and public life. *Discipline* is a manifestation of the way personal obligations to yourself and society are perceived and given meaning.

After the end of the spring half-season, the results were measured, processed, and subjected to variation, correlation, comparative and descriptive analysis, Van der Waerden test, and processing of the text information from games played.

RESULTS

Notable from the results obtained is that in the time interval of meetings the number of penalty cards received in the spring half-season is lower than in the autumn one – the regression in this regard is almost four times, which is indicative of the effectiveness of the educational work carried out. Pearson's correlation coefficient and determination factor calculated using the IBM SPSS Statistics software platform, and the statistical variation values presented in Table 2, shall be used to determine the presence and degree of connectivity between the measures taken as a factor variable and the performance of the competitors as a result variable.

Table 2. *Variation and correlation values of penalty cards*

Variational values	**Autumn**	**Spring**
Number of teams	34	34
Total number of penalty cards	66	16
Average number of penalty cards per team	1.94	0.47
Maximum number of penalty cards per team	7	2
Standard Error	0.29233	0.11357
Asymmetry factor	1.306	1.112
Excess coefficient	1.397	0.153
Correlation factors	**Value**	
Pearson coefficient (R)	.589	
Coefficient of certainty (R^2)	34.69 %	

The value of the presented dependency of the strength scale coefficient of common Pearson's correlation indicates the existence of a significant relationship with a positive direction, which means that there is a straight correlation between the variables. The resulting value of the coefficient of certainty shows that just over 1/3 of the changes in the resultant variable are the result of the impact of the factor variable. The relationship between the latter and the individual behavioral indicators is specified by the determining factor (Table 3).

Table 3. *Dependencies between the factor variable and the research criteria*

Criteria	Dependency strength	R^2 (%)
Behavior/attitude	Significant	54.69
Self-expression		56.75
Responsibility	Moderate	34.39
Discipline		31.44

The results in the table show that the strength of dependency varies from criteria to criteria. It is significant in the criteria directly related to the championship matches held. It is moderate in relation to those criteria that are related to an already built stereotype and personal qualities, responsibility, and discipline.

The inquiry analysis carried out by place of residence shows that the effect on the behavior of the competitors studied has higher values in those living in the larger cities, but cannot be taken as a definite fact because the number of teams participating in the surveyed groups of the championship is different from the different cities.

Table 4. *Information on the strength of dependency between variables in different cities*

Town	Size by population	R	R^2 (%)	Dependency strength	Number of teams
Stara Zagora	big	0.765	58.47	Significant	11
Sliven	average	0.682	46.44	Moderate	4
Yambol	average	0.716	51.22	Significant	5
Haskovo	average	0.706	49.88	Moderate	3
Kazanlak	average	0.579	33.53	Moderate	5
Dimitrovgrad	average	0.638	40.74	Moderate	2
Svilengrad	small	0.602	36.21	Moderate	3
Chirpan	small	0.542	29.37	Low	1

DISCUSSION

The results obtained show visible positive and statistically presented changes in the behavior of the competitors under the criteria and indicators studied and prove the developing impact of active sports activity on the moral culture of the person. The survey shows the effectiveness of targeted work with adolescents in the field of their behavioral responses, especially when it comes to the educational purpose of the pedagogical profession. The hypothesis proven is that the impact of the targeted and conscious work of sports educators on the behavior of adolescent competitors during the training and sport and competitive processes leads to the building of personal qualities that can be the basis of behavior in life in general. In turn, built behavioral habits can motivate the individuals surveyed in this research to pass on what they have learned to future generations, which is a prerequisite for increased public attention to the presented problem.

REFERENCES

Babalova, R. A. (1991). *Theory of Education (lecture course),* Part I, UPP St. Kl. Ohridski, Sofia.

Dimitrova, Y. (2016). Formation of values in students through the training in physical education and sports. *Abstract.*

Echeva, G., Ignatov, G. (2021). Survey of the opinion of students regarding the conduct of extracurricular activ-

ities in football. *Modern trends of physical education and sports*, UPP St. Kl. Ohridski, Sofia, pp. 117-126.

Ignatov, G., Echeva, G. (2021). State of the regulatory basis and conditions in the learning environment for providing class and extracurricular activities in physical education and sport. *Trakia Journal of Sciences*, Vol. 19, Suppl. 1, pp. 677-683.

Laleva, D. (1991). School-family and the moral values of adolescents. *For Humane and Democratic Bulgarian School*, Reports Part I, Research Institute of Education, Sofia, pp. 141-145.

Naydenova, K. (2020). *Theoretic and methodical formulations of football training of students*, NSA PRESS, Sofia.

Petrov, G. (2007). *Public Education*, No. 47 (2), pp. 13-18.

Popova, E., & Hristova, E. (1990). *Theory and methodology of physical education*, UPP St. Kl. Ohridski, Sofia.

Chavdarova-Kostova, S. (2016). *Education (content and procedural dimensions*), UPP St. Kl. Ohridski, Sofia.

Corresponding author:
Donka Zheleva-Terzieva
Faculty of Education
Tracian University,
Stara Zagora, 6000, Bulgaria
E-mail: donka.zheleva-terzieva@trakia-uni.bg

MORPHOLOGICAL CHARACTERISTICS AND HEALTH STATUS OF 8-19-YEAR OLD GIRLS

Iveta Bonova[1], Eleonora Mileva[1], Stefan Kolimechkov[2]
[1]National Sports Academy "Vassil Levski", Sofia, Bulgaria
[2]STK Sport, London, United Kingdom

ABSTRACT
Factors influencing health and well-being of children and adolescents are related to their morphological characteristics and health status. Anthropometric and morphological parameters correlate with children's health, well-being, physical activity, and self-esteem. Therefore, the aim of this study was to analyze the factors with the most significant impact on the body composition and health status and to evaluate overweight and obesity levels of girls and adolescents between the ages of 8 and 19 by using WHO references. This study included 202 girls with a mean age of 12.1 ± 3.5 years, mean height of 150.1 ± 15.0 cm, and mean BMI of 18.8 ± 4.0 kg/m². All of the participants were assessed by using the InBody120 body composition analyzer. Principal component factor analysis, using body height as a selection variable, was used in order to determine the main factors related to health status of children and adolescents. The factor analysis identified three main factors: (1) anthropometric parameters of obesity; (2) morphological characteristics; (3) age and metabolism. In conclusion, the anthropometric parameters of obesity had the most significant impact on the analyses of the body composition and health status in children and adolescents.

Keywords: *anthropometry, adolescents, health status, height, factor analysis*

INTRODUCTION

Changes in lifestyle, associated with constant use of digital technologies in all areas of social activity and communication, have had a significant impact on the health-related physical fitness of children and adolescents. The wide-spread of online learning influenced by Covid-19 lockdowns was a main factor for reducing physical activity of school children with little or no Physical Education and sports classes, and at the same time increasing their screen time and sedentary behavior. This has been well-documented by a number of authors who outlined the negative impact of the pandemic on children's physical activity (Galle et al., 2020; Gobbi et al., 2020; Lopez-Gil et al., 2021; Bronikowska et al., 2021; Daniel, 2020; Zheng et al., 2020), in addition to the fact that most children and adolescents did not reach the recommended by the WHO physical activity guidelines of 60 min of physical activity per day even before the COVID-19 pandemic (Konstabel et al., 2014). Physical activity during youth is essential for adolescent's health and wellbeing, and therefore its reduction could have harmful effects in later life (Scheerder et al., 2006). One of the most common effects which have been reported in relation to reduced physical activity in children and adolescents include negative changes in body composition, increased obesity levels, depression, social isolation, decline in metabolic and immunological functions, and others (Jakobsson et al., 2020; Hwang et al.; Stockwell et al., 2021). Reported results indicated that the physical activity patterns of children are significantly related to their physical fitness (Tremblay et al., 2016). Therefore, health-related studies on morphological and anthropometrical parameters in children and adolescents are of a significant interest in the current pandemic and post-pandemic conditions.

The assessment and evaluation of body composition in children and adolescents are mainly undertaken for two reasons: to observe the relationship between anthropometric and morphological parameters in relation to physical fitness and in relation to health and wellbeing (Kilani & Abu-Eisheh, 2010; Bjelica et al., 2021). Overweight children and adolescents with low physical activity levels tend to transfer these negative outcomes in later life (Dietz et al., 2007), and it has been reported that fat accumulation during childhood contributes to becoming overweight in adulthood (Gültekin, Dasgupta & Özer, 2014). For those reasons, it has been recommended to monitor and evaluate body composition at young ages (Espana-Romero et al., 2010; Ruiz et al., 2010; Ortega et al., 2015; Cvejic, Pejovic & Ostojic, 2013; Seefeldt & Vogel, 1989).

One of the most important anthropometric parameters providing useful information about the process of growth and maturation of the child's body are body height, body weight, and body mass index (BMI). The BMI is calculated as body

weight divided by height in meters squared, and it has been widely applied to classify children's weight as underweight, normal, overweight or obese (WHO, 2000; Flegal, Tabak & Ogden, 2006; Pekar, 2011; Keys et al., 2014). However, the BMI does not distinguish between fat and muscle tissues (Chatterjee, Bajpai & Gerdes, 2021; Bogin & Varela-Silva, 2012). Another limitation of the BMI is that its value varies significantly at young ages (Cole, Freeman & Preece, 1995; Cole, Bellizzi, Flegal & Dietz, 2000; Holford & Colson, 2008), and the criteria used to evaluate children's BMI are different from that for adults. The value of children's BMI is compared against reference charts for the same age and gender, and then transformed into a percentile or Z-score (Flegal, Tabak & Ogden, 2006). One of the most popular international BMI reference charts for children and adolescents are those produced by the World Health Organization (WHO, 2007).

The utilization of adequate statistical methods can provide further clarity on the importance of growth parameters, such as body weight and height, and their relationship with the health and physical activity levels of children and adolescents. Therefore, the aim of this study was to analyze the main factors which have the most significant impact on the body composition and health status, as well as to evaluate overweight and obesity levels of girls and adolescents between the ages of 8 and 19 by using WHO references.

METHODS

This study consisted of 202 girls and adolescents from 8 to 19 years of age (mean age of 12.1 ± 3.5 years) from different schools in Sofia, Bulgaria. The sample of students was obtained according to the needs of the study and the accessibility of the participants. All participants were engaged in similar levels of physical activity and PE lessons.

An informed consent form was obtained from the parents of the participants prior to the study intervention, and the study was undertaken in accordance with the ethical standards established in the Declaration of Helsinki for Human Research (WMA, 2013).

Body height was measured to the nearest 0.1 cm by using SECA height measure. A standardized protocol for analyses with the InBody120 body composition analyzer was used for all participants. The portable analyzer uses a direct segmental multi-frequency bioelectrical impedance analysis method (DSM-BIA) with two different frequencies (20 kHz, 100kHz) at a total of five body segments (right arm, left arm, trunk, right leg, and left leg).

The following parameters were recorded: Body Mass Index (BMI), weight, body fat mass (BFM), present body fat (PBF), waist-to-hip ratio (WHR), growth score, obesity degree (normal range between 90-110), protein, minerals, fat free mass (FFM), skeletal muscle mass (SMM), total body water (TBW), and basal metabolic ratio (BMR).

Participants were measured in the morning on an empty stomach, bear feet, wearing shorts and T-shirts. All of the measurements and assessments were conducted in the sports lab at the Center for Scientific and Applied Activity in Sports, National Sports Academy, Bulgaria.

The statistical analyses were conducted by using SPSS 20.0, IBM, USA software. The analyses were based on the total of 202 participants by using descriptive statistics and principal component factor analysis with rotated component matrix (Varimax with Kaiser Normalization). Body height was chosen as the selection variable to determine the factors related to morphological characteristics and health status of children and adolescents.

RESULTS AND ANALYSIS

The recorded parameters of all participants in this study are presented in Table 1. The coefficient of variation was very good (CV ≤ 10) for the parameter height and WHR; good (CV 10-20) for growth score and obesity degree, and acceptable for (CV 20-30) age, BMI and BMR. The mean BMI of the 8-19-year-old girls was 18.8 ± 4.0 kg/m^2, which was within the 'normal' weight category (18.5–24.9 kg/m^2) defined by the WHO (WHO, 2000). The BMI Z-scores were calculated based on the WHO references for children and adolescents between the ages of 5 and 19 years of age, where normal Z-score is defined between -2SD and 1SD, overweight is >1SD and <2SD, obesity >2SD, and thinness > -2SD (WHO, 2007). The individual BMI Z-scores of the children in our study showed that 73.8% of the girls were within the 'normal category', 3.5% were assessed as 'thin', 17.3% were 'overweight', and 5.4% were 'obese'.

Table 1. *Anthropometric and morphological parameters of the 8-19-year-old girls*

Parameters	Mean ± SD	Coefficient of Variation
Age [years]	**12.1** ± 3.5	28.9
Height [cm]	**150.1** ± 15.0	10.0
Weight [kg]	**42.5** ± 15.0	35.4
BMI [kg/m2]	**18.8** ± 4.0	21.0
Total Body Water [L]	**24.1** ± 7.9	32.7
Protein [kg]	**10.3** ± 9.5	92.2
Minerals [kg]	**8.3** ± 13.4	160.6
Body Fat Mass [kg]	**9.1** ± 5.5	60.8
Fat Free Mass [kg]	**25.8** ± 13.9	54.0
Skeletal Muscle Mass [kg]	**15.3** ± 6.1	39.6
Percent Body Fat [%]	**21.0** ± 8.2	38.8
Basal Metabolic Ratio [kcal/24h]	**1080.1** ± 232.4	21.5
Waist-to-Hip Ratio	**0.81** ± 0.05	6.1
Growth Score [points]	**88.9** ± 16.1	18.1
Obesity degree	**95.2** ± 17.3	18.2

In addition, the individual BMI Z-scores for girls between the ages of 8-11 and 12-19 were also analyzed due to the specific differences in growth and physical development in those age brackets. The results showed that 77% of the girls between 8 and 11 were assessed within the 'normal category', 13% were 'overweight', 7% were 'obese', and 3% were 'thin'. In the group of girls between the age of 12 and 19, around 80% were with 'normal' weight, 17% were 'overweight', 2.4% were 'thin', and none of them were 'obese'. The lack of any obese children in this age bracket is probably due to the higher level of physical activity reported in the older girls, including an average of 3 training sessions a week.

The factor analysis component matrix is presented in Table 2. The analysis identified three factors which were named depending on the anthropometric, morphological, age- and metabolic-related parameters included in them (with a factor score above 0.700). The three factors derived from the correlation matrix had a total of 95.48% explained variance. The first factor accounted for 59.2%, which was the largest possible variance in the data set. The second factor accounted for 29.6% and the third for 6.6%.

Table 2. *Factor analysis of the anthropometric and morphological parameters for 8-19-year-old girls*

Parameters	Factor 1	Factor 2	Factor 3
Age	.004	-.078	-.786
BMI	**.834**	.220	.503
Weight	**.816**	.306	.488
Total Body Water (TBW)	.342	.079	**.862**
Protein	-.099	**-.992**	.062
Minerals	-.119	**-.993**	-.007
Body Fat Mass (BFM)	**.891**	.273	.314
Fat Free Mass (FFM)	.205	**.945**	.238
Skeletal Muscle Mass (SMM)	.231	**.908**	.321
Percent Body Fat (PBF)	**.888**	.312	.216
Basal Metabolic Rate (BMR)	.345	.110	**.858**
Waist-to-Hip Ratio (WHR)	**.942**	.096	.170
Growth Score	**-.922**	.146	.232
Obesity degree	**.815**	.308	.488

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

The first factor was named 'anthropometric parameters of obesity', and it included the following: BMI, weight, BFM, PBF, WHR, growth score, and obesity degree index. This factor accounted for more than half of the variance of the data set. The second factor was named 'morphological characteristics' including the following recoded parameters: protein, minerals, FFM, and SMM. The third factor was named 'age and metabolism' and it included age, TBW, and BMR.

DISCUSSION AND CONCLUSION

The factor analysis of the anthropometric and morphological parameters of the children and adolescents in our study identified three main components related to their health status.

The first one included mostly body composition parameters, and accounted for more than half, 56% of the variance in the data set. The parameter with the highest value (0.94) within the first factor was WHR (Table 2). The WHR represents the circumference of the waist to that of the hips, and a value above 0.85 in women is considered abdominal obesity (Andreacchi et al., 2013; Wright et al., 2021). In our study, 21 girls (around 10% of the sample) were evaluated with abdominal obesity but at the same time these subjects had a normal BMI. This is probably because of the limitation of the BMI assessment. Furthermore, studies indicated that the location and amount of fat, rather than overall adiposity, are much more informative for predicting obesity, cardiometabolic disease, and cancer (Pulit et al., 2019). Therefore, the BMI assessment should be utilized in a combination with other methods for evaluating body composition.

The parameter with the second highest value in the first factor was growth score (-0.92). In essence, the growth score includes body composition, obesity degree, height and weight, and it helps to establish the growth stage of children and adolescents (InBody120, 2022).

Body fat mass and percent body fat were the third and fourth parameters with the highest values, respectively (Table 2). Both parameters possess a great importance for the health and wellbeing of children in the later stages of their adult life. The findings of a comprehensive review including longitudinal studies showed that a higher level of healthy body composition with less fat mass in childhood is associated with a healthier cardiovascular profile and with a lower risk of developing diseases in adulthood (Ruiz et al., 2009).

The last two parameters with a high value in the first factor from our study were BMI and weight. They are both widely used in the classifications of normal body weight. BMI was recommended as an index of underweight for screening out children who are malnourished (Lohman & Going, 2006), and low body weight in children in sport, below the age- and gender-related norms, was reported as the most significant factor in delaying the onset of puberty (Georgopoulos et al., 2004).

The second factor (morphological characteristics) accounted for 29.6% variance in the data set, and it included parameters such as minerals, protein, FFM and SMM. The parameter with the highest value in the second factor was the amount of minerals (Table 2). It was reported that minerals account for around 4% of the body weight (McArdle, Katch & Katch, 2015). The second highest parameter in the morphological characteristics factor in our study was the amount of proteins, which are essential for the body to repair cells and make new ones. The third and fourth parameters with high value were FFM and SMM. The primary component of FFM is SMM, which is the force generating tissue of the body (Malina et al., 2013). FFM have been also used in the literature to calculate fat-free mass index (FFMI, FFM/height^2) and fat mass index (FMI; FM/height^2) (Hattori, Tatsumi & Tanaka, 1997). Both indexes were utilized to assess body composition in diabetes adolescent girls (Chung et al., 2015). It has been reported that FFM in a combination with low PBF are used as criteria in training sessions to achieve ideal body composition related fitness (Kilani & Abu-Eisheh, 2010).

The third factor in our study was linked with age and metabolism, and it accounted for the lowest variance in the data set (around 7%). The parameters included in this factor were age, TBW and BMR, from which TBW had the highest value (Table 2). TBW content decreases with age, with newborns having the highest water content. TBW accounts for 40-60% of human body weight, and around 74% of muscle tissue and 50% of fat tissue is water Moreover, water is vital for the human body because it is involved in the metabolic and thermoregulatory processes. Furthermore, of the total

body water, around 62% is intracellular and 38% is extracellular (McArdle, Katch & Katch, 2015).

For the calculation of our study BMR was determined by using the InBody120 body composition analyzer applying a regression equation based on FFM (InBody120, 2022). BMR is the minimum energy required to maintain the body's vital functions at rest, and our results showed that BMR was correlated with the other anthropometric and morphological parameter: height (r = .897); age (r = .790); BMI (r = .700); weight (r = .950); TBW (r = 1); SMM (r = .700); FFM (r = .200); WHR (r = .570); growth score (r = .380); obesity (r = .400) ; protein (r = .600); Minerals (r = .500); BFM (r = .500). BMR is affected by FFM, and in people with higher amount of FFM, the basal metabolic rate is much higher, which means that more kilocalories are needed for vital body functions at rest.

In our study, a total of 20% of the girls between the ages of 8 and 11 were assessed as overweight (13%) or obese (7%), and 17% of the female adolescents between 12 and 19 years of age were overweight with zero obese subjects. These findings were lower than the observed values by other researchers, which ranged from 30% to 45% of overweight/obesity frequency in children (Guinhouya, Apete & Hubert, 2009; Sanchez-Vaznaugh, 2015). Nevertheless, 20% is still a high number (2 out of every 10 children) considering that excessive weight above the WHO norms not only limits performance but it also possesses a risk of developing diseases in adulthood.

In conclusion, the anthropometric parameter height showed a strong relation with the other parameters from the analysis of body composition. The strongest relation of height was reported with the parameters from the first factor (anthropometric parameters of obesity). The anthropometric parameters of obesity had the most significant impact on the analyses of the body composition and health status of the children and adolescents in our study.

Although the second and the third factors accounted for much less variance in the data set, they determine the structure of the human body, and they are influenced by lifestyle, diet, and exercise. Therefore, all three factors are important in building the morphological characteristics of children and adolescents. At the same time, they should be considered in the context of the overall health status and well-being of the subjects.

Our results raise the question of the dynamics and the relationship between the parameters that are most relevant to the health of children nowadays. This study provides the basis for conduct new, similar research, and comparisons of some age- and gender-related characteristics. At the same time, future cross-cultural research would be of a great interest in order to identify differences in the parameters studied in terms of certain national, social and demographic characteristics.

REFERENCES

Andreacchi, A.T., Griffith, L.E., Guindon, G.E., Mayhew, A., Bassim, C., Pigeyre, M. et al. (2021). Body mass index, waist circumference, waist-to-hip ratio, and body fat in relation to health care use in the Canadian Longitudinal Study on Aging. *Int. J. Obes.* (Lond). 45(3):666-676.

Bjelica, D., Gardasevic, J., Milosevic, Z., Bozic, P.R. & Masanovic, B. (2021). Trajectories of Body Height, Body Weight, BMI, and Nutrition Status from 1979 to 1987: A Measurement-Based Analysis of 8740 Montenegrin Male Adolescents from the Municipality of Berane. *International journal of environmental research and public health*. 18(10).

Bogin, B. & Varela-Silva, I. (2012). The Body Mass Index: the good, the bad and the horrid. *Bulletin de la Societe Suisse d'Anthropologi*e. 18(2):5-11.

Bronikowska, M., Krzysztoszek, J., Lopatka, M., Ludwiczak, M. & Pluta, B. (2021). Comparison of Physical Activity Levels in Youths before and during a Pandemic Lockdown. *International journal of environmental research and public health*. 18(10).

Chatterjee, A., Bajpai, R. & Gerdes, M. (2021). Analyze the Impact of Healthy Behavior on Weight Change with a Mathematical Model using the Harris-Benedict Equations. *Research square.* doi: 10.21203/rs.3.rs-584141/v1

Chung, S., Park, H.W., Kwak, B.O. & Kim, K.S. (2015). Fat free mass index and fat mass index tracing on body composition chart in diabetes adolescent girls. *Int. J. Pediatr. Endocrinol*. Suppl 1:20.

Cole, T.J., Freeman, J.V. & Preece, M. A. Body mass index reference curves for the UK, 1990.(1995). *Archives of disease in childhood*. 73(1):25-29.

Cole, T., M., Bellizzi, Flegal, K. & Dietz W. (2000). Establishing a standard definition for child overweight and obesity worldwide: international survey. *Bmj*. 320(7244):1240-1243.

Cvejic, D., Pejovic, T. & Ostojic, S. (2013). Assessment

of physical fitness in children and adolescents. *Physical Education and Sport.* 11(2):135-145.

Daniel, J. (2020). Education and the COVID-19 pandemic. *PROSPECTS*. 49:91-96.

Dietz, W., Lee, J., Wechsler, H., Malepati, S., & Sherry, B. (2007). Health plans' role in preventing overweight in children and adolescents. *Health affairs*. 26(2):430-440.

Espana-Romero, V., E. Artero, D. Jimenez-Pavon, M. Cuenca-Garcia, F. Ortega, J. Castro-Pinero et al. (2010). Assessing Health-Related Fitness Tests in the School Setting: Reliability, Feasibility and Safety. The ALPHA Study. *Int. J. Sports Med*.

Flegal, K.M., Tabak, C.J. & Ogden, C.L. (2006). Overweight in children: definitions and interpretation. *Health education research.* 21(6):755-760.

Galle, F., Sabella, E.A., Ferracuti, S., De Giglio, O., Caggiano, G., Protano, C. et al. (2020). Sedentary Behaviors and Physical Activity of Italian Undergraduate Students during Lockdown at the Time of CoViD-19 Pandemic. *International journal of environmental research and public health.* 17(17).

Georgopoulos NA, Markou KB, Theodoropoulou A, Vagenakis GA, Mylonas P. & Vagenakis AG. (2004). Growth, pubertal development, skeletal maturation and bone mass acquisition in athletes. *Hormones*. 3(4):233-243.

Guinhouya, C.B., Apete, G.K. & Hubert, H. (2009). Diagnostic quality of Actigraph-based physical activity cut-offs for children: what overweight/obesity references can tell? *Pediatrics international: official journal of the Japan Pediatric Society*. 51(4):568-573.

Gobbi, E., Maltagliati, S., Sarrazin, P., di Fronso, S., Colangelo, A., Cheval, B. et al. (2020). Promoting Physical Activity during School Closures Imposed by the First Wave of the COVID-19 Pandemic: Physical Education Teachers' Behaviors in France, Italy and Turkey. *International journal of environmental research and public health.* 17(24).

Gültekin, T., Dasgupta, P. & Özer, B.K. (2014). Segmental bioelectrical impedance analysis in children aged 7–18 years living in Ankara-Turkey: Age and sex difference in the measures of adiposity. *Papers on Antropology*. 23(2):23-36.

Hattori, K., Tatsumi, N. & Tanaka, S. (1997). Assessment of body composition by using a new chart method. *American journal of human biology: the official journal of the Human Biology Council.* 9(5):573-578.

Holford, P. & Colson, D. (2008). Optimum Nutrition for Your Child. Great Britain: Piatkus Books.

Hwang, T.J., Rabheru, K., Peisah, C., Reichman, W. & Ikeda, M. (2020). Loneliness and social isolation during the COVID-19 pandemic. *International psychogeriatrics*. 32(10):1217-1220.

InBody120 - Body composition assessment and nutritional information 2022 [cited 2022 12 February]. Available from: http://inbody.com.hk/inbody120/.

Jakobsson, J., Malm, C., Furberg, M., Ekelund, U. & Svensson, M. (2020). Physical Activity During the Coronavirus (COVID-19) Pandemic: Prevention of a Decline in Metabolic and Immunological Functions. *Frontiers in sports and active living*. 2:57.

Keys, A., Fidanza, F., Karvonen, M.J., Kimura, N. & Taylor, H.L. (2014). Indices of relative weight and obesity. *Int. J. Epidemiol.* 43(3):655-665.

Kilani, H. & Abu-Eisheh, A. (2010). Optimum anthropometric criteria for ideal body composition related fitness. *Sultan Qaboos University medical journal.* 10(1):74-79.

Konstabel, K., Veidebaum, T., Verbestel, V., Moreno, L.A., Bammann, K., Tornaritis, M. et al. (2014). Objectively measured physical activity in European children: the IDEFICS study. *Int. J. Obes.* (Lond). 38 Suppl 2:135-143.

Lohman, T.G. & Going, S.B. (2006). Body composition assessment for development of an international growth standard for preadolescent and adolescent children. *Food and nutrition bulletin.* 27(4 Suppl Growth Standard): 314-325.

Lopez-Gil, J.F., Tremblay, M.S. & Brazo-Sayavera, J. (2021). Changes in Healthy Behaviors and Meeting 24-h Movement Guidelines in Spanish and Brazilian Preschoolers, Children and Adolescents during the COVID-19 Lockdown. *Children*. 8(2).

Malina, R.M., Baxter-Jones, A.D., Armstrong, N., Beunen, G.P., Caine, D., Daly, R.M. et al. (2013). Role of intensive training in the growth and maturation of artistic gymnasts. *Sports Med.* 43(9):783-802.

McArdle, W.D., Katch, F.I. & Katch, V.L. (2015). Exercise Physiology: Nutrition, Energy, and Human Performance. Eight Edition. USA: Wolters Kluwer Health.

Ortega, F.B., Cadenas-Sanchez, C., Sanchez-Delgado, G., Mora-Gonzalez, J., Martinez-Tellez, B., Artero, E.G. et al. (2015). Systematic review and proposal of a field-based physical fitness-test battery in preschool children: the PREFIT battery. *Sports Med.* 45(4):533-555.

Pekar, T. (2011). Body Mass Index. IMS Magazine. Summer 2011:21-22.

Pulit, S.L, Stoneman, C., Morris, A.P., Wood, A.R., Glastonbury, C.A., Tyrrell, J. et al. (2019). Meta-analysis of genome-wide association studies for body fat distribution in 694 649 individuals of European ancestry. *Hum. Mol. Genet*. 28(1):166-174.

Ruiz, J.J., Castro-Pinero, E., Espana-Romero, V., Artero, F., Ortega, M., Cuenca et al. (2010). Field-based fitness assessment in young people: the ALPHA health-related

fitness test battery for children and adolescents. *Br. J. Sports Med.*

Ruiz, J.J., Castro-Pinero, E., Artero, F., Ortega, M., Sjostrom, J., Suni et al. (2009). Predictive validity of health-related fitness in youth: a systematic review. *Br. J. Sports Med.* 43(12):909-923.

Sanchez-Vaznaugh, E.V., Sanchez, B.N., Crawford, P.B. & Egerter, S. (2015). Association between competitive food and beverage policies in elementary schools and childhood overweight/obesity trends: differences by neighborhood socioeconomic resources. *JAMA Pediatr*. 169(5):e150781. doi: 10.1001/jamapediatrics.2015.0781

Seefeldt, V., Vogel, P. (1989). Physical Fitness Testing of Children: A 30-Year History of Misguided Efforts? *Pediatric Exercise Science*. 1:295-302.

Scheerder, J., Thomis, M., Vanreusel, B., Lefevre, J., Renson, R., Vanden Eynde et al. (2006). Sports Participation Among Females From Adolescence To Adulthood: A Longitudinal Study. *International Review for the Sociology of Sport*. 41(3-4):413–430.

Stockwell, S., Trott, M., Tully, M., Shin, J., Barnett, Y., Butler, L. et al. (2021). Changes in physical activity and sedentary behaviours from before to during the COVID-19 pandemic lockdown: a systematic review. *BMJ open sport & exercise medicine*. 7(1):e000960.

Tremblay, M.S., Barnes, J.D., Gonzalez, S.A., Katzmarzyk, P.T., Onywera, V.O., Reilly, J.J. et al. (2016). Global Matrix 2.0: Report Card Grades on the Physical Activity of Children and Youth Comparing 38 Countries. *J. Phys. Act Health.* 13(11 Suppl 2):343-366.

WHO. (2000). Obesity: preventing and managing the global epidemic. Report of a WHO Consultation WHO Technical Report Series 894 Geneva: World Health Organization.

WHO. (2007). BMI-for-age (5-19 years): World Health Organization [cited 2022 accessed on 12 February]. Available from: https://www.who.int/toolkits/growth-reference-data-for-5to19-years/indicators/bmi-for-age.

WMA. (2013). WMA Declaration of Helsinki - Ethical Principles for Medical Research Involving Human Subjects.

Wright, C., Heron, J., Kipping, R., Hickman, M., Campbell, R. & Martin, R.M. (2021). Young adult cancer risk behaviours originate in adolescence: a longitudinal analysis using ALSPAC, a UK birth cohort study. *BMC cancer*. 21(1):365.

Zheng, C., Huang, W.Y., Sheridan, S., Sit, C.H., Chen, X.K. & Wong, S.H. (2020). COVID-19 Pandemic Brings a Sedentary Lifestyle in Young Adults: A Cross-Sectional and Longitudinal Study. *International journal of environmental research and public health.* 17(17). doi: 10.3390/ijerph17176035

Corresponding author:
Iveta Bonova, PhD.
National Sports Academy "Vassil Levski"
21, Acad. Stefan Mladenov str.
Studentski grad, Sofia 1700, Bulgaria
E-mail: ivetansa@gmail.com

PHYSICAL ACTIVITY AND DEVELOPMENT OF BULGARIAN STUDENTS

Petya Petkova, Oleg Hristov, Petar Peev, Borislava Petrova, Milena Zdravcheva, Hristo Andonov &Velichka Aleksandrova
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
According to the World health organization (WHO), physical activity is the basis of healthy living. Most of these topics are made through questionnaires that express the inner feeling of the participant without data that can direct any norms for that activity. WHO has suggestions for children's physical activity, but there is not enough empirical data about children's physical activity in Bulgaria. All of the mentioned things above lead us to the aim of the study to determine the physical activity parameters in students in Bulgaria. The tasks of the research are 1) The determination of the physical activity of Bulgarian students (boys and girls) made daily; 2) The determination of the health status (physical development) of the Bulgarian students. Methods: The main research methods include anthropometry with segmental body analysis and an accelerometer. We used anthropometric indicators: Weight, height, BMI, Body mass %, body mass, and Muscle mass Weight, and from accelerometers, we used MET threshold units to determine the levels of physical activity. The study group contains 215 students that study in Sofia municipality. The investigated students are separated into three sub-groups based on their current study grade. Results: On average Bulgarian students gain Weight and get taller with growing up. BMI and Muscle mass increases with age for the boys, but BF percentage decreases.
Whereas in girls, BMI decreases with no apparent trend of BF, but muscle mass increases and this may be due to puberty., and that may be due to puberty. The parameters of the physical activity are interesting because they are unique in Bulgarian science data. As an overall trend for boys and girls, we could observe that the average sitting time increases, but all of the other parameters decrease. That means that with aging Bulgarian children have less activity as a total. Conclusion: Based on the current data, Bulgarian students are less active with aging but somehow manage to keep a normal BMI.

Keywords: *health status, adolescent, body fats*

INTRODUCTION

According to data from the World Health Organization (WHO), about 60% of the world's population are not engaged in sufficient physical activity. According to evaluation data from the WHO, the level of physical activity in 2/3 of the population over 15 years of age in EU countries is below the recommended level (Cavill et al., 2006). Based on the documents and teaching practice, it turns out that students in our country receive an average of only about 87 minutes of organized compulsory sports activities per week. This is many times below the sanitary minimum of about 190 min. of average weekly activity according to the National Association of Sports and Physical Education of the USA and the recommended by WHO 60 min. daily (Kinov, 2009).
Similar to global trends in recent years on a national aspect, there has been a severe increase in overweight and obesity among children and adosolents. Obesity in children is a current and serious problem of public importance that should not be ignored.

The physical activity of children and adosolents in Bulgaria is insufficient in quantity and unsatisfactory in quality. The reasons for this are both objective and subjective. Decreased physical activity among children and students is a risk factor for the appearance of chronic non-communicable diseases at a later age, such as obesity, and overweight, which are leading health problems. Other diseases include impaired metabolism, hypertension, reduced pulmonary ventilation, impaired functions of endocrine glands, reduced strength and elasticity of muscles, reaction, and coordination. According to the World Health Organization (WHO), physical activity is the basis of a healthy life. For this reason, it is imperative to increase physical activity among adolescents and prevent these adverse conditions in children and adolescents.

The body mass index (BMI) is a value obtained when we divide the weight in kilograms by the height in meters raised squared. It can be determined using a table or using a calculator. Body mass is a general term for total body composition and includes body fat, muscles, and bones. This method is widely used for screening for obesity and overweight and can be applied quickly and effectively to large groups of people. As noted by some authors, the disadvantage of this method is the impossibility of obtaining information about the ratio of accumulated body

fat and skeletal-muscular tissues (Demerath et al., 2006; Federico et al., 2011; Pietrobelli et al., 1998). That is why we included the Segmental spectral analysis of the body mass composition system in the current development for a more detailed analysis of mass body composition. In this regard, in the foreign literature studied on the subject, there are more and more data from scientific studies in which BMI is divided into an index of active body mass and an index of adipose tissue (Lohman, Going, 2006; Wells, 2001; Wells et al., 2002).

From here steams, the purpose of our research, namely, to determine the parameters of the physical activity of Bulgarian students.

Aim and objectives of the study

The study's main aim is to determine the physical activity and health status of Bulgarian students.

METHODS

The study group included 217 students (43.7% boys and 56.3% girls) from Bulgarian schools from the 5th grade to the 7th grade. The average group height was 159 cm ± 9.96 cm, and Weight was 48.4 kg ± 13.04 kg.

The method used in this study to determine the daily physical activity was accelerometry devices, which we put on the wrist with a wristband. The devices used are Axivity AX3, which record with 100 Hz frequency and ±16g acceleration, with a battery life of 14 days. We collect anthropometric and body composition data from InBody 230 system, which has an 8-point tactile electrode system with direct segmental analysis that measures impedance for the five different parts of the body at multiple frequencies.

Informed consent and declaration were prepared and sent to all parents of the students. After their agreement, we started measuring the agreed children. At the start of the investigation, we collected anthropometrical and body composition data. Then put the accelerometry devices on the non-dominant hand. The students wore the AX3 devices for seven days, from which five working days and two holiday days. After this period, we collect the devices and download the raw data.

The statistical methods we used to interpret the measured data were descriptive statistics, Bi-variate analysis, and correlation analysis.

RESULTS

The results of the present study are displayed in Tables 1 and 2. Both tables summarize all researched indicators for boys and girls. A more detailed analysis will be made in the report's discussion section.

Table 1. *Summarized values of the researched indicators for boys*

Indicator	Average time in seated position (min)	Average time in low intensity activity (min))	Average time in moderate intensity activity (min)	Average time in vigorous intensity activity (min)	Height	Weight	BMI	Body fats %	Muscle mass (kg)	Fat mass (kg)
V grade	651.8	83.3	203.8	33.7	152.4	41.8	18.0	20.2	17.4	9.0
VI grade	682.3	76.9	189.4	24.8	159.9	51.0	19.7	19.2	22.1	10.5
VII grade	711.1	72.3	176.5	19.6	170.0	58.6	20.2	16.7	26.7	10.4

Table 2. *Summarized values of the researched indicators for girls*

Indicator	Average time in seated position (min)	Average time in low intensity activity (min)	Average time in moderate intensity activity (min)	Average time in vigorous intensity activity (min)	Height	Weight	BMI	Body fats %	Muscle mass (kg)	Fat mass (kg)
V grade	651.2	93.1	214.7	16.2	155.2	47.1	19.4	24.2	18.7	12.0
VI grade	687.0	84.1	197.7	9.1	162.7	48.0	18.3	19.5	20.3	10.3
VII grade	732.6	76.5	161.8	6.2	165.2	51.1	18.7	22.7	20.7	12.5

DISCUSSION

Analyzing the data, we find that children's height and body mass increase with growth (boys and girls). The difference in height from V to VI class is, on average, 5% (boys - 5%; girls - 5%), but the body mass difference is 18% for boys and only 2% for girls. From VI to VII grade, we find a difference in the height of 6% for boys and 2% for girls. At the same time, the body mass of the boys increases by 13% but that of the girls by only 6%. We present the absolute values of height and weight. In conclusion, we may say that children's growth increases their body mass more than their height.

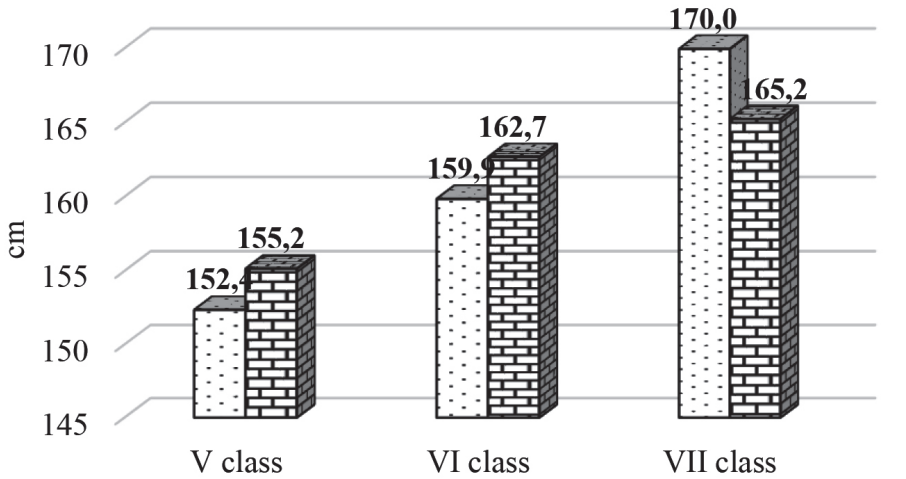


Figure 1. *Height of investigated children separated by gender and class, n=217*

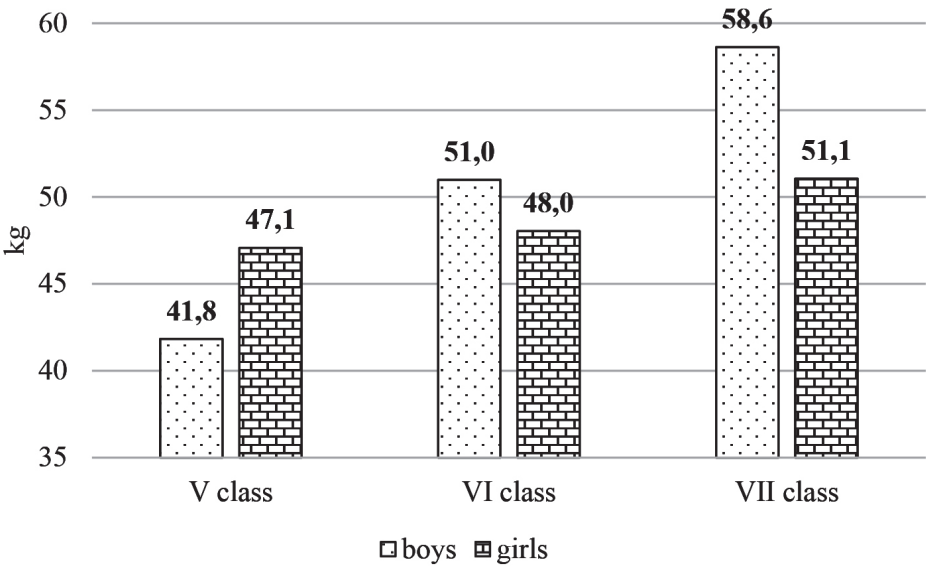


Figure 2. *Weight of investigated children separated by gender and class, n=217*

The presented results of BMI in Figure 3 show a difference in the index between V, VI, and VII classes. These absolute values increase for boys from 18.0 in V class to 20.2 in VII class and decrease for girls to 19.4 for V class and 18.7 for VII class students.

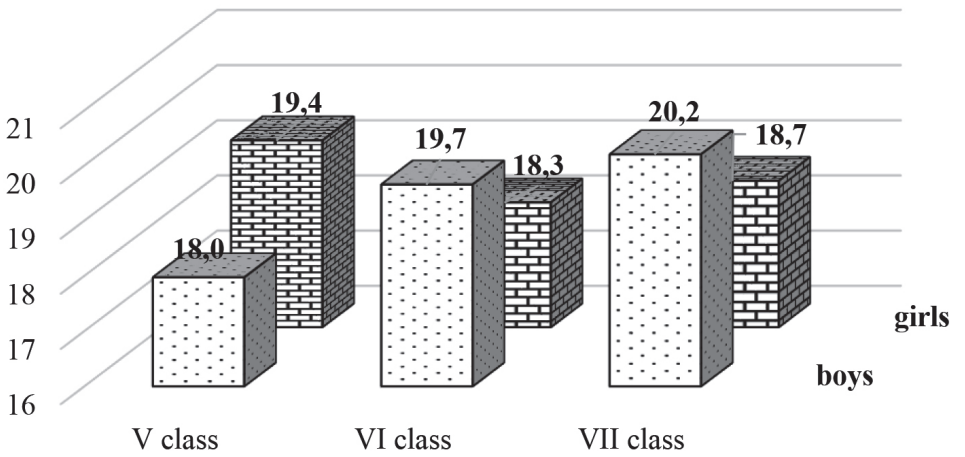


Figure 3. *BMI of investigated children separated by gender and class, n=217*

Body fat percentage is one of the essential parameters bound with the Degree of Obesity in children. We analyze PBF (Percent Body Fat) and show that with growth, the boys and girls have less PBF. Boys have 20.2% in V class in front of 16.7% in VII class, which is less than -3.5%. The girls' difference in PBF is -1.5%, less than that of boys with 2%. We present these data in Figure 4.

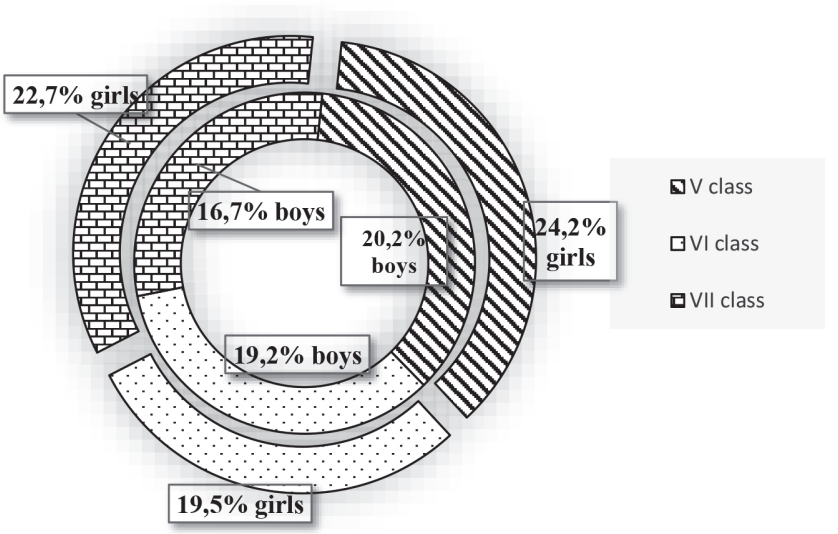


Figure 4. Percent body fat of investigated children separated by gender and class, n=217

In conclusion, we may say that in different classes from V to VII, we have observed an increase in absolute values of height, Weight, and BMI of boys and decreasing in PBF values. At the same time, the trend of girls' parameters shows an increase in height and weight but a decrease in BMI and PBF.

According to data from the Regional Health Inspectorate, it is stated that after children enter school, their motor activity decreases by 30 to 50% that in pre-school age. The implementation of organized motor activity 2-3 hours a week is far below the norm for the hygienic requirements for satisfying the "muscle hunger" of the students. These hours make up Primary and middle school age (6-7 and 13-14 years), during which familiar forms of movement are significantly improved, and many new movements are acquired and consolidated. The Bulgarian ministry of education brochure at this age is most suitable for including children in the preliminary preparation for consistently forming habits, skills, personal qualities, values, and attitudes for a healthy lifestyle. In adolescence, a positive pattern of adequate systemic motor activity can be established, which could be maintained later.

In this regard, systematic prevention is required by creating conditions for exercising the minimum physical activity recommended for the relevant age, including mass sports in and outside of school, reducing the use of technology, and encouraging students to have a healthy lifestyle.

The most favorable for this purpose are extracurricular activities with physical exercises and sports, which occupy an important place in the educational system and are defined as a connecting link between school and life. In parallel, through them, good mental health and self-esteem, emotional comfort, protection against stressful effects, overcoming mental fatigue, and building a healthy culture among adolescents should be guaranteed (Dimitrova, 2009).

The recommendations of the World Health Organization (WHO) basis on "WHO guidelines on physical activity and sedentary behavior" for minimal levels of physical activity are the following:

- Children and adolescents should perform physical activities for at least 60 minutes weekly – starting from moderate to high intensity, primarily aerobic.
- High-intensity aerobic activities, which stabilize muscles and bones, should be included in children's activities at least three times a week.
- Children and adolescents should limit sedentary time, mainly recreational screen time.

From the obtained data, it can conclude that with increasing age, boys and girls spent less time in physical activity.

Presented in Figure 5 can be analyzed as a decrease in motor activity at all intensities (light, moderate and vigorous) of male students. There was a decrease in motor activity in light intensity with an average of 6.8% and moderate activity with 6.9%. The reduction of time spent in vigorous activity is significantly higher (23.6%).

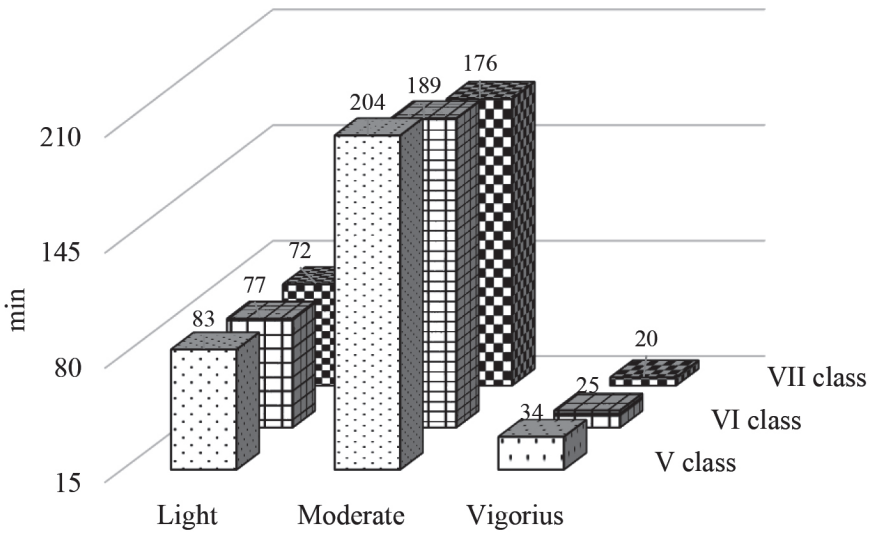


Figure 5. *Time spent in different intensity of investigated boys separated by class, n=217*

In the studied girls, the results obtained from the accelerometry devices were not so different from that of the boys. Namely, there was a decrease in light activity with an average of 9.4% with increasing age and 13.1% in moderate intensity. The decline at the emotional level of intensity is even more significant than boys', with an average of 38.0%. Presented absolute values of the time during which motor activity was performed with a different activity at different ages, as we can see in Figure 6.

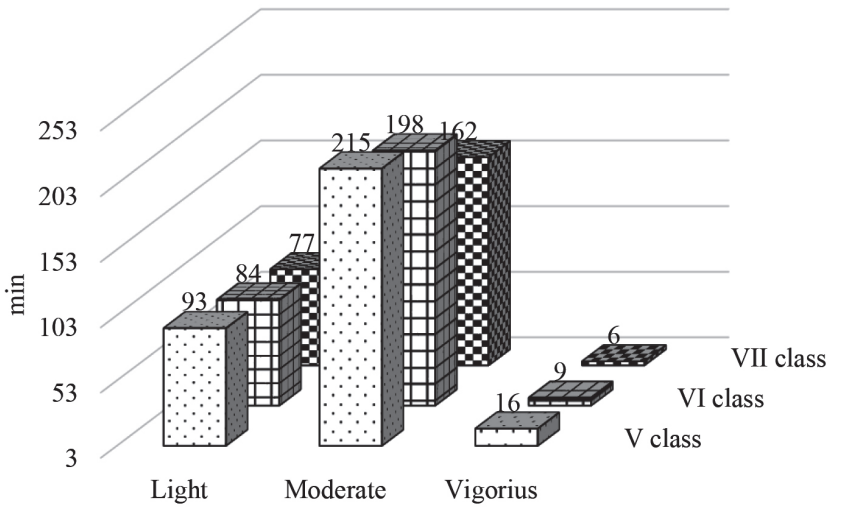


Figure 6. *Time spent in different intensity of investigated girls separated by class, n=217*

In the study group, we can observe a decrease in the total time in any motor activity while the time in a sedentary position significantly increases (Figure 7).

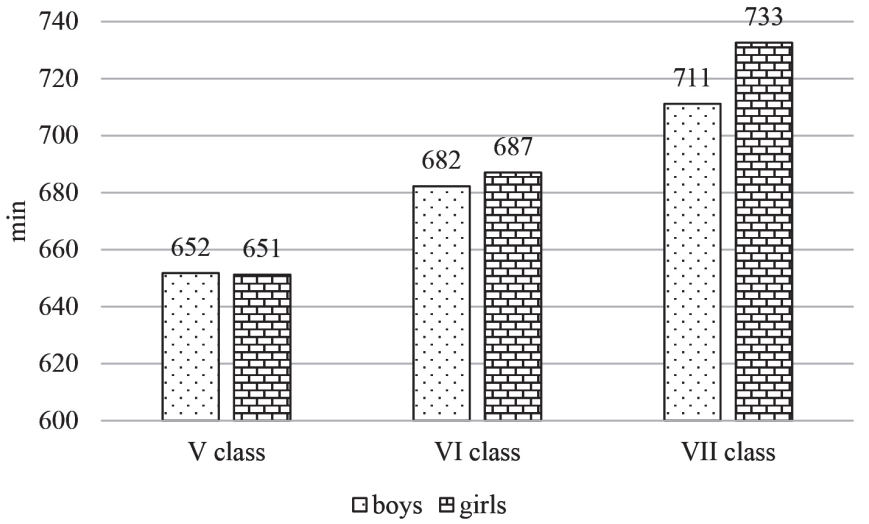


Figure 7. *Time spent in Sedentary position of investigated students separated by gender and class, n=217*

As shown in Figure 7, the average time spent in a sitting position for boys increased by 4.3% and for girls by 5.7%. From the analyses made above, it can be concluded that as the age of students (girls and boys) increases, they move less in all intensity levels and spend more time in a seated position. As the age of the students increases, muscle mass increases by an average of 19.1% in boys and 4.8% in girls. Observed the same trend in body fat mass, but the increase is minor, on average 6.7% in boys and 0.7% in girls. This data that we presented are in Tables 1 and 2.

CONCLUSION

In conclusion, we can say that as the increasing students age from the 5th to the 7th grade, there is an increase in height, Weight, and BMI. PBF is decreasing in identical conditions. These results may be affected by reducing the practice time of physical activity with different intensities (light, moderate, vigorous) and increasing the time spent sitting.

We recommend that adosolents from the 5th to the 7th grade increase their time spent practicing physical activity in their daily routine and reduce sitting behaviors.

All children and young people should have the opportunity to be physically active and should be encouraged to play sports. Support and provision must be available regardless of physical condition,

religion, ethnicity, social, economic, and other circumstances. (National Institute for Health and Clinical Excellence, 2009).

Acknowledgments
This investigation was funded from National Sports Academy "Vasil Levski" with the special participation of the Center for Scientific and Applied Research in sport, Department of National Sports Academy "Vasil Levski".

REFERENCES

Cavill, N., Kahlmeie, S., Racioppi, F. (2006). *Physical activity and health in Europe: evidence for action/edited.* Genmark.

Demerath. E.W., Schubert, C.M., Maynard, L.M., Sun, S.S., Chumlea, W.C., Pickoff, A., Czerwinski, S.A., Towne, B., Siervogel, R.M. (2006). Do changes in body mass index percentile reflect changes in body composition in children?, Data from the Fels Longitudinal Study. *Pediatrics*.117(3), 487-495.

Dimitrova, Z. (2015). Izvynklasni formi na obuchenie po fizichesko vyzpitanie I sport za deca ot nachalna uchiklishtna vyzrast. *Nauchni trudove na rusenskiq universitet*, tom 54, seriq 8.2-83, Ruse.

Federico, B., D'Aliesio, F., Pane, F., Capelli, G., Rodio, A. (2011). Body mass index has a curvilinear relationship with the percentage of body fat among children, *BMC Research Notes* 4, 301.

Kinov, St. (2014). Izvyn urochna deinost v sistemata za fizichesko vyzpitanie i sport (ideina koncepcia, sydyrjaniei formi za realizaciq), *avtoreferat na disertacionen trud*, Blagoevgrad.

Lohman, T., Going, S. (2006). Body composition assessment for development of an international growth standard for preadolescent and adolescent children. *Food Nutr. Bull*, 27(4), 314-25.

National Institute for Health and Clinical Excellence (2009). Promoting physical activity, active play and sport for pre-school and school age children and young people in family, preschool, school and community settings. London, 3-10.

Peikov, S. (2009). Problemi na uchilishtnoto fizichesko vyzpitanie i sport. *Nauchni trudove na rusenskiq universitet*, tom 48, seriq 8.2-149, Ruse.

Pietrobelli, A., Faith, M.S., Allison, D.B., Gallagher, D., Chiumello, G., Heymsfield, S.B. (1998). Body mass index as a measure of adiposity among children and adolescents: a validation study, *J Pediatr*. 132, 204–210.

Wells, J.C.K. (2001). A critique of the expression of paediatric body composition data. *Arch Dis Child*. 85, 67–72.

Wells, J.C.K., Coward, W.A., Cole, T.J., Davies, P.S.W. (2002). The contribution of fat and fat-free tissue to body mass index in contemporary children and the reference child. *Int J Obes Relat Metab Disord.* 26, 1323–1328.

WHO guidelines on physical activity and sedentary behaviour. (2020). Geneva: World Health Organization. Licence: CC BY-NC-SA 3.0 IGO.

Corresponding author:
Petya Petkova, Ph.D.
Track and field Department
National Sports Academy "Vassil Levski"
21, Acad. Stefan Mladenov, str.
Sofia, Bulgaria
E-mail: teryy@abv.bg

STUDY OF THE RELATIONSHIP BETWEEN THE MOTOR ABILITIES OF PRESCHOOL BOYS

Tsveta Traykova
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
The study of the interrelationship and interdependencies between the children motor abilities is of particular importance for the selection and application of an effective methodology for their development and improvement.
The purpose of the study was to establish the dynamics of the degree and character of the relationship between the motor abilities of preschool boys as a result of the application of an experimental physical culture educational program.
Methods of study: theoretical analysis, pedagogical experiment, pedagogical testing, statistical methods. A total of 62 boys from the 3rd and 4th age groups participated in the experiment. They were tested twice with 11 motor tests.
Results: Most of the recorded correlations between the motor abilities of boys in the 3rd age group were low and statistically insignificant. In the initial study 8 significant moderate correlations were found between them and in the second one only 1, as well as 3 significant correlations. In the 4th age group more statistically reliable relationships between the motor abilities in both studies were registered - 15 moderate and 7 significant correlations at the beginning of the experiment and at the end, respectively, their number was 21 and 7.
From the correlation analysis we can make the following conclusion: at the beginning of the experiment in both age groups of boys dominated moderate and statistically reliable correlations between motor abilities, while at the end the number of statistically significant relationships in the 3rd boy group IS decreased (4 in total) while in the group of the bigger boys an increase of the significant correlations was registered (28 in total). So as age increases and a purposeful physical activity program is implemented a positive transfer between the motor abilities of preschool boys is observed.

Keywords: *motor abilities, relationships, dynamics, 5-7-year-old children*

INTRODUCTION

Motor abilities are usually accepted as different aspects of a person's physical fitness. although genetically predetermined, they change and develop, both under the influence of a number of endogenous (genetics) and exogenous factors such as education, training, external environmental conditions, lifestyle, etc. (Sotirov, 2020, Traykova, 2021).

In the process of physical education of preschoolers, the main motor abilities – speed, strength, agility, endurance, flexibility – have a trend of continuous development but to a certain extent. this depends on the motor skills and habits level of improvement and automation and vice versa. In cases of insufficient development of motor abilities, training and performance of various physical exercises is difficult and sometimes impossible. So the well-controlled and automated motor habits are a solid basis for an effective development and manifestation of motor abilities.

In addition, a certain heterochronicity in the development of the motor abilities of preschool children is observed. K. Rachev (1984) stresses on the fact that there are some periods with different intensity of growth as most pronounced natural increase of the motor abilities is found in the 4th and the 6th year both in girls and boys while in the 3rd and 7th year no progress is registered in both sexes.

A number of investigations studying the models for developing the main motor abilities in preschool age and the initial stage of school prove that there is a certain relationship between them (Kotsev et al., 1995). It has been established that developing a given motor ability the other abilities are influenced to a certain extent too.

In the theory and practice of physical education this phenomenon is known as " positive transfer between physical abilities" and is well manifested in young children and untrained individuals (Zaciorski, 2020; Philin, 1975).

In this connection, most authors (Kim, 2015, Rachev, 1984, Marinov, 2020, etc.) recommend complex development of the motor abilities in preschool age, devoting more time to one ability or another, depending on the period of its development (whether it is sensitive or not),

Unfortunately, in the contemporary literature the scientific data confirming or rejecting that thesis are not so much. So our research will have some practical value as its results will be useful for the

professionals in the kindergartens to choose the most appropriate methods, means and forms, consistent to the sex - age peculiarities of children in order to improve the level and quality of their physical fitness.

The *purpose of this study* was to establish the dynamics of the strength and character of the relationship between the motor abilities of preschool boys as a result of the application of an experimental physical culture educational program.

METHODS

The subject of the study were the motor abilities of 5-6-year-old boys - strength, speed, endurance, flexibility, and agility.
The object of the research was the strength and character of the correlations between the motor abilities of preschool boys.

Participants

The pedagogical experiment was organized and conducted with total 62 boys from two age groups – 3rd (n=30*)* and 4th (n=32) preparatory group in two Sofia kindergartens and one school.

Parents voluntarily signed an informed consent form for the participation of their children in this study.

Materials And Testing

The fitness test battery developed by the author (Traykova, 2017) was used in the current study, which is focused on testing the basic components of the physical fitness as follows:

A number of motor tests were carried out to reveal the level of motor abilities, as follows: 1. Hand grip of the right hand (static strength of the flexors of the wrist) – kg; 2. Back strength dynamometry (static strength of the low back and trunk muscles) – kg; 3. 40 m run (speed of movement) – sec; 4. Standing broad jump (speed-strength of the lower extremities) – cm; 5. Throwing a medical ball 1 kg with two hands above the head (speed-strength of the upper extremities) – cm; 6. Throwing a medical ball 1 kg with two hands underneath (speed-strength of the upper extremities) – cm; 7. Throwing a small dense ball 150 g as far as possible (speed-strength of the upper extremities) – cm; 8. Throwing a small dense ball 150 g towards horizontal and vertical marker (coordination and speed-strength of the upper extremities) – cm; 9. Maximum number of squats for 20 sec (strength endurance) – n; 10. 200 m run (endurance)- sec; 11. Sit and reach (flexibility) – cm.

The following research methods were used to achieve the purpose set:
- Theoretical analysis of the informational resources;
- Pedagogical experiment;
- Pedagogical testing ;
- Statistical methods – variation and correlation analysis.

PROCEDURES

After obtaining the appropriate permits in kindergartens and informed parental consents we started the experimental physical culture educational program which aimed to stimulate the physical activity of children by using new and interesting physical exercises and games and in that way to improve their motor abilities and respectively the total physical fitness and health.

It lasted one school year. the children were tested twice – at the beginning and at the end of the experimental period according to the test battery.

STATISTICAL ANALYSIS

In order to process the empirical data, SPSS 19 program was used. variation and correlation analysis were performed. The last one was used to establish the strength and character of the existing correlations between the studied motor abilities.
Ordinary correlation coefficients (Pearson's coefficient – r) were calculated (Traykova, 2017).

For statistically significant were accepted those values of the coefficient – r – which are greater than or equal to the theoretically calculated (in our case r = .11). The statistical significance was selected at the level of $p < .05$.

RESULTS

The results of the correlation analysis are presented in tables 1, 2, 3, and 4 separately for the two age groups – 5- and 6-year-old boys - initial and final testing.

The analysis of the correlation coefficients shows that a certain relationship between the studied motor abilities exist but the values of a large part of the recorded correlations are low and moderate in strength and most of them are statistically insignificant.

Table 1. *Correlation matrix of motor abilities of 5-year-old boys – initial testing*

Tests	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1. Hand grip - right hand (kg)	1										
2. Trunk strength dynamometry (kg)	.321	1									
3. 40 m run (sec)	.074	-.066	1								
4. Standing broad jump (cm)	.27	.108	-.339	1							
5. Throwing medical ball 1 kg above head (cm)	.406*	.281	.001	.225	1						
6. Throwing medical ball 1 kg underneath (cm)	.224	.486**	-.005	.128	.245	1					
7. Throwing small ball as far as possible (cm)	.398*	.145	.025	.398*	.458*	.09	1				
8. Towards horizontal and vertical mark (n)	.143	.09	-.211	.105	.295	.213	.357	1			
9. Max squats for 20 sec(n)	.073	.064	-.358	.24	.131	-.086	-.128	.123	1		
10. 200 m run (sec)	-.082	.209	-.044	.017	-.119	-.084	-.045	.095	-.094	1	
11. Sit and reach (cm)	.113	.417*	-.405*	.246	.28	-.153	.094	.103	.374*	.049	1

Table 2. *Correlation matrix of motor abilities of 5-year-old boys – final testing*

Tests	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1. Hand grip - right hand (kg)	1										
2. Trunk strength dynamometry (kg)	.397*	1									
3. 40 m run (sec)	-.114	-.256	1								
4. Standing broad jump (cm)	.291	.294	-0.327	1							
5. Throwing medical ball 1 kg above head (cm)	.555**	.111	-.095	.016	1						
6. Throwing medical ball 1 kg underneath (cm)	.155	.353	-.222	.186	.289	1					
7. Throwing small ball as far as possible(cm)	.255	.088	-.104	.172	.512**	.305	1				
8. Towards horizontal and vertical mark (n)	.161	.16	-.019	-.309	-.048	.132	.253	1			
9. Max squats for 20 sec(n)	.118	-.083	-.166	-.089	.112	-.138	.121	-.001	1		
10. 200 m run (sec)	-.128	-.063	.158	-.135	-.24	-.191	-.038	-.036	-.087	1	
11. Sit and reach (cm)	.094	.141	-.514**	.343	.284	.029	.289	-.067	.229	.368	1

Table 3. *Correlation matrix of motor abilities of 6-year-old boys – initial testing*

Tests	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1. Hand grip - right hand (kg)	1										
2. Trunk strength dynamometry (kg)	.367*	1									
3. 40 m run (sec)	-.450**	-.281	1								
4. Standing broad jump (cm)	.312	.419*	-.254	1							
5. Throwing medical ball 1 kg above head (cm)	.591**	.225	-.360*	.234	1						
6. Throwing medical ball 1 kg underneath (cm)	.655**	.442*	-.475**	.34	.591**	1					
7. Throwing small ball as far as possible(cm)	.450**	.596	-.258	.502**	.371*	.656**	1				
8. Towards horizontal and vertical mark (n)	.374*	.495*	.018	.304	.507**	.337	.408*	1			
9. Max squats for 20 sec(n)	-.08	.05	-.032	.038	.026	.288	.14	.026	1		
10. 200 m run (sec)	.015	-.034	.470**	-.232	-.098	-.084	-.014	.077	-.296	1	
11. Sit and reach (cm)	.284	.371*	-.222	0.33	.205	.454**	.457**	.097	.192	-0.28	1

Table 4. *Correlation matrix of motor abilities of 6-year-old boys – final testing*

Tests	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1. Hand grip - right hand (kg)	1										
2. Trunk strength dynamometry (kg)	.486**	1									
3. 40 m run (sec)	-.463**	-.341	1								
4. Standing broad jump (cm)	.448*	.462**	-.390*	1							
5. Throwing medical ball 1 kg above head (cm)	.635**	.467**	-.495**	.446*	1						
6. Throwing medical ball 1 kg underneath (cm)	.484**	.368*	-.292	.407*	.472**	1					
7. Throwing small ball as far as possible(cm)	.540**	.663**	-.446*	.539**	..596**	.531**	1				
8. Towards horizontal and vertical mark (n)	-.017	.32	.218	-.101	.28	.043	.365*	1			
9. Max squats for 20 sec(n)	-.034	-.131	.226	.075	-.196	-.037	-.094	-.187	1		
10. 200 m run (sec)	.072	-.043	.433*	-.358*	-.162	-.05	-.058	.141	.111	1	
11. Sit and reach (cm)	.411*	.409*	-.392	.513**	.258	.338	.460**	-.109	-.074	-.457**	1

In that regard, in our report we are going to discuss only those correlations which are statistically significant and moderate and significant in strength.

Table 5 shows the distribution of the correlation coefficients according to the degree of their significance for the two age groups – initial and final testing

Table 5. *Degree of significance of the correlation coefficients by age – initial and final testing*

Degree of significance	5-year-old boys- I test	6-year-old boys-I- test	5-year-old boys- II test	6-year-old boys- II test
Moderate (n)	8	15	1	21
Significant (n)	0	7	3	7

A total of 8 moderate correlations were found in the 5-year-old boys group in the initial testing and only one in the final one. in the second study only 3 significant correlations were recorded.

In the group of 6-year-old boys more moderate correlations were recorded, both in the first testing – a total of 15 and in the second one – 21. the number of the significant relationships in the first and second measurements did not change – a total of 7 for the two measurements.

In the 5-year-old boys – initial testing - moderate correlations were recorded between the speed-strength of the upper extremities, measured by the tests "throwing a small dense ball as far as possible" and "throwing a medical ball 1 kg with two hands above the head", between them and the static strength of the flexors of the wrist and of the trunk, measured by the tests "hand grip" and "back strength dynamometry", as well as with the speed of movement measured by the test "40 m run" and with the speed-strength of the lower extremities, measured by the test " standing broad jump ".

In the second measurement, the existing interrelationships are stronger and are located in the range of the significant correlations. In addition, a negative relationship between flexibility and speed is recorded and a moderate one between the two tests, measuring the static strength of the wrist flexors and the trunk muscles.

In the 6-year-old boys, more moderate and significant correlation dependencies were registered both at the beginning and at the end of the experimental period. in comparison with the 5-year-old boys.

In the initial testing (table 3) most relationships are recorded between the speed–strength of the upper extremities ("Throwing a small dense ball as far as possible") and the static strength of the wrist flexors and trunk muscles, with the speed-strength of the lower extremities ("Standing broad jump"), as well as with the other tests measuring that quality,

The static strength of the wrist flexors is interrelated with the speed-strength of the upper extremities in all tests measuring that quality, with the static strength of the trunk muscles and the speed of movement.

The coordination abilities measured by the test, "throwing a small dense ball towards horizontal and vertical marker" correlate with two tests measuring the speed-strength of the upper extremities ("Throwing a dense ball with two hands above the head" and "Throwing a small dense ball as far as possible"), and with the static strength of the wrist flexors and the trunk muscles.

Flexibility correlates with the static strength of the trunk muscles and with the speed-strength of the upper extremities ("Throwing a medical ball with two hands underneath" and "Throwing a small dense ball as far as possible").

In the final testing, (Table 4) the speed-strength of the upper extremities ("Throwing a small dense ball as far as possible" and throwing a dense medical ball with two hands above the head and underneath") is insignificant and moderate correlation with most of the measured motor abilities – the static strength, the speed –strength of the lower extremities ("standing long jump"), the speed ("40 m run"), as the last correlation is negative.

The speed-strength of the lower extremities ("Standing long jump") the correlates positively with static strength (both tests) and negatively with the speed.

Coordination abilities ("Throwing a small dense ball towards a marker") do not correlate with any of the measured motor abilities.

Flexibility correlates positively with most of the motor abilities, as the relationship with the speed is negative. The static strength of the wrist flexors and the muscles of the trunk correlates positively with all other motor abilities!

The endurance correlates positively with speed and negatively with the speed- strength of the lower extremities.

DISCUSSION

The analysis of the correlation coefficients shows that a certain relationship between the studied motor abilities exists in the 5-6 age period but the values of a large part of the recorded correlations are low and moderate in strength and most of them are statistically insignificant.

However, statistically reliable moderate, and significant correlations between the tested motor abilities and their forms were also recorded in 5-6-year-old boys which is confirmed by other authors (Kotsev et al.,1995, Nikolova, 2012). Again, their number and strength is greater in 6-year-olds, in addition, more moderate and significant correlations were recorded in older children in the second study. So, with the increasing the age and the application of appropriate motor activity, the technique of performing the physical exercises is better which also leads to higher results in motor tests, less values of the variation coefficients (groups are homogeneous) and a stronger relationship between the tested motor abilities.

Some of the results about the character of the relationships between the investigated motor abilities are alogical and contradictory in nature so we are going to discuss only few of all established correlations.

The results of the correlation analysis show that there is a statistically significant positive relationship between the speed–strength abilities of the studied muscle groups (those of upper and lower extremities) in all the tests used as well as in the two age groups and testings! The recorded correlation coefficients are moderate and significant in strength.

It means that the physiological impact (physical load) on them leads to their parallel and complex development and that the increase of any one of the strength forms results in the increasing of the other ones or there is a positive transfer between these motor abilities. That fact confirms the statement that the development of the speed-strenght abilities in that age period (6-7-years-old) have a complex character depending on the sensitive period of their natural growth and development on one hand and on the impact of the purposeful and adequate physical activity on the other (Nikolova, 2012, Martinov et al., 1983).

REFERENCES

Guba, V. et al. (2021*). Sensitivnые periodы razvitiya detey*. Izd. „Sport“// Губа, В. и кол. (2021). Сенситивные периоды развития детей. Изд. „Спорт“.

Hadzhiev, N., Andonov, K., Dobrev, D., Petrov, V. (2011). *Gimnastika. Fizicheska podgotovka.* NSA PRES. Sofia. // Хаджиев, Н., Андонов, К., Добрев, Д., Петров, В. (2011). Гимнастика. Физическа подготовка. НСА ПРЕС. София.

Fizicheskata podgotovka na detsata ot preduchilishtna vazrast (1984). Pod redaktsiyata na K. Rachev. M i F, Sofia // Физическата подготовка на децата от предучилищна възраст (1984). Под редакцията на К. Рачев. М и Ф, София.

Kim, T. (2015). Fizicheskoe vospitanie detey rannego i doshkolynogo vozrasta. Moskva. // Ким, Т. (2015). Физическое воспитание детей раннего *и* дошкольного возраста. Москва.

Kotsev, Ch., et al. (1995). Struktura na rabotosposobnostta na uchenitsite ot 1-vi i 3-ti klas (7-9 god.). Sport i nauka, № 10-11, str. 42 // Коцев, Ч. И кол. (1995). Структура на работоспособността на учениците от 1-ви и 3-ти клас (7-9 год.). *Спорт и наука,* № 10-11, стр. 42

Marinov, T. (2020). Osnovi na fizicheskoto vazpitanie. Teoriya i metodika. NSA PRES. Sofia // Маринов, Т. (2020). Основи на физическото възпитание. Теория и методика. НСА ПРЕС. София.

Martinov, G., Ereminov, V., Panchev, M., Nankov, K. (1983). Podobryavane fizicheskite kachestva na uchenitsite. M i F. Sofia // Мартинов, Г., Ереминов, В., Панчев, М., Нанков, К. (1983). Подобряване физическите качества на учениците. М и Ф. София

Nikolova, E. (2012). *Dvigatelnite kachestva v uchebnite programi po fizichesko vazpitanie*. Bolid Ins. Sofia // Николова, Е. (2012). Двигателните качества *в* учебните програми по физическо възпитание. Болид Инс. София.

Sotirov, Ch. (2020). *Fizicheskata kultura i fizicheskoto vazpitanie v preduchilishtnoto obrazovanie.* Monografiya, Shumen // Сотиров, Ч. (2020). Физическата култура *и* физическото възпитание *в* предучилищното образование. Монография, Шумен

Traykova, Tsv. (2017). *Sastoyanie na fizicheskoto razvitie i dvigatelnite sposobnosti na detsa v podgotvitelna grupa za uchilishte (5–7-godishni).* Disertatsiya, Sofia. //Трайкова, Цв. (2017). *Състояние на физическото*

развитие и двигателните способности на деца в подготвителна група за училище (5–7-годишни). Дисертация, София.

Traykova, Tsv. (2021). *Dvigatelni kachestva na detsa v preduchilishtna vazrast.* Monografiya. NSA PRES. Sofia //Двигателни качества на деца в предучилищна възраст. Монография. НСА ПРЕС. София.

Zatsiorskiy, V. (2020). *Fizicheskie kachestva sportsmenov*. Moskva // Зациорский, В. (2020). Физические качества спортсменов. Москва

Corresponding author:
Tsveta Traykova, PhD
Theory of the physical education Department
National Sports Academy „Vassil Levski"
1700, Sofia, Studentski grad
E-mail: CvetaDimitrova@abv.bg

DYNAMICS OF THE DEVELOPMENT OF MOTOR QUALITY SPEED IN 12 – 15-YEAR-OLD GIRLS

Korneliya Naydenova, Dilyana Nancheva
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
The development of motor abilities is a permanent physical education task. Its undertaking ensures the formation and further development of several physical and individual qualities, which are a prerequisite for students acquiring the skills necessary for sustainable self-improvement and leading a healthy lifestyle. Completing this task requires knowledge of the changes and peculiarities in the manifestation of motor abilities, which in turn requires continuous monitoring of the peculiarities in the manifestation of motor abilities to improve the methodology, means, and modes of their development. Based on the above statements, the dynamics in the manifestation of motor quality speed in girls between 12 and 15 years old were set out to be studied. To achieve the aim, the following tasks were set:

1. *Research the problem based on literature sources.*
2. *Testing with 30-meter-race test of the 12 – 15 years old schoolgirls.*
3. *Analysis of testing results and identification of the peculiarities in the dynamics of manifestation of speed.*

The test results were processed through the SPSS v. 20 software product. The resulting data was analyzed statistically by variance and comparative analysis. After processing and analyzing the study results, many changes in the speed performance of 12-15 years old schoolgirls were found. As essential in this direction are the changes within a school year, which allow recommendations for the work of the Physical Education and Sports teachers to be made.

Keywords: *physical education, schoolgirls, speed*

INTRODUCTION

Changes in motor abilities and, in particular motor qualities in pupils are frequently addressed in the field of physical education and sport. On the one hand, this continuous demand is caused by the relationship between the child's motor development, motor activity, and physical health. On the other hand, the continuous development of man from a phylogenetic point of view brings in its wake continuous changes in the ontogenetic development of the individual, which are manifested as different rates of growth, development, formation, and the manifestation of movements, multiple changes in sensitivity with respect to individual motor qualities, etc.

We can support what has been stated so far by the presence of numerous authors who address motor abilities in preschool and school-age children. The first such studies in Bulgaria began at the end of the IXX century and continue to this day by authors such as (Yanev et al., 1965), (Rachev 1972), (Shterev and Popov, 1975), (Yanev and Genov, 1982), (Slunchev et al., 1992), (Popov, 1994), (Dimitrova, 2001), (Nacheva et al., 2002), (Borisov, 2014, 2019), (Marinov, 2014), (Miladinov et al., 2018), (Dimitrova, 2019), (Kostova, 2019). Similar interest has been noticed in Europe and the USA, where the problem has been studied by the following authors (Fleischman, 1970), (Fomin & Filin, 1975, 1985), (Haubenstricker & Seefeldt, 1986), (Pate et al., 1990), (Newell et al., 2016), (Fiori et al., 2020). (Speer et al., 2022) unequivocally point out the relationship between children's motor performance and a healthy lifestyle. In their study findings, they state that measuring children's motor performance at least once a year should be an integral part of the health monitoring process. Moreover, (Geneviève, 2018) reveals the existence of a direct correlation between the level of students' motor abilities, their cognitive abilities, and their academic performance.

The sustained scientific interest in the problem under consideration allows us to segment the present study, which is aimed at revealing the manifestation of the motor quality speed in female students of the lower secondary stage of the Bulgarian school. Tracking changes in the manifestation of the mentioned motor quality reveals possibilities for the derivation of methodological guidelines relating to the subsequent effects in developing the quality. This aims to improve the overall motor performance of female students in the age period under consideration, which is a prerequisite for leading a healthy lifestyle and higher academic performance.

Another point of view of the problem we are considering is the specificity in the manifestation of the motor quality speed and its genetic predetermination, which largely limits the improvement of results in an individual. Such factors are pointed out by L. Djaoui et al. (2017) to be the amount of white muscle fibers, the ability of the nervous system to engage these fibers in the execution of the movement preferentially, the ability to transition from excitation to inhibition in muscle contractions rapidly. D. A. Szabo et al. (2019) also point out that, as a consequence of genetic dependence, speed development is impossible without multi-year, purposeful, and planned influences. This, of course, implies the tracking of the effect of these impacts. The search for solutions to this problem is another point of view that justifies continuous research in motor qualities in adolescents.

Aim and objectives of the study

Based on the above-mentioned necessity of constant research into the specificity of the manifestation of motor abilities and, in particular motor qualities in adolescents, we set as the aim of the present study to identify the dynamics in the manifestation of the motor quality speed in girls between 12 and 15 years old. To achieve this aim, we set the following tasks:

1. Research the problem based on literature sources.
2. Testing with 30-meter-race test of the 12 – 15 years old schoolgirls.
3. Analysis of testing results and identification of the peculiarities in the dynamics of manifestation of speed.

The aim and objectives thus set make it possible to establish the current state of the motor quality speed in female students of the lower secondary stage of primary education in the country and, on this basis, to give an assessment of their speed capabilities and the corresponding recommendations and guidelines for their development in the above-mentioned age period.

METHODS

The object of the present study is the changes in the manifestation of the motor quality speed in girls between 12 and 15 years of age. The contingent of the study includes a total of 105 girls from the V, VI, and VII Grades of 81st "Victor Hugo" Secondary School in Sofia. Of them, 25 are in V Grade, 36 in VI Grade, and 44 in VII Grade. The parents of the children involved in this study signed informed consent for the tests with their children included in the study and publication of the results.

Testing was done once at the beginning and once at the end of the school year for students in VI and VII Grades, while those in V Grade were tested at the end of the 2021-2022 school year. To ascertain the status of motor quality speed, we administered the Running 30m test, which is part of the established national system for assessing students' physical ability.

We processed the data obtained from the tests statistically by applying variance and comparative analyses, which we performed using the SPSS v. 22 software product. We also subjected the data to a one-factor dispersion analysis (One Way Anova), which allowed us to examine the manifestations of age characteristics on the results of our tested female students.

RESULTS

The first step in processing the data obtained from the study was to subject it to an analysis of variance. We present the results in the following table (Table 1). The results presented in the table allowed us to perform the first analyses and select the next statistical indicators to apply in the processing.

Table 1. *Results of the analysis of variance of the test data*

Grade	Testings	N	R	X min	X max	$\bar{x}$	S	V%	As	Ex
V	Testing 2	25	1.45	5.45	6.90	6.04	0.35	5.80	0.500	0.538
VI	Testing 1	36	1.75	5.20	6.95	5.91	0.40	6.81	0.470	0.904
	Testing 2	36	2.46	4.48	6.94	5.59	0.54	9.81	0.322	0.115
VII	Testing 1	44	2.10	4.20	6.30	5.01	0.40	8.06	0.644	1.248
	Testing 2	44	2.20	3.85	6.05	4.74	0.40	8.54	0.724	1.986

Considering that our study examines the achievement of female students in the pubertal period, the values of the coefficient of variation (V%) are of interest. In each of the tests, these did not reach 10%, which indicates a high homogeneity of the groups studied in terms of average achievement. On the other hand, the positive values of the coefficient of asymmetry (As) point us to the fact that the achievements of the examined persons are concentrated around the maximum values, which in this case points us to the weak achievements. This, in turn, indicates the presence of reserves and opportunities in terms of future impacts in the direction of improving the parameters of the motor quality speed.

The most significant component of the analysis of variance is the mean maximum and minimum achievements of the subjects, which we present in detail in Figure 1. The data presented in the figure show a continuous improvement of the average achievements ($\bar{x}$) of the subjects, which over the study period improved within a second and a half, as is evident from the trend lines plotted. However, this is not the case for the minimum and maximum values at different ages, which give us information about the individual abilities of some of the persons studied.

In the case of the students from V Grade, who are 12-13 years old, the spread (R=1.45 sec.) of the achievements is the smallest, which, in our opinion, can be attributed to the work of the teacher and the means and methods applied by him to develop speed within the school year. We can interpret this as a high degree of development of the group of students under consideration.

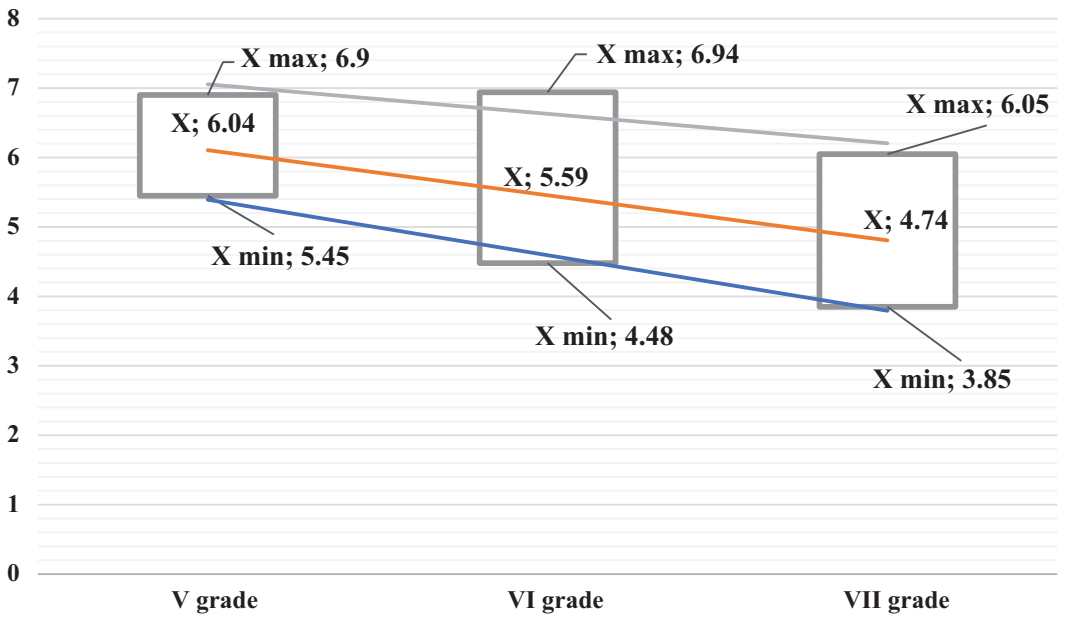


Figure 1. *Minimum maximum and average values for the performance in the tests conducted at the end of each school year*

This is not the case for the performance of the group of 14-year-old girls studied, where the value of the swing (R) at the beginning of the school year was close to that of the previous age group at 1.75 seconds. At the end of the study period reached 2.46 seconds, which, compared with the same indicator for 13-year-old girls, was an increase of more than 1 second. At the same time, we observe an increase in the maximum and a decrease in the minimum value of performance, which is in favor of the minimum performance. This indicates, on the one hand, an improvement in the speed capabilities of female students in this period and, on the other hand, a strengthening of the individual manifestations of the quality under consideration, which implies individualization of means and methods in their development. At the end of VII grade, the individual differences mentioned in the previous age are strengthened, which we explain by the decrease of both the maximum and the minimum of such, which reaches 3.85 seconds with an average value of the performance of 4.74 seconds, which is the lowest for the considered age period 12-15 years.

Based on the regularity of the distributions confirmed by the values of the coefficients of asymmetry (As) and excess (Ex), with few exceptions in 14- and 15-year-old students, we applied the Student's *t*-criterion for dependent and independent samples. This allowed us to test the reliability of the differences in achievement for the different groups of subjects obtained and presented in Figure 1 and the following Figure 2.

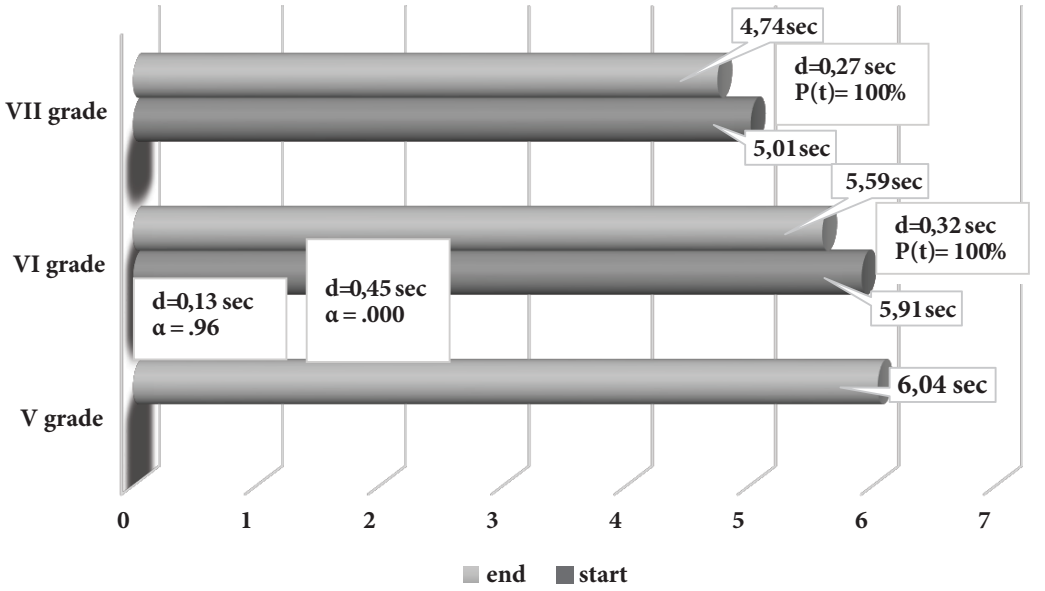


Figure 2. *Average performance in tests conducted at the beginning and end of the school year*

The values of the differences in performance between the tests at the beginning and the end of the school year in the students of the VI and VII grades show differences in average performance that are close to half a second. Considering the specificity of the test applied, the peculiarities of the manifestation of the motor quality speed revealed earlier in the study, and the high level of the probability of guarantee in both comparisons where P(t) is 100%, we can define this increment as reliable and significant. Looking at the values of the absolute increment, which is within 5%, we can assume such an improvement of the score within eight months separating the two tests is normal.

The results presented in Figure 2 show the reliability of the differences between the different ages and grades, tested using the Student's t-criterion for independent samples. The first comparison we made was between the achievements measured at the end of the V grade and the same at the beginning of the VI grade. Here we assume the difference of 0.13 seconds to be random, given the significance level α – .196. The changes in one year between the end of V grade and the end of VI-grade are within 0.45 seconds, and we can assume them to be reliable based on the value of α – .000. We find similar statistically significant differences in the other comparisons we made between the tests at the end of grade V and at the beginning and end of VII grade, where the difference in mean achievement is 1.03 and 1.3 seconds, respectively. With the required level of significance, the values of the differences in achievement between the individual testings of VI and VII grades are also confirmed, where the differences are within 0.50 to 1.17 seconds.

DISCUSSION

The relative increment reported above in the analysis of the results obtained, which is within 5% and is maintained throughout the entire study period, can be considered normal considering the specificity of manifestation and the factors limiting the manifestation of the motor quality speed indicated by authors such as (Djaoui et al., 2017) and (Szabo et al., 2019).

The specificity of the manifestation of speed in the contingent of persons studied by us indicates the presence of individual peculiarities in the manifestation of speed in girls in the age range 12 - 15 years, which from a practical and methodological point of view suggests the need for a careful and more often

individual approach in the selection of methods and means for developing speed in physical education classes, which should depend on the results and growth in the achievements of individual students.

The numerical values of Fisher's coefficient and the adjacent α values in the different comparisons clearly showed the influence of age characteristics on the differences in achievement revealed above between the three tests conducted at the end of each of the three grades. This largely reveals opportunities for targeted development of the motor quality speed in female students of the lower secondary stage who fall within the age range of 12 to 15 years. This statement of ours contradicts the conclusions drawn by authors such as (Rachev, 1972, 1999) and (Fomin and Filin, 1975) (Završnik et al., 2017).

The results we obtained can be supported by the assumption, generated by our observations, that in the secondary education system in our country, working with students from I to IV grade on the subject of physical education is not at the necessary level, which creates prerequisites for such an increase in achievement in the subsequent age range, despite the peculiarities in the development of the musculoskeletal system. Such results support the necessity of continuous monitoring of the parameters of individual motor qualities at school age in order to clarify the peculiarities of their manifestation and the changes that occur as a consequence of the phylogenetic development of a person that is caused by his lifestyle.

REFERENCES

Borisov, L. (2014). Vliqnie na zadaljitelnata podgotovka po fizichesko vyzpitanie i sport vyrhu dvigatelniq potentzial na uchenitzi ot 11 do 14 godishna vyzrast. Sofiq: disertatziq. //Борисов, Л. (2014). Влияние на задължителната подготовка по физическо възпитание и спорт върху двигателния потенциал на ученици от 11 до 14 годишна възраст. София: *Дисертация*.

Borisov, L. (2017). Korelatzionni vzaimozavisimosti mejdu pokazatelite za fizicheska deesposobnost pri uchenitzi ot V do VIII klas. Fizichesko vyzpitanie, sport i kineziterapiq. Nauchno- prilojni izsledvaniq, *Sbornik nauch. dokladi* str.71-79.//Борисов, Л. (2017). Корелационни взаимозависимости между показателите за физическа дееспособност при ученици от V до VIII клас. Физическо възпитание, спорт и кинезитерапия. Научно-приложни изследвания, *Сборник науч.доклади,* стр. 71-79.

Borisov, L. (2019). Sravnitelen analiz na fizicheskata deesposobnost na uchenicite ot progimnazialen etap. Godishnik na Natzionalna Sportna Akademiq „Vasil Levski", str.62-67. // Борисов, Л. (2019). Сравнителен анализ на физическата дееспособност на ученици от прогимназиален етап. *Годишник на Национална спортна академия «Васил Левски»,* стр. 62-67.

Cadoret, G., Bigras, N., Duval, S., Lemay, L., Tremblay, T., Lemire, J. (2018). The mediating role of cognitive ability on the relationship between motor proficiency and early academic achievement in children. *Human Movement Science, Volume 57, pp. 149-157. https://doi.org/10.1016/j.humov.2017.12.002.*

Djaoui, L., Chamari, K. A., Owen, L., Dellal, A. (2017). Maximal sprinting speed of elite soccer players during training and matches. *The Journal of Strength and Conditioning Research, 31(6), DOI: 10.1519/JSC.0000000000001642*, 1509–1517.

Dimitrova, D. (2001). Fizicheska deespsobnost na podrastvashtite vyv vryzka s vyzrastovite promeni v telesnite razmeri i systava na telesnata masa. Sofiq: Disertatziq.// Димитрова, Д. (2001). Физическа дееспособност на подрастващите във връзка с възрастовите промени в телесните размери и състава на телесната маса. София: Дисертация.

Dimitrova, Tz. (2019). Otzenka na fizicheskata deesposobnost na 7-10 godishni uchenitzi. *Godishnik na Natzionalna Sportna Akademiq „Vasil Levski",* tom 1., str.87-91.// Димитрова, Ц. (2019). Оценка на физическата дееспособност на 7-10-годишни ученици. *Годишник на Национална спортна академия "Васил Левски": Том 1.,* стр. 87-91.

Fiori F, Bravo, G., Parpinel, M., Messina, G., Malavolta, R., et al. (2020). Relationship between body mass index and physical fitness in Italian prepubertal schoolchildren. *PLOS ONE*, 15 (5). https://doi.org/10.1371/journal.pone.0233362.

Flaishman, E. (1970). Struktura i izmervane na fizicheskata godnost. // Флайшман. Е. (1970). Структура и измерване на физическата годност.

Fomin, N., Filin V. (1975). Vyzrastovi osnovi na fizicheskoto vyzpitanie. Sofiq, Meditzina i fizkultura. // Фомин, Н., В. Филин. (1975). Възрастови основи на физическото възпитание. София, Медицина и физкултура.

Haubenstricker, J., Seefeldt. V. (1986). Acquisition of motor skills during childhood. in V.Seefeldt (ed.) Physical Activity And Weel-being, Reston, Va. *American Alliance for Health, Physical Education, Recreation and Dance*, 41-102.

Kostova. N, (2019). Systoqnie na fizicheskata deesposobnost pri uchenitzi ot nachalen etap na osnovnata obra-

zovatelna stepen. *Godishnik na Natzionalna Sportna Akademiq „Vasil Levski"*, tom 1., str.73-91.// Костова, Н. (2019). Състояние на физическата дееспособност при ученици от начален етап от основната образователна степен. *Годишник на Национална спортна академия „Васил Левски", Том 1,* стр. 73-91.

Marinov, T. (2014). Promeni v razvitieto na byrzinata pri uchenitzite v rezultat ot obuchenieto po fizichesko vyzpitanie i sport. *Po nqkoi aktualni problemi na fizicheskoto vyzpitanie i sporta, Sbornik nauch. dokladi,* str.57-64.// Маринов, Т. (2014). Промени в развитието на бързината при учениците в резултат от обучението по физическо възпитание и спорт. *По някои актуални проблеми на физическото възпитание и спорта, Сборник науч.доклади,* стр. 57-64.

Nacheva, A., Kondova, N., Iordanova, L., Lazarova, E. (2002). Fizichesko razvitie. kryvno nalqgane i puls pri 7-14 godishni uchenici ot Sofiq. *Sport i nauka*, kn.2, 113-121.// Начева, А., Кондова, Н., Йорданова, Л., Лазарова, Е. (2002). Физическо развитие, кръвно налягане и пулс при 7-14 годишни ученици от София. *Спорт и наука*, кн.2, 113-121.

Newell, K. M., (1985). Coordination, control, and skills. От K. D. Newell, Differing Perspectives in Motor Learning (стр. 295-317). Amsterdam: *Elsevier Science Publishing*.

Pate, R., Dowda, M., Ross, J. (1990). Association between physical activity and physical phytness in Americn Children. *Sports Medicine, 144*, 1123-1129.

Popov, I. (1994). Dinamika, modelirane i prognozirane na fizicheskata deesposobnost, fizicheskoto razvitie na podrastvashtite. //Попов. И. (1994). Динамика, моделиране и прогнозиране на физическата дееспособност физическото развитие на подрастващите.

Rachev, K. (1972). Vyzrastova dinamika i metodika na razvitieto na osnovnite fizicheski kachestva. *Problemi na detsko-iunosheskiq sport.* Sofiq.// Рачев К. (1972). Възрастова динамика и методика на развитието на основните физически качества. *Проблеми на детско-юношеския спорт.* София.

Rachev, K. (1999). Optimizirane na podgotovkata na mladite sportisti, Sofiq, *Novi znaniq.*// Рачев, К. (1999). Оптимизиране на подготовката на младите спортисти. От К. Рачев, София, *Нови знания.*

Shterev, P., Popov, I. (1975). Harakteristika na deesposobnostta na naselenieto na Bylgariq pri bqgane i hvyrlqne. VFK, 2.// Щерев, П., Попов, И., (1975). Характеристика на дееспособността на населението на България при бягане и хвърляне. *ВФК,* 2.

Slynchev, P., Qnev, B. et al. (1992). Fizichesko razvitie, fizicheska deesposobnost i nervno- psihicheska rekreativnost na naselenieto na Bylgariq 1980-1982. III- to nacionalno izsledvane, Sofiq. // Слънчев, П., Янев, Б. и кол. (1992). Физическо развитие, физическа дееспособност и нервно-психическа реактивност на населението на България 1980-1982. III-то национално изследване, София.

Speer, A., Wagner, P., Streicher, H., Ziegeldorf, A., Benkert, I., Wulff. H. (2022). Längsschnittstudie zum Verlauf motorischer Fähigkeiten von Grundschulkindern in Abhängigkeit auffälliger motorischer Leistungen der Fein- und Grobmotorik. *Schwerpunkt: Entwicklungsstörungen in der Kindheit, Volume 31, Issue 3,* 155-163, *https://doi.org/10.1026/0942-5403/a000351*.

Szabo, D. A., Fagaras, P. S., Cileau, L., Sopa, I. S. (2019). Use of the 30 m acceleration test for predicting results at athletic tests of speed on 60, 100 and 200 m in children with a range of 10 to 11 years. *Studia ubb educatio artis gymn., LXIV, 4, 64(4).29*, 43 - 58. *DOI:10.24193/subbeag.*

Qnev B., Genov, F. (1982). Fizicheskoto razvitie, fizicheskata deespsobnost i nervno- psihicheskata reaktivnost na naselenieto. Sofiq: Meditzina i fizkultura.// Янев Б., Ф.Генов. (1982). Физическото развитие, физическата дееспособност и нервно-психическата реактивност на населението. София: Медицина и физкултура.

Qnev B., Shterev, P., Boev, P., Semerdjieva, R., Sepetliev, D. (1965). Fizichesko razvitie i deespsobnost na naselenieto na Bylgariq ot rajdaneto do dvadeset i shest godini. Sofiq: Bylgarska akademiq na naukite. //Янев, Б., Щерев, П., Боев, П., Семерджиева, Р., Сепетлиев, Д. (1965). Физическо развитие и дееспособност на населението на България от раждането до двадесет и шест години. София, Българска академия на науките.

Tsiros M.D., Coates, A.M., Howe, P.R.C., Walkley, J., Hills, A.P., Wood, R.E. et al. (2016). Adiposity is related to decrements in cardiorespiratory fitness in obese and normal-weight children. *Pediatr Obes.*, pp. 144–150.

Završnik, J., Pišot, R., Šimunič, B., Kokol, P., Blažun Vošner, H. (2017). Biomechanical characteristics of skeletal muscles and associations between running speed and contraction time in 8- to 13-year-old children. *Journal of International Medical Research, 45 (1),* 231-245, *https://doi.org/10.1177/0300060516687212*.

Corresponding author:
Korneliya Naydenova
Department of Theory of Physical Education
National Sports Academy „Vassil Levski"
21, Acad. Stefan Mladenov str.
Sofia, Bulgaria
E-mail: knaidenova.nsa@gmail.com

IMPACT OF DISTANCE LEARNING IN AN ONLINE ENVIRONMENT ON PHYSICAL PERFORMANCE IN HIGH SCHOOL BOYS

Daniela Simeonova, Andrey Shalev
National Sports Academy "Vassil Levski", Sofia Bulgaria

ABSTRACT
One of the tasks of physical education in the different grades of the Bulgarian school is the purposeful development of motor skills and achieving an optimal level of physical activity for every age group. The COVID-19 pandemic forced a change in the way students are taught and the conduct of their physical education classes. In this regard, the aim of our research is to reveal the impact of one year of training in an online environment on the physical fitness of high school students.
To achieve this goal, we conducted our research twice (at the beginning and end of the 2021/2022 school year) and tested 39 students (boys) from the "Peter Beron" high school for foreign language teaching - the city of Montana. We conducted the research through the national system for evaluating the physical fitness of students, which includes the tests of running 30 meters, long jump from a place with both feet, throwing a solid ball, running 200 meters shuttle run, and T-test. We applied a variation and comparative analysis to the data from the two tests. Results showed a positive change in the following tests: throwing a solid ball, long jump from a place with both feet, and the 200m shuttle run. In the other two tests, there was no improvement in results.

Keywords: *physical education and sports, students, physical ability, online environment.*

INTRODUCTION

Various authors point out the reduced levels of physical activity, overweight and improper nutrition among adolescents, which affect their physical fitness, and hence their quality of life. Due to online learning, in the last three years, students' physical activity has also been significantly reduced in physical education classes. This made us explore the changes in high school students' physical fitness.

In the middle and the end of the 20th century in our country (Shterev, 1975), (Petkova and Kvartirnikova, 1985), (Slanchev, 1992), (Rachev, 1968) studied the problems of physical fitness. In recent years, studies on physical fitness have been conducted by (Marinov, 2020), (Marinov, Georgieva, Alipieva, 2019), (Borisov et al., 2019), (Nancheva, 2019), (Nancheva and Naydenova, 2019), (Miladinov and Konchev, 2019).

Despite the number of the authors who have examined the problems of physical fitness, Marinov, Georgieva, and Alipieva (2019) claimed 'that no actions have been taken to update the system for assessing the students' physical fitness in the last 25 years. Moreover, Borisov et al., (2019) defined the studies on physical fitness conducted between the 1960s and 1980s as wide-ranging and a result of purposeful state policy, and those conducted since the beginning of the 21st century - as random and a result of personal research interests. Considering the importance of physical fitness, we believe that systematic studies on the problem are necessary. According to Marinov (2020) '... the strategy for improving the health of an individual or the population as a whole should be focused on the level of physical fitness.'

As we noted above, recent years have left their mark on the students' physical activity. In her report, Kuleva (2020) talked about the impact of the COVID-19 pandemic on the effectiveness of work in distance learning. Other authors like Naydenova (2021) pointed out the difficulties and opportunities for conducting physical education lessons in an electronic environment. Nevertheless, online learning is believed to limit the students's movement significantly. They were forced to study in front of the computer, which changed some of their habits related to physical activity, which reflected on their physical fitness. This raised questions about how negatively the online learning affected students' health and physical fitness and how the harm caused by it can be amended, which brought us to the aim of our research.

Aim and objectives of the study

The study aimed at revealing the impact of e-learning on high school boys' physical fitness. To achieve

our goal, we set the following tasks to solve:

1. To study the literary sources on the problem under consideration.
2. To apply a sport-pedagogical test on students' physical fitness by using the test battery of Miladinov et al., (2018)
3. To study the change in students' physical fitness over one school year.

Based on the literary sources reviewed and the above-mentioned goal and tasks, we defined the physical fitness of students between 14 and 16 years of age as the subject of our study and changes that occurred in students' physical fitness for one school year of online learning as the objects of the research.

METHODS

The testing was done at the beginning and the end of the school year 2021/2022 in the High School with Foreign Language Education 'Peter Bogdan' in Montana. The selected students were tested twice following five tests: 30 meters running, standing long jump, throwing a solid ball, 200 meters shuttle run, and T-test. The test results were processed with the statistical software product SPSS.22. and variation and comparative analyses were made.

The study included 39 students between 14 and 16 years. Twenty-one of them were14 years old and 18 -16 years old.

All parents of the studied participants studied have signed an informed agreement that the information received from the tests will be used in the present survey.

RESULTS

The data analysis and interpretation began with the indicators from the variation analysis. The values of the variation coefficient in 14-year-old boys were between 12 and 20%. This showed a relative similarity in achievements, which gave us the reason to assume that physical education work with the respective class was not conducted effectively. The values of the asymmetry (As) and excess (Ex) coefficients, which carry information about the normality of the distribution, showed the presence of normality in all tests except for the T-test done at the end of the school year, and the two measurements of 30 meters running. Significantly lower values of the variation coefficient were noticed in all tests done by the 16-year-old boys, which indicated a significant standardization of the mean achievements in the respective class. This gave us the reason to assume that the work carried out during the school year in physical education lessons positively impacted separate motor skills as components of physical fitness in adolescents. The asymmetry (As) and excess (Ex) coefficients showed normal distribution, which allowed us to use parametric statistics indicators in the follow-up analysis. The follow-up analysis began with the results from the 30m running test.

Table 1. *Data from the comparative analysis of 14-year-old boys*

Test	n	Initial Data			Final data			Increase		t	P(t)
		$\bar{X}$	S	V%	$\bar{X}$	S	V%	D	d %		
30 m running	21	5.07	0.78	15.38	4.99	0.91	18.23	-0.08	-1.57	.492	37.2
Long jump	21	187.61	30.76	16.39	196.85	32.94	16.73	9.24	4.92	-2.324	96.8
Throwing a solid ball	21	594.76	123.19	20.71	632.38	138.45	21.89	37.62	6.32	-1.493	84.8
200 m shuttle run	21	42.05	5.20	12.36	41.00	4.61	11.24	-1.05	-3.57	1.119	72.4
T – test	21	13.90	1.41	10.14	14.78	2.28	15.42	0.88	6.33	-1.914	93

The results in Figure 1 show changes in the studied boys at both ages. The improvement of the results in 14-year-olds, within the school year was by 0.08 seconds, which, based on the guaranteed probability P(t) presented in Table 1 – 37.2%, can be defined as insignificant. In the participants from the other age group, we noticed an improvement in the result between the two tests by 0.21 seconds, which was confirmed with the required level of guarantee probability P(t) – 99.9%. This difference in the results and the statistical reliability gave us a reason to confirm the above-mentioned assumption about the positive impact of the applied means and methods in physical education lessons during online learning within the school year we studied.

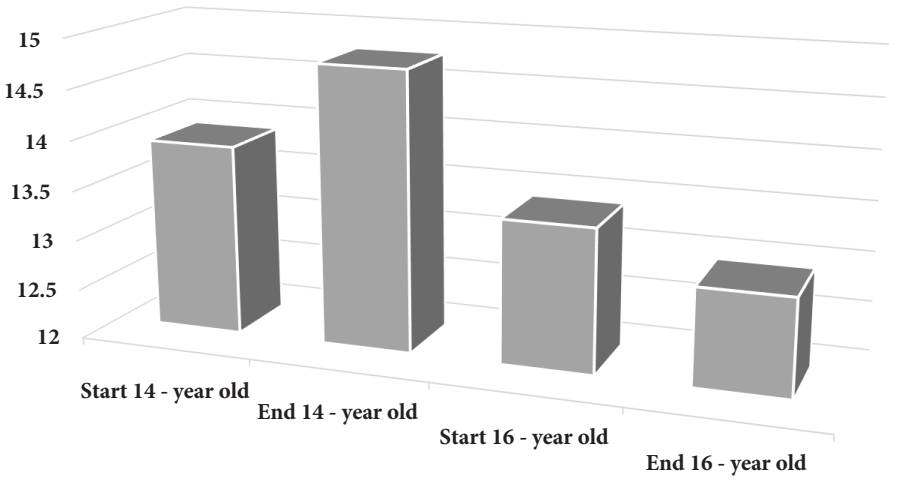


Figure 1. *Mean values of the results achieved in the 30-meter running test*

Tables 1 and 2, and Figure 2 present the Standing long jump test results. The figures showed improvement in the results in both age groups. In the group of 14-year-old students, we noted an increase of 9.24 cm within the school year. This difference can be defined as credible and attributed to the influence of the physical education training in that year. The guarantee probability P(t) was high – 96.8%. The difference between the achievements at the beginning and the end of the school year for the older students was 0.89 cm. Still, contrary to the younger students, as seen in Table 2, the guarantee probability was low - 27.5%, which gave us a reason to attribute it to random factors.

Table 2. *Data from the comparative analysis of 16-year-old boys*

Test	n	Initial Data			Final data			Increase		t	P(t)
		$\bar{X}$	S	V%	$\bar{X}$	S	V%	D	d %		
30 m running	18	4.57	0.30	6.56	4.36	0.21	4.82	-0.21	4.59	3.78	99.9
Long jump	18	216.33	20.55	9.50	217.22	19.53	8.99	0.89	0.41	-.358	27.5
Throwing a solid ball	18	801.66	110.04	13.72	821.11	109.75	13.37	19.45	2.43	-1.816	91.3
200 m shuttle run	18	35.78	3.67	10.26	33.97	3.29	9.68	-1.81	-5.06	4.262	99.9
T – test	18	13.43	0.96	7.15	12.97	0.92	7.09	-0.43	-3.20	2.567	98

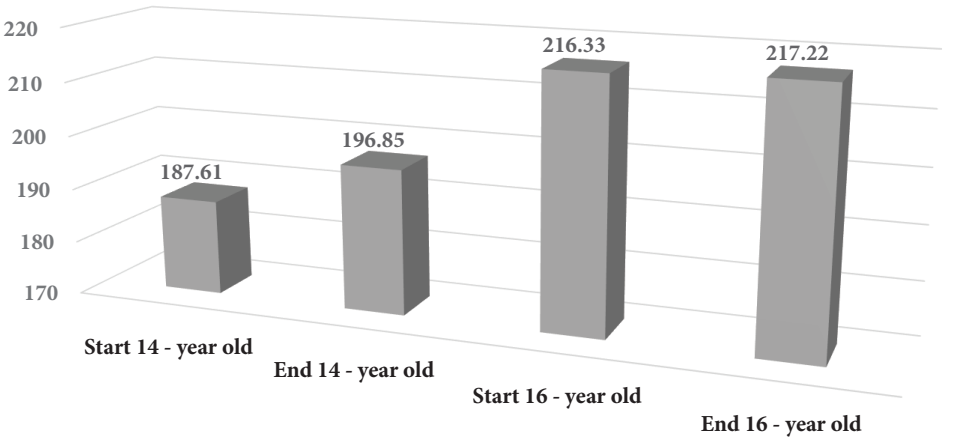


Figure 2. *Mean values of the results achieved in the Standing long jump test*

The results from the Solid ball throwing test, presented in Figure 3, made us consider that the physical education lessons in the electronic environment had a positive impact on the upper limbs explosive power. The results of the studied 14–16-year-old students showed an improvement in their achievements. In the case of 14-year-old boys, the improvement was with 37.62 cm within the research. The obtained difference could not be defined as reliable, based on the value of P(t), presented in table 1 - 84.8%. For the 16-year-old students, the difference in achievement was 19.45 cm, comparing the results from the beginning and the end of the school year. Still, this difference could not be supported by the required level of guarantee probability P(t) - 91.3%. Although both considered age groups showed improvements in their achievements, considering the statistical indicators, we could not attribute these differences to the applied means and methods in the physical education lesson.

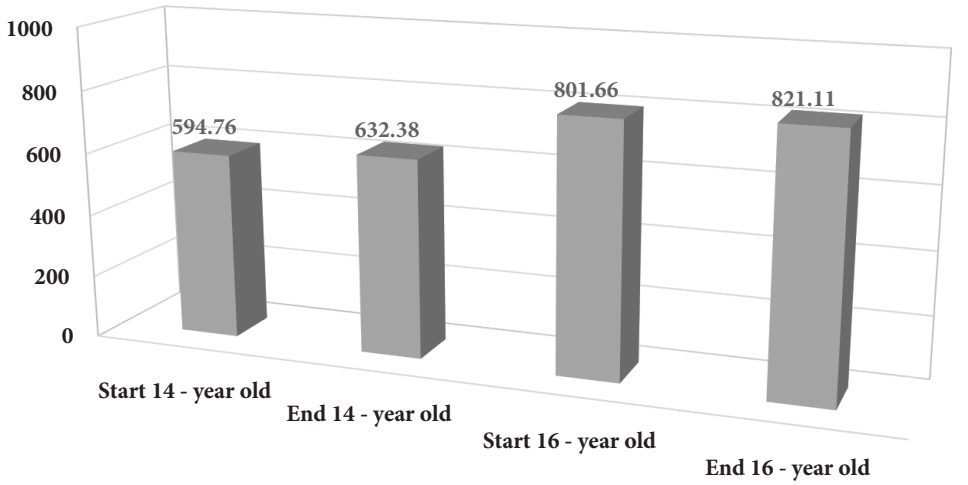


Figure 3. *Mean values of the results achieved in the Solid ball throwing test*

The 200m shuttle running test provides information on the changes that occur in speed endurance. The results from the study for both groups included in our study showed a minimal improvement in the results at the end of the school year compared to those at the beginning. The younger participants showed improvement by 1.05 seconds, which could not be confirmed with the required level of guarantee probability P(t) - 72.4%. This was not the case with the older students tested, in which the mean difference between the first and second measurements was 1.81 seconds. The difference here was confirmed with the required level of guarantee probability P(t) – 99.9%. The shown difference and the statistical reliability gave us a reason to attribute the improvement of these achievements to the physical education lessons implemented in an electronic environment.

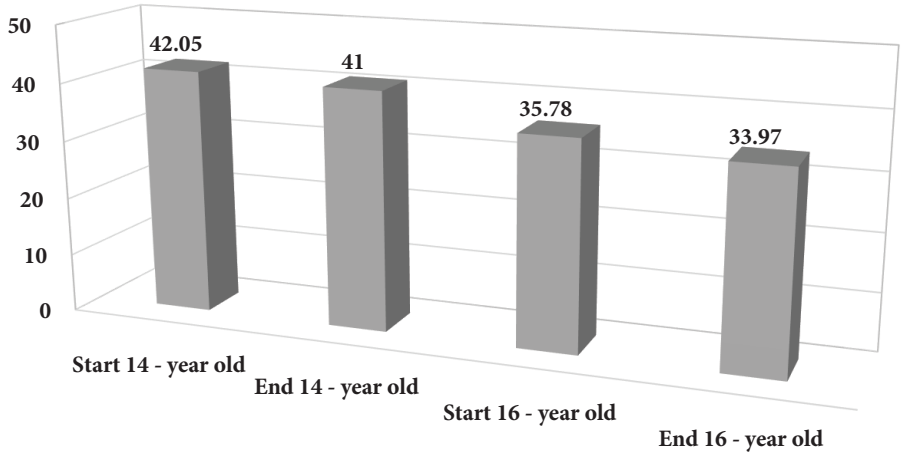


Figure 4. *Mean values of the results achieved in 200 m shuttle running test*

Tables 1 and 2 and Figure 5 present the results from the T-test conducted in both groups The14-year-old students showed lower results by 0.88 seconds, which, despite the lack of statistical reliability P(t) - 93%, was alarming regarding the selection of methods and means aimed at developing one of the motor skills - agility - in the specific class. The results of the 16-year-old students showed improvement in achievements obtained from the tests at the beginning and the end of the school year. The difference between the two measurements was 0.43 seconds, confirmed with the required level of guarantee probability P(t) – 98%. The difference in results and the statistical reliability level allowed us to positively assess the work in physical education lessons and the means, and methods used by the teacher.

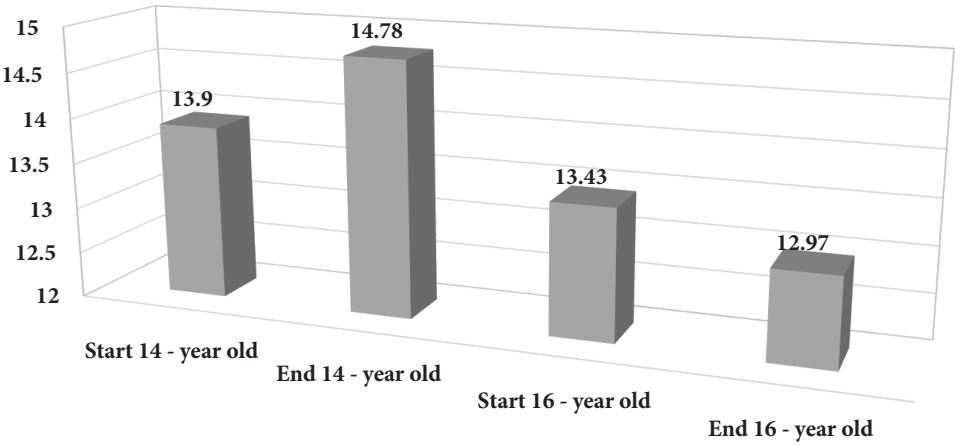


Figure 5. *Mean values of the results achieved in the T-test*

DISCUSSION

The analysis and interpretation of the results obtained from the study showed a lot of changes regarding the physical fitness manifestation in both age groups of the studied students. Comparing these two groups' results, we can claim that positive changes occurred only in the lower limbs' explosive power in the 14-year-old students. The results confirmed the opinions of authors like Zheleva-Terzieva (2019), who claimed that new technologies negatively affected adolescents' motor activity, which inevitably affected their physical fitness. On the other hand, these results confirmed the obtained in a study by Naydenova and Alachev (2019), reporting a continuous increase in explosive power measured by the same test in schoolgirls.

The results from the tests with the 16-year-old students showed a statistically reliable increase in the achievements in three of the total five applied. It is impressive that the results from all tests requiring running over a certain distance - 30-meter run, 200-meter shuttle run, and T-test – improved. At the same time, the achievements in the tests giving information about lower and upper limbs' explosive power got worse.

Our research results showed possibilities for a positive effect of physical education lessons in an electronic environment, but, in our opinion, these possibilities need to be broadened in future, which should be based on the experience gained so far from this kind of learning. At the same time, our research results confirmed those got by Zheleva-Terzieva (2021), who, although partially, examined the problem, paying attention to the impact of the COVID pandemic on motor skill strength, and pointed out some influences and changes in the skill parameters.

REFERENCES

Borisov, L., Naydenova, K., Kostova, N., Nancheva, D. (2019). Prouchvane varhu nyakoi strani na fizicheskata deesposobnost pri 6–18-godishni uchenitzi za 60-godishen period. *Godishnik na Natsionalna sportna akademia "Vasil Levski"*, Tom 1, str. 14-21. Sofiq: NSA PRES // Борисов, Л., Найденова, К., Костова, Н., Нанчева, Д. (2019). Проучване върху някои страни на физическата дееспособност при 6–18-годишни ученици за 60-годишен период. *Го-*

дишник на Национална спортна академия "Васил Левски", Том 1, стр. 14-21. София: НСА ПРЕС

Kuleva, M. (2020) The impact of Covid-19 pandemic on the evaluation of the effectiveness of online distance learning. *Pedagogy Bulgarian journal of educational research and practice,* vol. 92, n. 7, special issue, p. 74-83, Sofia.

Miladinov, O., Konchev, M. (2019). Metodika za razrabotvane na sistema za otzenyavane na fizicheskata deesposobnost na uchenitsite ot I do XII klas. *Godishnik na Natzionalna sportna akademia "Vasil Levski",* Tom 1, str. 22-33. Sofiq: NSA PRES // Миладинов, О., Кончев, М. (2019). Методика за разработване на система за оценяване на физическата дееспособност на учениците от I до XII клас. *Годишник на Национална спортна академия "Васил Левски",* Том 1. (стр. 22-33). София: НСА ПРЕС

Marinov, T., Georgieva, K., Alipieva, L. (2019). Sastoyanie na sistemata za otzenka na fizicheskata deesposobnost na uchenitzi ot srednite uchilishta v Republika Bulgaria. *Godishnik na Natzionalna sportna akademia "Vasil Levski",* Tom 1, str. 7 – 13. Sofiq: NSA PRES // Маринов, Т. Георгиева, К., Алипиева, Л. (2019). Състояние на системата за оценка на физическата дееспособност на ученици от средните училища в Република България. *Годишник на Национална спортна академия "Васил Левски",* Том 1, стр. 7 – 13. София: НСА ПРЕС

Marinov, T. (2020). *Osnovi na fizicheskoto vazpitanie - teoria i metodika*, Sofia, NSA PRES // Маринов, Т. (2020). *Основи на физическото възпитание - теория и методика*, София, НСА ПРЕС

Naydenova, K. (2021). Distantsionnoto obuchenie po fizichesko vazpitanie i sport – predizvikatelstva i reshenia. *Godishnik na Natsionalna sportna akademia "Vasil Levski",* Tom 2, (str. 7 – 15). Sofia: NSA PRES // Найденова, К (2021). Дистанционното обучение по физическо възпитание и спорт – предизвикателства и решения. *Годишник на Национална спортна академия "Васил Левски",* Том 2, стр. 7 – 15. София: НСА ПРЕС

Naydenova, K., Alachev, S. (2019). Promeni v stoynostite na skorostno-silovite vazmozhnosti na uchenichki ot gimnazialen etap, ustanoveni chrez testa "Skok na dalzhina s dva kraka ot myasto", *Sport i nauka*, NSA, BSFS, br. 1, 2, str. 90-97 // Найденова, К., Алачев, С. (2019). Промени в стойностите на скоростно-силовите възможности на ученички от гимназиален етап, установени чрез теста "Скок на дължина с два крака от място", *Спорт и наука*, НСА, БСФС, бр. 1,2, стр. 90-97

Nancheva, D. (2019) Sastoyanie na izdrazhlivostta na uchenitzi ot gimnazialen etap. *Godishnik na Natzionalna sportna akademia "Vasil Levski",* Tom 1, str. 82-86. Sofiq: NSA PRES // Нанчева, Д. (2019) Състояние на издръжливостта на ученици от гимназиален етап. *Годишник на Национална спортна академия "Васил Левски"*, Том 1, стр. 82-86. София: НСА ПРЕС //

Nancheva, D., Naydenova, K. (2019) Study of the impact of the motor characteristics of speed on the age peculiarities, *Proceeding book of International Congress Applied Sports Science*, NSA Press, str. 163 -165

Petkova L., Kvartirnikova, M. (1985). *Testove za otsenyavane na fizicheskata deesposobnost.* Sofia. // Петкова Л., Квартирникова, М. (1985). *Тестове за оценяване на физическата дееспособност*. София.

Rachev, K. (1968). *Povishavane na fizicheskata deesposobnost na uchenitzite.* Narodna prosveta. // Рачев, К. (1968). *Повишаване на физическата дееспособност на учениците*. Народна просвета.

Slynchev, P. B. (1992). *Fizichesko razvitie, fizicheska deesposobnost i nervno-psihicheska rekreativnost na naselenieto na Bylgariq 1980-1982.* III- to nacionalno izsledvane. Sofiq. // Слънчев, П. Б. (1992). *Физическо развитие, физическа дееспособност и нервно-психическа реактивност на населението на България 1980-1982.* III-то национално изследване. София.

Shterev, P., Yanev, P. (1975). *Harakteristika na deesposobnostta na naselenieto na Bulgariq pri bqgane i hvyrlqne.* VFK, 2. // Щерев П., Янев, П. (1975). *Характеристика на дееспособността на населението на България при бягане и хвърляне.* ВФК, 2.

Zheleva-Terzieva, D. (2019). Relevance and importance of the pedagogue`s sports-animation competence. *E-magazine "Pedagogical Forum",* vol. 1, 51-57., DOI: 10.15547/PF.2019.006

Zheleva-Terzieva, D. (2021). Impact of distance learning on the motor abilities of primary school-aged pupils. *Proceedings of CBU in Social Sciences* Vol. 2, https://doi.org/10.12955/pss. v 2. 247, p. 362-365.

Corresponding author:
Daniela Simeonova, PhD
Department of Theory of Physical Education
National Sports Academy „Vassil Levski"
21, Acad. Stefan Mladenov str.
Sofia, Bulgaria
E-mail: daniela.simeonova@nsa.bg

INTERDISCIPLINARY TRAINING METHODOLOGY IMPACT ON MOTOR QUALITIES OF SCHOOL BOYS

Lyubomir Borisov
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
The interdisciplinary approach encourages students to put into practice the new knowledge and skills they have acquired in the course of their education in different school subjects. It helps them develop abilities to find content and functional connections between processes and phenomena studied in different school disciplines.
The present study aimed to establish the effect of the interdisciplinary methodology applied in the subject of Physical Education and Sport on the development of motor skills of boys in the second grade at primary school. The object of the study was the level of improvement of the motor skills of school boys in the second grade. The experimental group included 8 boys from the Primary School "Otez Paisii" in the town of Knezha, Bulgaria, where the new interdisciplinary methodology was implemented. The control group using the traditional education methods included 14 boys from the 120 Primary School "G.S. Rakovski" in Sofia, Bulgaria. The experimental methodology was applied for a period of two school years. The students were tested twice in this period; the first was in September 2020, and the second was in May 2022.
The interdisciplinary methodology was specially developed to involve several school subjects – Physical Education and Sport, Bulgarian Language and Literature, Mathematics, English Language, Man and Society, and Man and Nature. The compulsory course program in Physical Education and Sport contains adapted educational content from the other school subjects, grounded on meaningful connections with them.
The following tests were used to evaluate the students' motor skills: 30-meter run, standing long jump (with a two-footed take-off), throwing a solid ball - 1 kg, 200-meter shuttle run, T-test, sit-ups, depth of bending, and frequency of knocking. After processing the acquired test results, it was established that the methodology used for interdisciplinary education in Physical Education and Sport was very efficient in developing the motor skills of ten-year-old boys.

Keywords: *physical capacity, motor skills, students*

INTRODUCTION

The main tasks laid down in the state education standards for general education preparation and in the education programs of all school subjects are the acquisition of key competencies and the implementation of cross-curricular connections.
Competences are abilities not innate but "developed through quality learning in suitable pedagogical environment and by acquiring serious practical experience" (Zwell, 2000).

According to a scientific study, a person's competencies should be tested, not their intelligence (McClelland, 1973). Another researcher has given an expanded interpretation of competencies as „motivated abilities, "specifying 37 relatively independent competencies, which he defines using different categories – readiness, ability, attitude, self-control, etc. (Raven, 1984).

Competence achievement orientation is not a new task for Bulgarian education. However, such an orientation would be sensible and effective if it helps resolve problems in various life situations. Contemporary education implies the introduction of new methods and approaches in the classroom leading to a change in the attitude to the school and stimulating students' motivation for learning. Actually, even the best lessons and books in the world will not succeed to make students interested in learning if they are not motivated. Motivation – intrinsic and extrinsic, is a key factor for their success at all levels of education. This understanding of education is the starting point for interdisciplinary learning and training.

The interdisciplinary approach stimulates students to put into practice the new knowledge and skills acquired in the course of learning different school subjects. It develops their abilities to establish content, and functional connections between processes and phenomena studied in various school disciplines. The interconnection between teachers in various spheres of knowledge grounded on the interactive approach in the education process would lead to the practical application of the statements laid down in the Pre-school and School Education Act about students' upbringing, socialization, and training through the development of various competencies.

The most important task of Physical Education and Sport is to increase the physical fitness of children as a main indicator of their health status and work capacity of the organism. The development of motor skills is based on physical capacity. The main idea of the present study is to use the interdisciplinary approach in the Physical Education and Sport classes to increase the motivation of students to participate in the lessons, which will positively affect the development of their motor skills.

Aim and objectives of the study

The study aimed to establish the effect of the interdisciplinary methodology applied in the Physical Education and Sport classes on the motor skills of boys from the second grade of primary school.

To achieve this goal, we set ourselves the following tasks:

1. Studying literary sources and documents on the problem;
2. Developing and applying interdisciplinary methods in the school subject Physical Education and Sport for a period of 2 years;
3. Establishing the level of development of the separate indicators characterizing the physical capacity of ten-year-old boys;
4. Processing and analysis of the acquired results.

METHODS

The object of the study was the effectiveness of the applied methodology for interdisciplinary education. The research was focused on the increase in the level of development of motor abilities of primary school boys. The research subjects were 22 boys from the second grade at school divided into two groups - an experimental and a control group. The experimental group where the new interdisciplinary methodology was applied included 8 boys from Primary School "Otez Paisii" in the town of Knezha, Bulgaria. The control group included 14 boys from the 120 Primary School "G.S. Rakovski" in Sofia and used traditional education methods. The parents of all participants studied have signed an informed agreement that the information received from the tests will be used in the present survey. The experimental methodology was applied for a period of two school years. The students were tested twice in this period; the first was in September 2020, and the second was in May 2022.

The interdisciplinary methodology was specially developed to involve several school subjects – Physical Education and Sport, Bulgarian Language and Literature, Mathematics, English Language, Man and Society, and Man and Nature. The compulsory course program in Physical Education and Sport contains adapted educational content from the other school subjects, grounded on meaningful connections with them.

For the realization of the aims of the research, the following tests were used for evaluation of the physical capacity of the subjects:

1) 30 meters running (sec.)
2) Standing long jump with two-footed take-off (cm.)
3) Throwing a solid ball - 1 kg. (cm.)
4) 200-meter shuttle run (sec.)
5) T-test (sec.)
6) Sit-ups for 30 seconds (number)
7) Depth of bending (cm.)
8) Frequency of knocking (number)

The acquired results from the students' achievements were processed with the mathematical and statistical methods of variation and comparative analysis.

RESULTS

The results from the variation analysis on the achievements of the boys from the experimental and the control group in the eight tests are presented in Table 1.

The values of the dispersion indexes around the mean value are within acceptable limits. The achievements in 30 m running and the t-test, are very homogeneous. The coefficient of variation does not exceed 12%. The greatest dispersion is observed in the control group's results on the 30-second sit-up test (V=22.45%) and the solid ball throwing test (V=23.74%).

The choice of Student's *t*-test for dependable variables is correct since the calculated asymmetry and excess coefficients do not exceed the critical values at the alpha significance level $\alpha = .05$.

Table1. *Variation analysis of the results from the experimental and control groups' second testing.*

Group	Test	n	R	Xmin	Xmax	$\overline{X}$	S	V(%)	As	Ex
Experimental group	30 meter running	8	1.33	6.03	7.36	6.66	0.54	8.1	0.32	-2.00
	Standing long jump	8	57	110	167	135.75	17.14	12.62	0.39	0.92
	Throwing solid ball	8	70	410	480	450.63	29.81	6.61	-0.44	-1.54
	200-meter shuttle run	8	15.71	47.85	63.56	54.16	6.73	12.42	0.64	-1.87
	T-test	8	2.76	14.21	16.97	15.51	1.00	6.44	0.31	-1.43
	Sit-ups	8	6	15	21	17.88	2.10	11.74	0.09	-1.19
	Flexibility	8	6	48	54	50.88	2.23	4.38	0.21	-1.73
	Frequency of knocking	8	4	12	16	14.38	1.18	8.2	-0.97	1.87
Control group	30 meter running	14	2.25	5.45	7.70	6.10	0.66	10.81	1.26	1.15
	Standing long jump	14	65	110	175	143.71	20.87	14.52	-0.24	-0.85
	Throwing solid ball	14	390	290	680	491.43	116.7	23.74	-0.21	-0.96
	200-meter shuttle run	14	25.60	44.27	69.87	51.60	9.04	17.51	1.09	-0.35
	T-test	14	5.02	14.77	19.79	16.61	1.50	9.03	0.76	-0.26
	Sit-ups	14	13	8	21	16.79	3.77	22.45	-0.95	0.77
	Flexibility	14	29	27	56	45.29	7.77	17.15	-0.99	0.97
	Frequency of knocking	14	4	7	11	9.21	1.31	14.22	-0.46	-0.75

The results from the comparative analysis of the increase in the results of the control and the experimental group are presented in two tables—first and second testing in the experimental group and first and second testing in the control group.

Table 2. *Results from the comparative analysis of the achievements between the experimental group's first and second testing.*

Test	n	I testing		II testing		Increase		t	P(t)
		$\overline{X}_1$	S_1	$\overline{X}_2$	S_2	d	d %		
30 meter running	8	7.68	0.81	6.66	0.54	-1.02	13.28	5.61	99.99
Standing long jump	8	108.13	13.15	135.75	17.14	27.63	25.54	5.93	99.99
Throwing solid ball	8	377.00	70.79	450.63	29.81	73.63	19.53	3.62	99.91
200-meter shuttle run	8	62.11	7.81	54.16	6.73	-7.95	12.79	4.79	99.8
T-test	8	17.04	1.32	15.51	1.00	-1.53	8.97	3.63	99.2
Sit-ups for 30 sec.	8	7.25	2.43	17.88	2.10	10.63	146.6	9.38	100
Depth of bending	8	38.88	1.96	50.88	2.23	12	30.86	10.3	100
Frequency of knocking	8	5.00	1.20	14.38	1.19	9.38	187.6	22.33	100

The comparative analysis of the results from the testing of the experimental group at the beginning and at the end of the experiment shows an increase in all eight tests, and all of them are supported by a guaranteed probability greater than 95%. Analyzing in detail the results of the separate tests presented in Table 1, we can see that in the test "Frequency of knocking", providing information on the development of coordination abilities and speed, the biggest increase is observed, i.e., 9.00 cycles of knocking, compared to the first testing. In the test "30 meters running" there is a decrease in the time by 1.02 seconds for covering the distance, and in the test "200 meters shuttle running", giving information about endurance, the increase is by 7.95 seconds less in comparison to the first testing. The results showing the strength of the abdominal muscles represented in the test "Sit-ups in 30 seconds" also present an increase of 10.63 numbers per 30 seconds. We checked the motor skill agility in the

T-test, and the positive change in the results is clearly obvious, the time for execution has decreased by 1,53 seconds. The data presented above support our claims about the high effectiveness of the applied interdisciplinary education methodology.

Table 3. *Results from the comparative analysis of the achievements between the control group's first and second testing.*

Test	n	I testing		II testing		Increase		t	P(t)
		$\bar{X}1$	S1	$\bar{X}2$	S2	d	d %		
30 meter running	14	6.60	0.67	6.10	0.66	-0.5	7.57	6.05	100
Standing long jump	14	132.50	21.46	143.71	20.87	11.21	8.46	5.49	100
Throwing solid ball	14	387.14	100.42	491.43	116.74	104.29	26.93	6.31	100
200-meter shuttle running	14	53.75	6.77	51.60	9.04	-2.15	4	2.09	94.3
T-test	14	18.11	1.93	16.61	1.50	-1.5	8.28	4.9	100
Sit-ups for 30 sec.	14	7.14	3.35	16.79	3.77	9.65	135.15	13.47	100
Flexibility	14	46.50	6.97	45.29	7.77	-1.21	2.6	1.22	75.6
Frequency of knocking	14	7.36	1.34	9.21	1.31	1.85	25.13	6.77	100

Analyzing the acquired results from the students in the control group, we can see that six of the eight tests are statistically reliable. Concerning the increase of the results, there is a big increase only in the test "Sit-ups for 30 seconds"– 9.65 numbers. The results from the "T-test" show a decrease in the time for performance by 1.5 seconds, supported with 100% guarantee probability. There is also a marked increase in the motor abilities presented in Table 2 with the "Throwing a solid ball" test, where the results were improved by 104.29 cm, and with the "Standing long jump" test.

In the test "200 m shuttle running" there is a decrease in the time for covering the distance. However, it is not statistically significant, and in the test "Depth of bending" providing information about flexibility, there is a deterioration of the results by 1.21 cm.

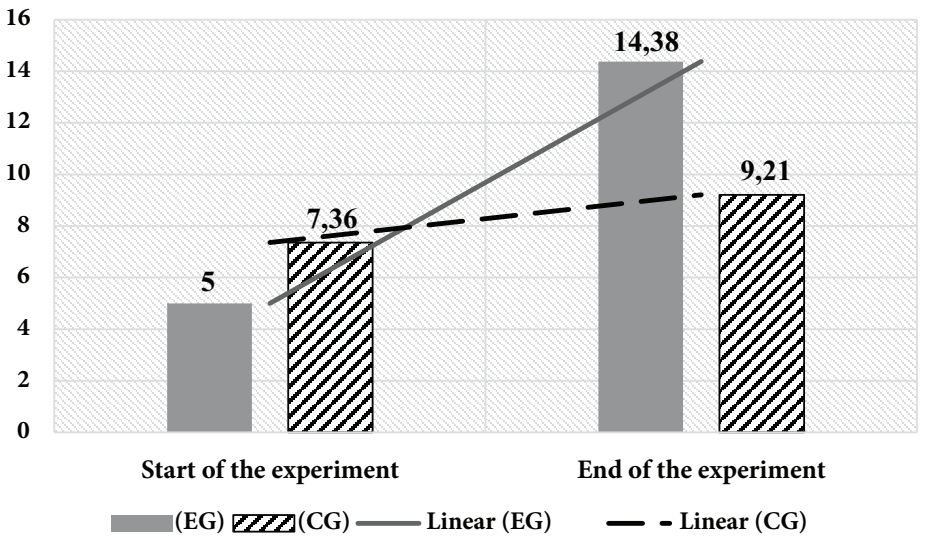


Figure 1. *Mean values of the achievements in the test "Frequency of knocking"*

The most significant differences between the two groups were discovered in the test "Frequency of knocking" presented in Figure 1. At the beginning of the school year, the boys from the experimental group had lower results than those of the students from the control group, 5 for the experimental group and 7.36 for the control group, respectively. In the next test at the end of the experiment, the experimental group already surpassed the results of the control group, showing a significant increase in their results - 187.6%, while the increase in the control group was only by 25.13%. The acquired results

give us the right to claim that the interdisciplinary learning methodology is very effective for the development of the motor skill of speed.

DISCUSSION

A comparison of the increase in the results of the two groups at the end of the experimental period clearly reveals which methodology has a bigger effect on the development of motor skills, the traditional or the experimental one, because there is an obvious difference between the initial results and the final results of the two groups. Considering the results, it is noticeable that in 7 of the tests, the increase in the experimental group is much bigger. Only in the test "Throwing a solid ball" the increase is bigger in the control group. These data give us reason to claim that the applied interdisciplinary methodology, including educational content from other different subjects, is more interesting and entertaining for the students. This leads to an increase in their motivation for participation in the lessons. In other words, they start performing the exercises with greater willingness and in a better way, which leads to better development of their motor skills.

Motivation is considered a basic prerequisite for participation in physical and sport competition activities. It acts as a stimulus in the effort to learn and to perform exercises. The main reasons for participation in sports activities are the improvement of skills, the pleasant experience, the acquisition of new skills, a search for new stimulating experiences, and improvement of physical fitness (Gill et al.,1983). According to another specialist, one of the leading reasons for participation in the Physical Education and Sport lesson is the emotional release (Mavrudiev, 2010). Increasing students' motivation could be achieved by applying several interactive methods for education and training based on game activities and focused on the acquisition of various competencies (Naydenova, 2020).

Using interdisciplinary education methods in the subject of "Physical Education and Sport" will provide greater variety and motivation for the students. The means used for the development of upper limb strength included in the presented methodology have to be revised and improved.

Analyzing the results of the experimental and the control group and comparing the increase in the indicators and the statistical reliability, we can conclude that the applied methodology has a positive effect on the development of the motor skills of ten-year-old boys.

REFERENCES

Gill, L., Gross, B., Huddleston, S. (1983). Participation motivation in youth sports, *International journal of sport psychology*, 14, 1–14.

Mavrudiev, S., Mindova, D. (2010). Motivatziq za zanimaniq s fizichesko vyspitanie i sport pri uchenitzi ot sredna uchilishtna stepen na R. Litva i R. Bylgariq. *Sport i nauka*, Sofia, isv. br.4-II //Маврудиев, С., Миндова, Д. (2010). Мотивация за занимания с физическо възпитание и спорт при ученици от средна училищна степен на Р Литва и Р България. *Спорт и наука*, София, изв.бр.4-II част//.

McClelland, D. (1973). Testing for Competence Rather than for Intelligence, *American Psychologist*, 28, 1–14.

Naydenova, K. (2020). *Teoretico – metodichni postanovki na obuchenieto po futbol s utzhenici,* Monographiq, NSA PRESS, Sofiq, ISBN 978-954-718-633-0. // Найденова, К. (2020). *Теоретико - методични постановки на обучението по футбол с ученици*, Монография, НСА ПРЕС, София, ISBN 978-954-718-633-0//.

Raven, J. (1984). *Dinophyte flagella: a cost-benefit analysis.*

Zwell, M. (2000). *Creating a Competence,* New York.

Corresponding author:
Lyubomir Borisov, Ph.D.
Department of Theory of Physical Education
National Sports Academy "Vassil Levski"
Studentski grad,
Sofia 1700, Bulgaria
E-mail: lubomirborissov@abv.bg

TRENDS IN THE DEVELOPMENT OF GENERAL PHYSICAL TRAINING IN 14-16 YEARS OLD STUDENTS

Boyan Zlatev, Hristo Andonov & Stoyan Andonov
National Sports Academy „Vassil Levski", Sofia, Bulgaria

ABSTRACT
Introduction: The motor abilities of a person are realized in certain movements, which are distinguished by their quantitative and qualitative characteristics. Sports development from childhood to adulthood depends on the rational combination of the main aspects of sports training: physical, sports-technical, and psychological training. The aim of the study is to determine the level of general physical training in 14-16-year-old students and to identify some trends in the development of adolescents in 21 high school "Hristo Botev".
Material and methods: Information research, sports-pedagogical testing, mathematical-statistical methods, analysis, and synthesis.
Results: A total of 135 boys and girls aged between 14 and 16 from 21 „Hristo Botev" high school of Sofia were examined. Of these, 75 are boys and 60 are girls. In both sexes, the mean values and the variability of the results were determined.
Conclusions: It was found that with increasing age, the explosive power of the lower extremities improves significantly. Confirmation of this are the results of the test "Jump length from a place". On the other hand, we have a large variation in the strength capabilities of the lower and upper limbs of the studied students.

Keywords: *motor skills, adolescents, testing, control.*

INTRODUCTION

Since the beginning of the 21st century, the analysis of various aspects of sport has been extremely intensive. (Petkova, 2020)

The motor abilities of a person are realized in certain movements, which are distinguished by their quantitative and qualitative characteristics. It is accepted that motor qualities are understood as separate aspects of human motor abilities (Zatsiorsky, 1970).

Motor activity is characteristic of every living being. It is especially specific for sports, where it is characterized by its high intensity and extremity. Motor qualities - strength, endurance, speed, flexibility, and agility, are manifested in this activity. These are specific human abilities that manifest in close motor structures (Zhelyaskov, Dasheva, 2017).

Despite the differences and the fact that individual motor qualities have a specific form of manifestation and many other specific features, due to the great similarity with psychophysiological mechanisms, their consideration as relatively independent qualitative features of the organism is conditional. This thesis supports the fact that many general patterns have been found in their development and improvement (Rachev, 1998).

Movement as a manifestation of motor activity exists in space and time. In its dynamic and kinematic characteristics, those specific abilities are manifested as well as the properties of the organism to motor activity, which we conditionally call motor qualities. The disclosure of their ontological nature is one of the debatable issues in the theory and methodology of sports training. The main reason for this is their overly differentiated treatment (Zatsiorsky, Kraemer, 2006).

Sports training for children and adolescents is one of the most important periods in determining future practice of a given sport by adult competitors. General physical preparation essentially affects coaching efficiency and the improvement of technical skills (Fraser-Thomas et al.,2005; Raczek, 1985, Young, James, 2002).

The type and level of general physical preparation are determined by the cumulative effects of the development of individual motor abilities. (Lloyd et al., 2016; Maio Alves et al., 2010; Fraser-Thomas et al.,2005; Malina, Biuchard, 1991; Schmidt, Lee, 1999).

Sports development from childhood to adulthood depends on the rational combination of the main aspects of sports training: physical, sports-technical, and psychological training. (Rachev, 1998).

Given the limitations of previous athletic development models, the article of Lloyd, & Oliver (2012) introduces a new alternative model that encom-

passes athletic development from early childhood (2 years of age) up to adulthood (21+ years of age). Youth Physical Development (YPD) model offers a comprehensive approach to the development of young males, as shown in Figure 1, and females, as shown in Figure 2, respectively (Stone et al., 2003; Wisloff et al., 2004).

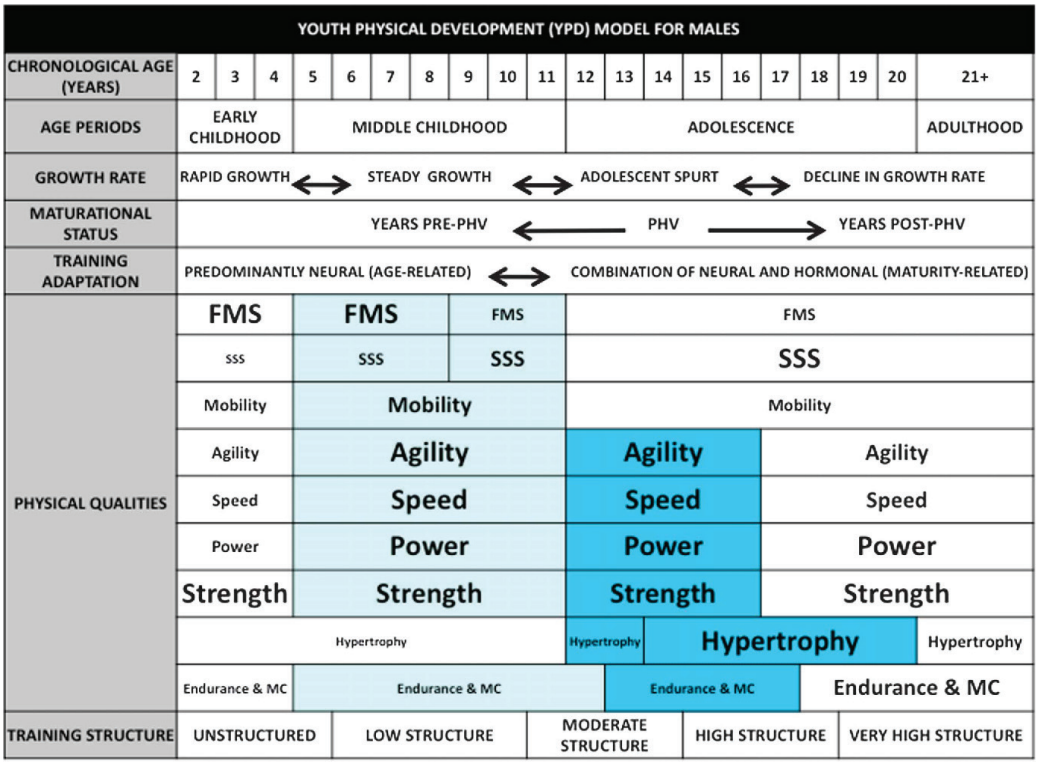


Figure 1. *The youth physical development model for males*

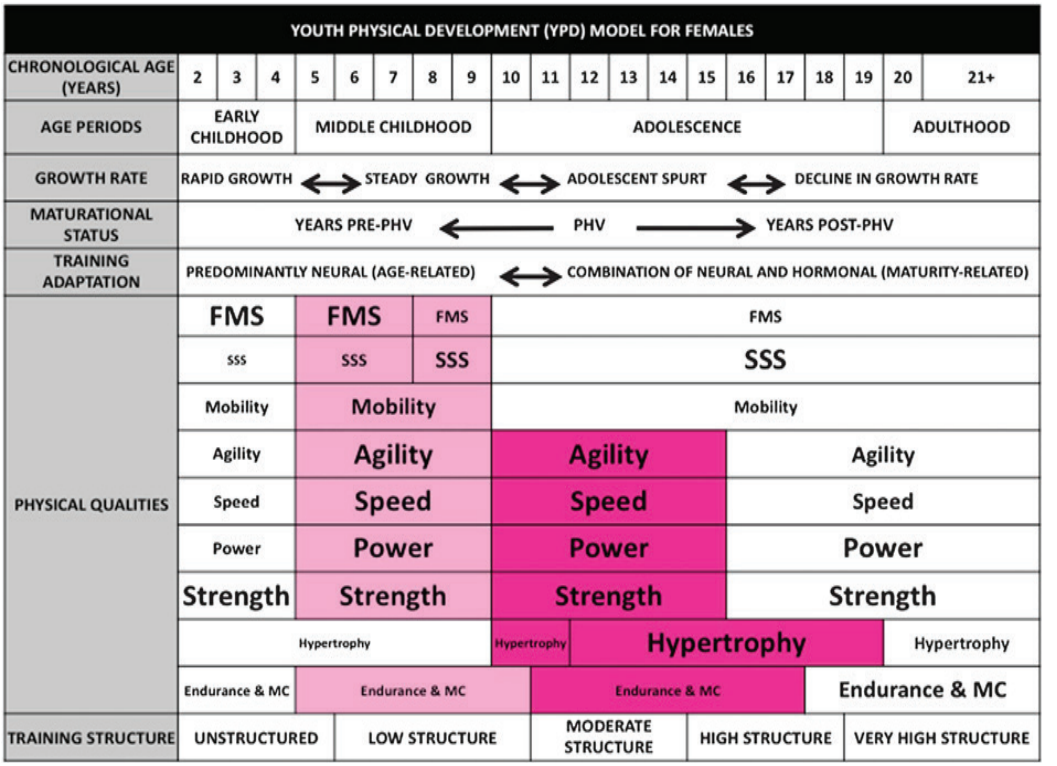


Figure 2. *The youth physical development model for females*

Aim and objectives of the study

The study aims to determine the level of general physical training in 14-16-year-old students and to identify some trends in the development of adolescents in 21 SU "Hristo Botev". The object of the study is general physical training in adolescents 14-16 years. The subject of the study is the changes in general physical training in the age aspect.

METHODOLOGY

Participants

The participants of this study were 135 students, 75 boys and 60 girls from VIII to X classes. In VIII class participants were 26 boys and 20 girls, IX class – had 28 boys and 17 girls, and X class – had 21 boys and 23 girls. The mean age of the subjects is 15 ± 0.6 years with a body height of 171.25 ± 6.44 cm. For participation in the study, informed consent was obtained from the parents.

Procedures

- Information study of specialized literature on the trends in the development of general physical training in adolescents aged 14-16 years;

- Test battery - the study includes five tests, which are borrowed from the system for assessing the physical performance of students from I to XII class (Performed by: all students aged 6 to 18 years.). All tests run on a flat site with non-slip rigid or rigid elastic pavement.

30 m run test

Starting: from a high start, the number of starting students is determined by the number of running tracks and the ability to measure more students at the same time. Commands are given by the teacher: "In places" and "Start". Execution: The starting students are at a distance of 1 m from the starting line in the starting position main position. The teacher, who is on the finish line with a high hand, gives the command "In places", in which the starting students move to the starting line and take a position for a high start. The teacher gives the command "Start" with a whistle or with the words "start", while at the same time lowering his raised hand. Measurement: with an accuracy of 0.01 sec.

Two-legged long jump test

A tape measure is stretched in the direction of the jump. Starting position: standing, feet shoulder-width apart, toes touching drawn line, arms raised up and forward, standing at elbows. Measurement: to the nearest 1 cm.

Throwing Ball Test

Performed by: from 6 to 10 years - weighing 1 kg., from 11 to 18 years - weighing 3 kg.

A tape measure is stretched in the direction of the throw. The zero of the tape measure is on the throw line. Starting position: standing, feet shoulder-width apart, toes touching a drawn line, palms tightly covering the ball from side to back with fingers slightly open, the ball is high above and slightly in front of the head. Performance: the student takes a single body and arms too far back and throw the ball forward and upward. Measure the distance from the throwing line to the point of contact of the ball on the support. It is not allowed to cross in front of the throwing line after the ball has taken off into the air. Measurement: to the nearest 1 cm.

200 m run test (shuttle run)

Starting: from a high start, the number of start-ups is determined by the number of available corridors and the possibilities for measuring more students at the same time. Commands given by the teacher are: "In places" and "Start". Execution: the starting students are at a distance of 1 m from the starting line in the starting position main position. The teacher who is on the start-finish line gives the command "In places", in which the starting students move to the starting line and take a position for a high start. The teacher gives the command "Start" with a whistle or with the words "start". The students run all the time in their own corridor. At the end of every 50 meters, they touch the line marking the end of the 50-meter distance with the foot of one foot, turn 180 degrees, and continue running in the same corridor. The finish is at the starting point after four lengths of 50 meters have been run.
Measurement: to the nearest 0.01 sec.

Test for agility (T-test)

Necessary equipment: 4 rubber or wooden hoops with a diameter of 15-20 cm and a thickness of 2-3 cm, 4 tennis balls. The hoops are arranged in the shape of the letter "T". There is one tennis ball in each hoop. Execution: the student stands behind the hoop at the place of the start-finish in the initial position main position. When the "Start" signal bends, takes the ball and moves to the other hoops

in the direction indicated with digits from (1) to (6). From each subsequent hoop, the student takes the ball in it and leaves the one he carries. The measurement stops the moment the ball touches the hoop field at the start-finish. Measurement: with an accuracy of 0.01 sec.

Statistical analysis

Variation analysis - a characteristic of the average level and the variation of the results of the participants in the study are made.

RESULTS

In both sexes, the mean values and the variability of the results were determined.

For boys, the average value of the "30 m run" test is 5.28 seconds. for VIII grade students in the results presented (Table 1), 4.52 sec. for students from IX grade in the results presented (Table 2), for students from X grade - 5.17 sec in the results presented (Table 3). Regarding the "Long Jump" test, the average values consistently presented by classes are - 188.54 cm, 197.79 cm, and 199.81 cm, which shows that with increasing age, the explosive power of the adolescents studied by us improves. In the test "200 m. Shuttle run" the average results are 37.7 seconds, 36.82 sec., and 38.96 sec. In the test "Throwing a solid ball - 3 kg." The average values of the studied adolescent students are 755 cm, 883.04 cm, and 802.86 cm. In the last test for dexterity control "T-test", the average values are - 16.23 sec, 14.14 sec., and 15.77 sec.

Table 1. *Variation analysis of the test results of VIII grade students, boys*

Index	n	X min	X max	R	X	S	V	As	Ex
30 m run test	26	4.1	6.92	2.82	5.28	0.73	13.74	0.68	-0.18
Two-legged long jump	26	130	232	102	188.54	26.81	14.22	-0.53	0.29
200 m run test (shuttle run)	26	32.94	45.28	12.34	37.7	3.12	8.28	0.71	0.38
Throwing Ball Test	26	520	1110	590	755	127.83	16.93	0.73	1.43
Test for agility (T-test)	26	12.4	21.45	9.05	16.23	2.72	16.78	0.27	-1.08

Table 2. *Variation analysis of the test results of IX grade students, boys*

Index	n	X min	X max	R	X	S	V	As	Ex
30 m run test	28	3.94	5.44	1.5	4.52	0.43	9.46	0.91 *	-0.18
Two-legged long jump	28	160	235	75	197.79	17.54	8.87	-0.08	-0.33
200 m run test (shuttle run)	28	32.42	45	12.58	36.82	3.14	8.52	1.09*	0.88
Throwing Ball Test	28	490	1200	710	883.04	156.71	17.75	-0.82	1.51
Test for agility (T-test)	28	12.2	18.74	6.54	14.14	1.58	11.20	1.29*	1.59

Table 3. *Variation analysis of the test results of X grade students, boys*

Index	n	X min	X max	R	X	S	V	As	Ex
30 m run test	21	4.24	7.38	3.14	5.17	0.82	15.94	1.25*	1.44
Two-legged long jump	21	130	250	120	199.81	32.62	16.33	-0.86	-0.04
200 m run test (shuttle run)	21	34.95	45.09	10.14	38.96	3.26	8.38	0.31	-1.13
Throwing Ball Test	21	470	1060	590	802.86	150.80	18.78	-0.67	0.08
Test for agility (T-test)	21	12.96	19.08	6.12	15.77	1.86	11.80	0.27	-1.08

For girls, the average results of the "30 m" test are 6.11 sec., 5.71 sec., and 6.09 sec., respectively for VIII, IX, and X grades. The results of the "Long Jump" test are 146.85 cm, 157.82 cm, and 159.65 cm. The third test "200 m shuttle run" has after average values: 44.66 sec., 46.47 sec., and 45.28 sec. Regarding the test "Throwing a solid ball - 3 kg." The achieved results are 538.75 cm, 571.76 cm, and 588.70 cm. Average values in the "T-test" are 19.12 sec., 17.02 sec., and 16.85 sec.

Table 4. *Variation analysis of the test results of VIII grade students, girls*

Index	**n**	**X min**	**X max**	**R**	**X**	**S**	**V**	**As**	**Ex**
30 m run test	20	5.12	7.27	2.15	6.11	0.58	9.43	0.29	-0.49
Two-legged long jump	20	100	180	80	146.85	21.64	14.74	-0.43	-0.68
200 m run test (shuttle run)	20	37.5	60.37	22.87	44.66	6.30	14.11	1.47*	2.26*
Throwing Ball Test	20	400	790	390	538.75	101.31	18.80	1.33*	1.38
Test for agility (T-test)	20	14.92	25.19	10.27	19.12	2.73	14.30	0.28	-0.10

Table 5. *Variation analysis of the test results of IX grade students, girls*

Index	**n**	**X min**	**X max**	**R**	**X**	**S**	**V**	**As**	**Ex**
30 m run test	17	4.57	7.85	3.28	5.71	0.78	13.63	1.47*	2.85*
Two-legged long jump	17	115	200	85	157.82	20.93	13.26	-0.07	0.22
200 m run test (shuttle run)	17	38.81	51.7	12.89	46.47	3.84	8.27	-0.38	-0.99
Throwing Ball Test	17	450	790	340	571.76	98.31	17.19	0.84	-0.14
Test for agility (T-test)	17	14.12	22.23	8.11	17.02	2.13	12.51	1.11*	1.37

Table 6. *Variation analysis of the test results of X grade students, girls*

Index	n	X min	X max	R	X	S	V	As	Ex
30 m run test	23	4.54	7.4	2.86	6.09	0.74	12.23	0.04	-0.513
Two-legged long jump	23	120	210	90	159.65	24.51	15.55	0.56	-0.65
200 m run test (shuttle run)	23	38.45	57.75	19.3	45.28	5.41	11.95	0.74	-0.22
Throwing Ball Test	23	420	870	450	588.70	122.04	20.73	0.62	-0.28
Test for agility (T-test)	23	13.85	21.42	7.57	16.85	2.13	12.67	0.33	-0.60

As the asymmetry and excess in some of the studied groups of students, of both sexes are above the allowable ones, the Kolmogorov-Smirnov test was used to check the normality of the data. The results of its application show that in all studied groups there is a normal distribution.

DISCUSSION

From the results obtained in the examined adolescents, it was found that the students of VIII grade have the lowest results in all tests, except for "200 m. Shuttle running". The main reason for this, in our opinion, is due to their age. Muscle mass accumulates as a result of a larger number of strength exercises, which are included in the curriculum of VIII - X classes. Speed opportunities are also improved through the use of various running exercises from athletics. With the transition to a higher class, the goals and tasks in the curriculum in team sports begin to be more complex and requirements for technical implementation improve agility.

It is interesting that, with the exception of the test for explosive power of the lower limbs, the other indicators in the IX grade are better than those of the X grade. This is an indicator of their higher level of general physical performance.

It was found that the results of the test "200 m. Shuttle run" in the three studied groups are very homogeneous - V = 8.28; 8.52; 8.38. It should be noted that VIII grade students performed better than those in X grade. In the test "throwing a solid ball - 3 kg." the best result is given to 15-year-olds, followed by 16-year-olds, and the weakest results are given to 8th-grade students. It is interesting that in the period 1973-1990. in the case of an identical "throwing a medicine ball" test, the same dependence of the results is established. This can be explained by the gradual decrease in interest in physical education and sports and hence in lowering the overall performance of older people. At the same time, the lower result for VIII grade students is due to the lower prevalence of strength exercises in their curriculum.

In the test "30 m. run" the time of the students from IX grade is the best. It is noteworthy that the difference between 14 and 16 years is insignificant - 0.11 sec. To a large extent, this may be due to the specifics of the development of speed, which is mainly carried out in childhood (from 4 years) and ends at 14-15 years. Speed movements are best controlled between the ages of 10 and 14 when the greatest increase in speed is noted.

The results of the agility test "T-test" are distributed in the same way, where again the 15-year-olds have the best achievements - 14.14 ± 1.58 sec., Then the 16-year-olds - 15.77 ± 1.86 sec. and the weakest achievements have 14-year-olds - 16.23 ± 2.72 sec. It should be noted that the difference in results between 14 and 16-year-olds is insignificant - less than half a second, while between 15 and 16-year-olds is more than a second. This is another sign of a decrease in overall physical performance in older students. The " Two-legged long jump" test is the only one in which the 16 years old have the best result, but also the variation in their results is the biggest.

The results of 14-year-olds are more than 10 cm weaker, but this is normal because according to a number of authors the dynamic force develops mainly in the period 15-16 years (Platonov, 2013; Verhoshanskiy, 1985; Zhelyazkov, 1985). Again, weaker results are observed in 14-year-olds with an average score of 175.39 ± 26.16 cm, and in students at 16 years - 193.46 ± 21.74 cm. From this, we conclude that the muscular force and its manifestation explosive force of the lower extremities are still not sufficiently developed in adolescents and girls aged 14 years compared to 15-16 years.

Regarding the test "200 m. Shuttle running" it was found that the best average result has girls aged 14 years - 44.66 ± 6.30 seconds. This is an indicator of a good level of speed in girls at this age, but at the same time must take into account the large variety of results, which does not allow unambiguous interpretation of the result. The main reason here is the motivation and individual ability of each of the studied students.

The "T-test" found that the results of girls improved with age. This test is complex and is associated with various manifestations of motor dexterity. That is, in older girls the ability to coordinate individual movements and actions in time, space, and effort adequate to the motor task is at a higher level. The reason for these results may be due to learning and memorizing the passing of the "T-test" over the years and, respectively, better work of the CNS, related to the automation of the test.

The "30 m. run" test shows similar results between the subjects. Student's t-criteria for independent samples showed that the results were P (t) <95%, which shows that the differences in performance are unreliable and the practical size of the difference (Cohen *d*) varies from small to medium.

Based on the results of the study we come to the following more important conclusions: It was found that with increasing age, the explosive power of the lower extremities improves significantly. Confirmation of this are the results of the test "Jump length from a place". Regarding the "30 m. run" test, the best results are achieved by 15-year-old boys and girls. It is noteworthy that the difference between the subjects is insignificant. Speed movements are best controlled between the ages of 10 and 14. Comparing the two sexes, much better results are found in adolescents compared to girls aged 14-16, which shows the need for gender differentiation. It is necessary for the development of general physical training in adolescents and girls aged 14-16 years to be a systematic process including a variety of at the same time accessible exercises, as well as to have time control.

REFERENCES

Fraser-Thomas, J., Cote, J. & Deakin, J. (2005). Youth sport programs: avenue to foster positive youth development.*Journal Physical Education and Sport Pedagogy*, Vol. 10 No. 1, pp. 19-41.

Lloyd, R., Cronin J. & Faigenbaum A. (2016). National Strength and Conditioning Association position statement on long-term athletic development. *Journal Strength Conditioning Research*. Vol. 30, pp. 1491-1509.

Lloyd, R. & Oliver, J. (2012). The Youth Physical Development Model: A New Approach to Long-Term Athletic Development. *Strength and Conditioning Journal*, Vol. 34 No. 3, pp. 61-72. doi: 10.1519/SSC.0b013e31825760ea

Maio Alves J., Rebelo A., Abrantes C., & Sampaio J. (2010). Short-term effects of complex and contrast training in soccer players' vertical jump, sprint, and agility abilities. *Journal Strength Conditioning Research*. Vol. 24, pp. 936-941.

Malina, R., & Bouchard, C. (1991). *Growth, maturation*

and physical activity. Champaign: Human Kinetics.

Petkova, V. (2020). Sport za vsichki i integratsiata na hora i inovatsii. *Godishnik na Nacionalna sportna academia*, tom 2, pp. 45-56.// Петкова В. (2020). Спорт за всички и интеграцията на хора и иновации. Годишник на Национална спортна академия, том 2, стр. 45-56.

Platonov, V. (2013). *Periodizaciia sportivnoy trenirovki,* Olympic Literature, Kiev.// Платонов, В. (2013). Периодизация спортивной тренировки. Олипииски лекции. Киев

Rachev, K. (1998). *Teoria i metodika na fizicheskoto vazpitanie, obshti osnovi na teoria na fizicheskoto vazpitanie,* NSA-PRES, Sofia.// Рачев, К. (1998). Т*еория и методика на физическото възпитание, общи основи на теория на физическото възпитание*, НСА-ПРЕС, София.

Raczek, J. (1985). *Koncepcja przygotowania sprawnościowego dzieci i młodzieży*, Rocznik Naukowy AWF, Katowice.

Schmidt, R. & Lee T. (1999). *Motor control and learning. A behavioral emphasis*. Champaign: Human Kinetics.

Stone MH, Sanborn K, O'Bryant HS, Hartman M, Stone ME, Proulx C, Ward B & Hruby J. (2003) Maximum strength-power-performance relationships in collegiate throwers. *Journal Strength Conditioning Research, Vol.* 17, pp. 739–745.

Wisloff, U., Castagna, C., Helgerud, J., Jones R. & Hoff J. (2004) Strong correlations of maximal squat strength with sprint performance and vertical jump height in elite soccer players. *Brish Journal Sports Medice,* Vol. 38, pp. 285–288.

Verhoshanskiy, J. (1985). P*rogrammirovanie i organizaciya trenirovochnogo processa,* Fizicheska kultura I sport, Moscow.// Верхошанскиир Ю. (1985). *Программирование и организация тренировочного процесса*, Физическа култура и спорт, Москва.

Young, W., James, R. & Montgomery, I. (2002). Is Muscle Power Related to Running Speed with Changes of Direction? Journal of Sports Medicine and Physical Fitness, Vol. 42 No. 3, pp. 282–288.

Zatsiorsky, V. (1970). Fizicheskite kachestva na sportista. Meditsina i fizkultura, Sofia.// Зациорски, В. (1970). Физическите качества на спортиста, Медицина и физкултура, София.

Zatsiorsky, V. & Kraemer, W. (2006). Science and Practice of Strength Training. 2nd edition book. Champaign: Human Kinetics.

Zhelyazkov, Ts. & Dasheva, D. (2017). *Osnovni na sportnata trenirovka.* Bolid-ins, Sofia// Желязков, Ц. & Дашева Д. (2017). Основи на спортната трериловка, Болид инс, София

Corresponding autor:
Boyan Zlatev, PhD
National Sports Academy „Vassil Levski"
21 Acad. Stefan Mladenov , str.
Sofia,1700, Bulgaria
E-mail: boyanzlatev@abv.bg

MOBILE GAMES AS A MEANS OF DEVELOPING MOTOR QUALITIES IN TENNIS TRAINING

Petko Mavrudiev
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
In many methods in different sports, mobile games are used to improve the motor abilities of adolescents. We have developed and tested a methodology based on mobile games in tennis training.
The study aims to optimize the physical preparation of the 10 years old boys who are training tennis in school in an extracurricular form of education through the tools of the moving games.
The object of study are 40 boys, 10 years old (3rd grade) divided into two groups of 20 children - experimental and control.
The subject of the study are the signs of physical development and motor skills.
To establish the effectiveness of the applied methodology, testing was carried out twice with all participants in the study (at the beginning and the end of the experimental period) on six tests, two physical development indicators, and BMI.
The results were subjected to mathematical and statistical processing by Variation analysis, Comparative t-criterion of Student, BMI.
The analysis of the results shows that, at the end of the experiment, the experimental group has higher achievements in all studied indicators. Unlike the first test, however, in which there were insignificant differences between the two groups in the level of development of the studied traits, in the second test - the ratio changed in favor of the experimental group.
It can be argued with a high guarantee probability that the specific work with the means of mobile games applied by us has led to a significant increase in the level of development of the boys in the experimental group speed endurance, the explosive force of the lower limbs, both in vertical and horizontal efforts.
As the main conclusion of the study, we could conclude that the experiment, through the means of mobile games in general, has positively influenced the development of basic motor skills, physical ability, and health status of students.

Keywords: *students, tennis, moving games, physical skills*

INTRODUCTION

The modern way of life responds with paradoxical contradictions - the improved living conditions increase the factors that negatively affect the harmonious development of adolescents (Mavrudiev, 2007; BFTennis, 2000; Rachev, 1994). The real fact is excessive mental load and reduced physical activity, acceleration in physical development, and retardation of the individual's physical capacity, as well as the fact that only physical education and sports lessons do not provide the necessary physical activity of students (BFTennis, 2000; Rachev, 1994). In recent years, there has been a growing objective need for attractive systematic extracurricular activities in exercise and sports to stimulate the active participation of adolescents and improve their level of motor skills and health status (Aleksandrova, Bahchevanski, Kornatovska, 2017; Nikolova, Marinov, 2002; Popivanova, 2007). In many methods in different sports, mobile games are used to improve the motor abilities of adolescents. We have developed and tested in the training of tennis methodology based on mobile games (Batllori, 2003; Kolev, 2003; Korotkov, Sevev, 1976; Sevev, 1991; Mavrudieva, 2008; Mavrudieva, Iskrov, Tsarova-Vasileva, 2015; Mavrudiev, 2007).

The study aims to optimize the physical fitness of 10-year-old boys who play tennis in extracurricular activities by applying mobile games (Mavrudiev, 2007; BFTennis, 2000).

METHODOLOGY

The object of the study are 40 boys from the third grade (10 years old), divided into two groups of 20 children - experimental and control.

The subject of research are the signs of physical development and motor qualities of the studied contingent.

The following methods were used to solve the purpose and tasks of the research:

1. *Theoretical and logical analysis;*
2. *Pedagogical experiment* - A complex of mobile games was compiled for the research. The ped-

agogical experiment was conducted for three months. The classes lasted 60 minutes and were held twice a week. For the participation of the children in the tennis classes we received permission from the parents. For this purpose we organized a meeting with the parents, at which they were introduced to the experiment and signed an informed agreement for the participation of the children, and also, that the results from the tests will be used in the current study.

3. *Testing* - To determine the effectiveness of the applied methodology. With all participants in the study, two tests were performed (at the beginning and the end of the experimental period) on six tests (Table 1).

Table 1. *List of indicators*

№	Indicators	Measures unit	Measurement accuracy	Direction of growth
1.	Height	m	0.01	+
2.	Weight	**Kg**	**0.50**	
3.	BMI	**Kg/m²**	**0.01**	
4.	Sprint 12 m	S	0.01	-
5.	Long jump	Cm	1.00	+
6.	High jump	Cm	1.00	+
7.	Throwing a solid ball	Cm	1.00	+
8.	Shuttle run	S	0.01	-
9.	Depth of slope	Cm	1.00	+

4. *Anthropometry* (Slunchev, 1998)

The study results were subjected to mathematical and statistical processing by *Variation analysis, Student's comparative t-test,* and *Body Mass Index – BMI.*

RESULTS AND ANALYSIS

The results of the variational processing of the initial data obtained during the initial testing of the boys from the experimental group are presented in Table 2.

Table 2. *Mean values and variability of indicators - experimental group – beginning of the experiment*

№	Indicators	X	S	V	min	max
1.	Height	142.15	8.90	6.26	137	152
2.	Weight	45.78	8.76	19.14	34	65
3.	BMI	22.66	3. 87	17.08	15.70	25.78
4.	Sprint 12 m	3.02	0.27	8.81	3.54	2.51
5.	Long jump	149.70	21.30	14.23	120	180
6.	High jump	27.80	8.13	29.24	18.00	40.00
7.	Throwing a solid ball	278.55	50.06	17.97	225	405
8.	Shuttle run	39.54	4.01	10.15	44.15	36.12
9.	Depth of slope	98.90	5.25	5.31	92	111

Analysis of the results Table 2 shows that of the 20 boys surveyed, seven were overweight, six were overweight, and only two were underweight. Table 2 shows that in the experimental group at the beginning of the experiment, only four of the studied indicators, the values of V are lower or at the limit of 10%. For the other indicators (2nd, 3rd, 5th, 6th, and 7th), the coefficient of variation occupies values between 14.23% and 29.24%, and therefore these indicators are relatively stable, and according to them, the group is relatively homogeneous (Figure 1).

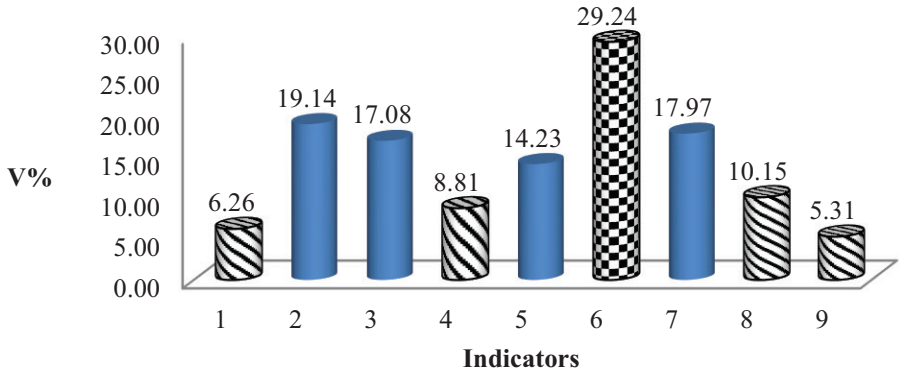


Figure 1. *Dispersion of signs - experimental group – beginning of the experiment*

The picture at the beginning of the experiment was slightly different in the control group. Its results from the variational analysis are presented in Table 3.

Table 3. *Mean values and variability of indicators - control group – beginning of the experiment*

№	Indicators	X	S	V	min	max
1.	Height	141.78	10.19	7.19	135	157
2.	Weight	44.21	7.66	17.32	34	66
3.	BMI	21.99	3.58	16.30	15.68	25.34
4.	Sprint 12 m	3.11	0.32	10.13	3.62	2.72
5.	Long jump	145.80	19.52	13.39	111	177
6.	High jump	25.00	8.46	33.84	18	43
7.	Throwing a solid ball	275.24	54.02	19.63	218	392
8.	Shuttle run	41.17	3.05	7.41	46.30	34.30
9.	Depth of slope	97.30	4.26	4.38	91	107

The analysis of the results from the table shows that, in general, in the control group at the beginning of the experiment, almost the same scattering zones were observed, in most of the indicators, as already commented in the experimental group. At indicator 6 (height rebound), the coefficient of variation is higher than 30% (Figure 2). Therefore, regarding the explosive force of the lower limbs under vertical forces, the control group was heterogeneous at the beginning of the experiment. Indicator 6 (rebound in height) - was unstable.

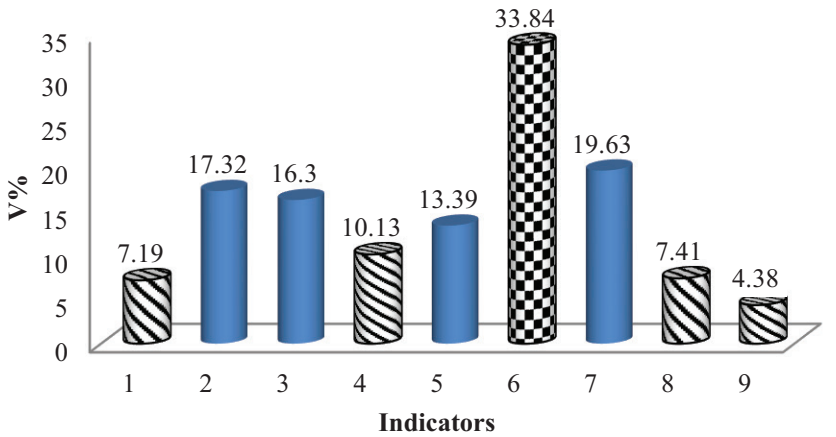


Figure 2. *Dispersion of signs - control group – beginning of the experiment*

Table 2 and Table 3 show that at the beginning of the observed period, there are not particularly large differences between the average levels of the studied traits in the experimental and control groups (Figure 3).

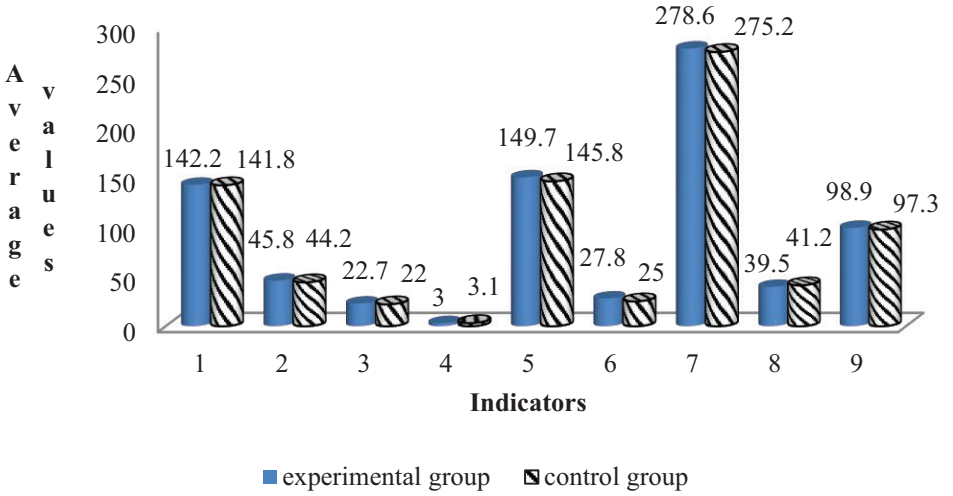


Figure 3. *Average levels of the studied traits*

To verify the validity of the existing differences, we calculated Student's t-criteria in independent samples and with a high guarantee probability of Pt ≥ 95% (Figure 4).

The analysis of the results presented in Figure 4 shows that in this comparison, the t-test takes values between 0.12 (for the 1st indicator - growth) and 1.44 (for the 8th indicator - "shuttle running") (i.e., it is below t critical = 2.02).

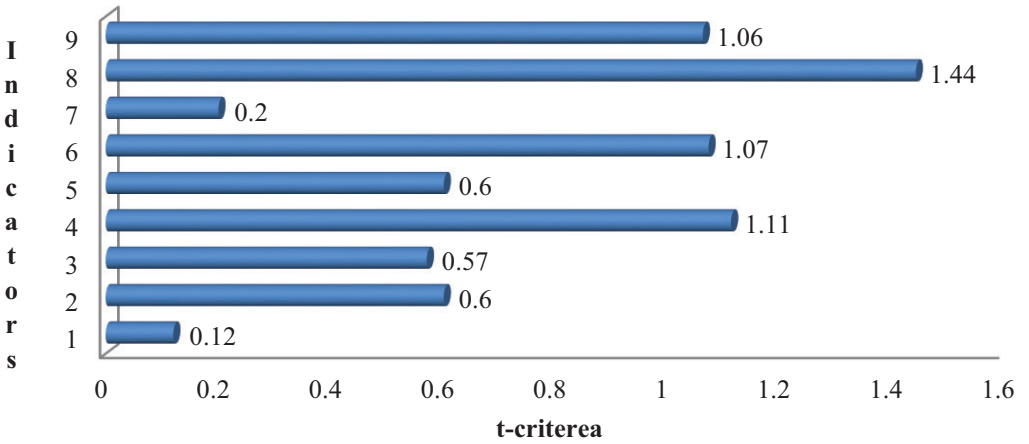


Figure 4. *Significance of the differences between the mean levels of the studied traits in the experimental and control groups - beginning of the experiment*

Therefore, with a high guarantee probability (Pt ≥ 95%), it can be stated that at the beginning of the experimental period, there are no significant differences between the average levels of the studied traits in the experimental and control groups, which ensures correctness at the start of the experiment.

As a final result of the work during the experiment, there were some changes in the average levels of the studied traits, which are presented in Table4.

Table 4. *Mean values and variability of indicators - experimental group – end of experiment*

№	Indicators	X	S	V	min	max
1.	Height	143.82	9.33	6.49	139	154
2.	Weight	46.24	9.23	19.14	35	67
3.	BMI	22.36	3.08	13.77	16.20	24.90
4.	Sprint 12 m	2.91	0.30	10.20	3.50	2.42
5.	Long jump	157.30	15.29	9.72	130	184
6.	High jump	30.55	7.11	23.27	20	42
7.	Throwing a solid ball	299.05	48.36	16.17	232	425
8.	Shuttle run	33.23	3.12	9.38	40.12	28.12
9.	Depth of slope	102.40	3.98	3.89	97	111

The analysis of the results from Table 4 and Table 2 shows that at the end of the experimental period, there is an increase in the average levels of all studied traits. More - there is a stabilization of most of the indicators, which is a guarantee for increased homogeneity of the experimental group on these traits and clearly visible in Figure 5. At the end of the experimental period, the scattering zone shrinks, which means a reduction in the variability of the studied indicators. The most obvious are the changes in the values of V% in the indicators that bring information about the level of development of the explosive force of the lower extremities under vertical forces (indicator 6 - height rebound), the explosive force of the lower extremities under horizontal forces (indicator 5 - jump) in length) and the degree of nutrition of the body (indicator 3 - body mass index).

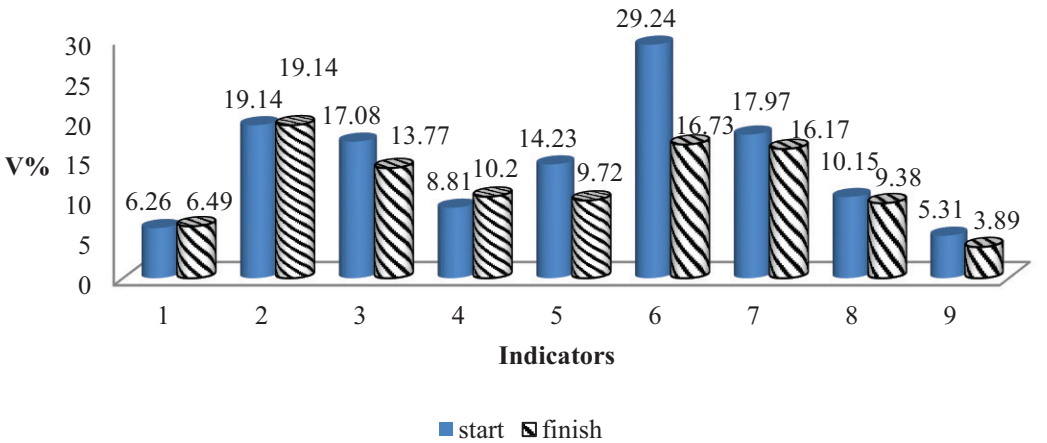


Figure 5. *Dispersion of signs in the experimental group*

The results of the variation analysis obtained in the first and second test of the boys from the control group are presented in Figure 6. It is clear that here, too, in most of the indicators, there is a positive change in variability, i.e., the values of V% decrease, which guarantees stabilization of the respective feature. This stabilization is most pronounced at the 6th and 7th, and 5th indicators. This gives us reason to believe that at the end of the experimental period, in the control group, under the influence of the natural physiological development of children, as well as due to the effects of physical education during the regular learning process, there was a stabilization of the upper indicators.

Table 5. *Mean values and variability of indicators - control group – end of experiment*

№	Indicators	X	S	V	min	max
1.	Height	143.10	10.66	7.45	136	158
2.	Weight	45.67	7.20	15.77	36	67
3.	BMI	22.30	3.32	14.89	15.73	24.87
4.	Sprint 12 m	3.04	0.29	9.54	3.56	2.62
5.	Long jump	148.10	13.40	9.05	125	185
6.	High jump	27.12	8.26	19.36	20	42
7.	Throwing a solid ball	282.09	22.06	7.82	223	416
8.	Shuttle run	37.06	3.51	9.47	43.67	31.70
9.	Depth of slope	101.42	5.26	5.19	96	110

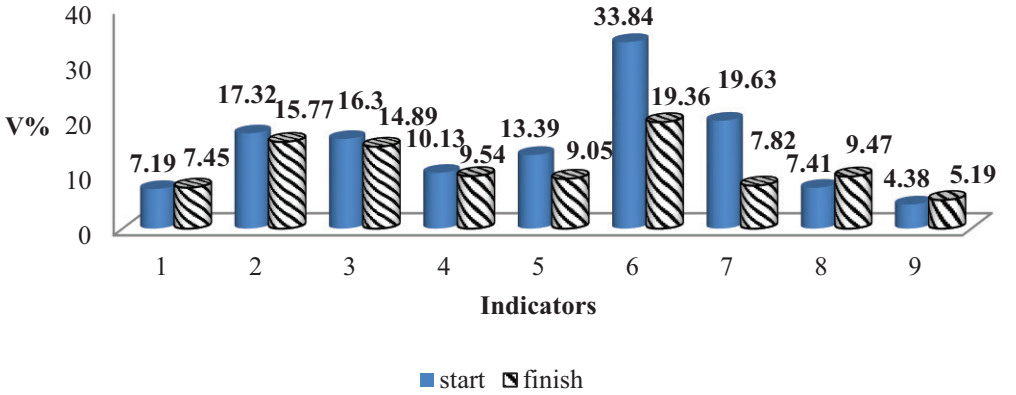


Figure 6. *Dispersion of signs in the control group*

Therefore, the homogeneity of the control group was most positively affected in terms of explosive force, both in the lower limbs in vertical and horizontal efforts (indicators 6 and 5) and in the upper limbs and shoulder girdle in horizontal efforts (indicator 7 - throwing a solid ball). The results also show that at the end of the experiment in the control group, six indicators are in the zone of homogeneity (V <10%) and three - in the zone of relative homogeneity.

The comparison of the arithmetic mean values of the studied indicators at the end of the experiment (Figure 7) shows that in all indicators, the advantage is in favor of the participants in the experimental group.

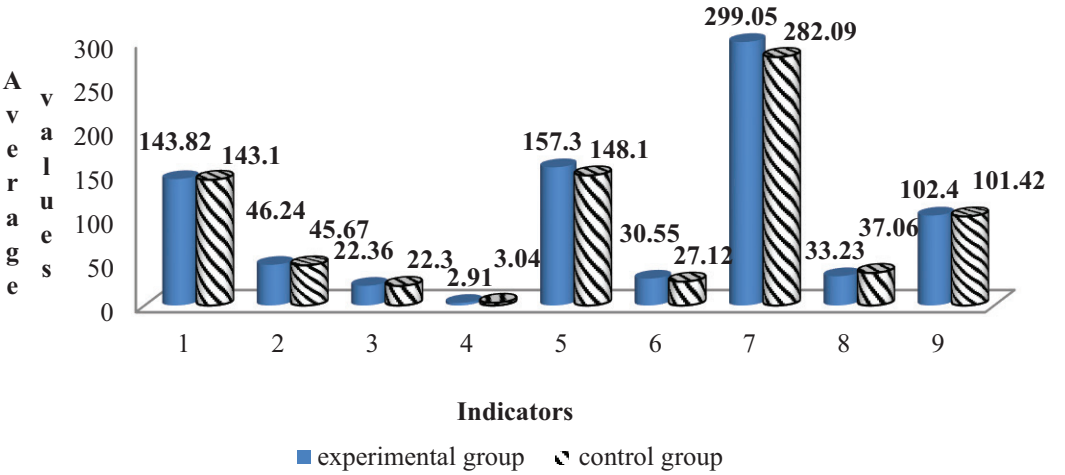


Figure 7. *Mean levels of studied signs in CG and EG at the end of the experiment*

To conclude the effectiveness of the applied methodology, we checked the significance of the observed differences at the end of the experimental period between the mean levels of the indicators in the two sets (experimental and control groups), using Student's t-criteria for independent samples (Figure 8).

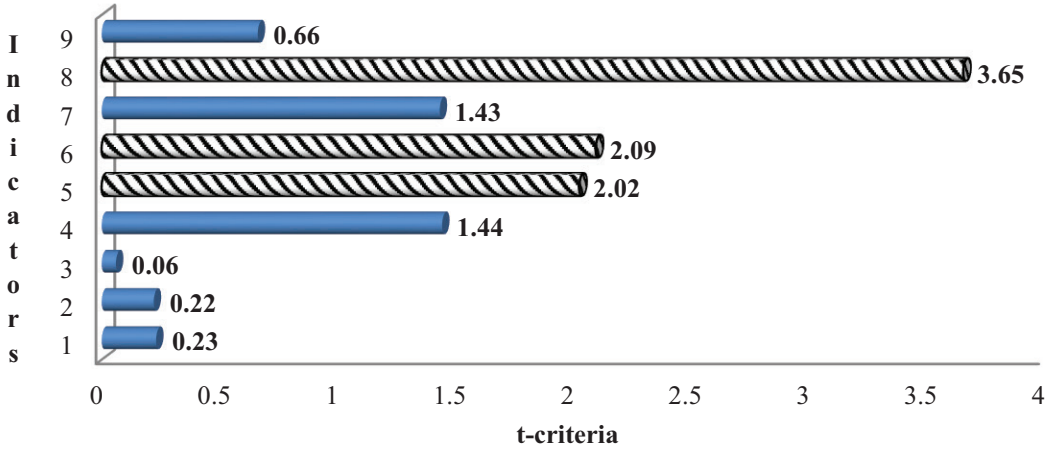


Figure 8. *Significance of the differences between the mean levels of the studied traits in the experimental and control groups at the end of the experiment*

The analysis of the results in Figure 8 shows that, as mentioned above, the experimental group has higher achievements in all studied indicators at the end of the experiment. Unlike the first test, however, in which there were insignificant differences between the two groups in the level of development of the studied traits, in the second test - the ratio changed. From Figure 8, it can be seen that for 3 of the indicators, the values of the calculated comparative t-criterion are higher or equal to the critical one (they have values above 2.02), and therefore, for these indicators with high guarantee probability, it can be argued that the specific work with the means of mobile games applied by us, has led to a significant increase in the boys in the experimental group in the level of development of speed endurance and explosive power of the lower limbs, both in vertical and horizontal efforts.

According to the other indicators, however, the values of the t-test are below the critical one (below 2.02). This gives grounds with a high guarantee probability to consider that the means applied by us did not have a significant impact on the indicators of physical development, which is logical due to the relatively short period of the experiment and more - on body flexibility, explosive power of the upper limbs and the shoulder girdle under horizontal effort and the sprint capabilities of the boys in the experimental group.

DISCUSSION

With a high guarantee probability (Pt ≥ 95%), it can be stated that at the beginning of the experimental period, there are no significant differences between the average levels of the studied traits in the experimental and control groups, which ensures correctness at the start of the experiment.

In general, the boys included in the experimental group have problems with their weight - the average body mass index is in the area of overweight. Despite the change in a positive direction, i.e., to the zone of normal weight, at the end of the experiment, the problem with overweight in the experimental group is not solved, which in our opinion, requires improvement of the methodology and duration of the experiment.

It can be argued with a high guarantee probability that the specific work with the means of mobile games applied by us has led to a significant increase in the level of development of the boys in the experimental group:

- ✓ speed endurance;
- ✓ the explosive force of the lower limbs, both in vertical and horizontal efforts.

CONCLUSION

As the main conclusion of the study, we could conclude that the experiment, through the means

of mobile games in general, has positively influenced the development of basic motor skills, physical ability, and health status of students.

The analysis of the results gives us reason to recommend adjusting the experimental methodology by adding additional mobile games and exercises that allow the development of a higher level of flexibility, explosive power of the upper limbs and shoulder girdle with horizontal effort and sprint capabilities, and increase the volume of training work. Also, to stimulate the systematic participation of students in extracurricular activities in sports is an important factor in overcoming the negative consequences of hypodynamics and the deteriorating health status of the young generation.

REFERENCE

Aleksandrova, V., Bahchevanski, S., Kornatovska, Z. (2017). Adapted physical activity and aqua gymnastics as a major prevention tool in obese children, *ACTA SALUS VITAE*, vol.5, num.1, pp.18-29.

Batllori, J. (2003). *50 games of Physical Education*, Parramon ediciones, S. A., Barcelona, Spain.

Gigova, V. (2002). *Statistical processing and analysis of data.* Sofia, NSA – IPB

Kolev, I. (2003). *Mobile games as a means of developing special motor skills and forming specific motor skills in basketball training*, Master thesis, S.

Korotkov, I., Sevev, M. (1976). *Games in the preparation of the athlete*, «Medicine and Physical Education», Sofia.

Mavrudieva, N. (2008). *Mobile games for training, coaching and sports animation*, NSA Press, Sofia.

Mavrudieva, N., Iskrov, V., Tsarova – Vasileva, A. (2015). Physical development of students participating in extracurricular basketball classes. *"30 years Pedagogical faculty VTU"*, Faber, Veliko Tarnovo, ISBN: 978-619-00-0352-6, pp. 518-524.

Mavrudiev, P. (2007). *Mobile games, as a means of developing motor skills in extracurricular tennis training*, Bachelor thesis, NSA, Sofia.

Nikolova, E., Marinov, B. (2002). *Physical activity, school, family,* Ed. „Bolid-ins", *S.*

Popivanova, Ts. (2007) Overweight and obesity in students, *Sport & science*, n.6.

BFTennis (2000). *Guide to school tennis*, Sofia.

Rachev, K. (1994). Problems of school physical education in connection with the educational reform in the Republic of Bulgaria – *Sport & science*, n. 9, Sofia.

Sevev, M. (1991). *Mobile games*, textbook for students from NSA, M and F, S.

Slunchev, P. (1998). *Sports Medicine*, NSA - IPB, Sofia.

Corresponding author:
Petko Mavrudiev
National Sports Academy „Vassil Levski"
Sofia, Bulgaria
E-mail: petkomavrudiev@gmail.com

STRUCTURAL SPECIFICS OF THE PHYSICAL ABILITY OF SECONDARY SCHOOL STUDENTS

Todor Marinov
National Sports Academy „Vassil Levski", Sofia, Bulgaria

ABSTRACT
Physical ability is a key indicator of the quality of the educational process at sports in schools. It is the subject of multiple publications, where the information analyzed by experts is used as the basis for tracking the quantitative changes in the development of motor qualities. Not much attention is given to determining its structure, which is defined by the interrelations when its specific qualities are manifested. The changes of the pre-determination of the motor qualities as a result of applying existing methodologies are not being analyzed. This, however, is of great interest to practice, since determining the structure of physical ability can provide for more precise planning of the process for the physical preparation of a lesson.
The purpose of the study is to define the structural specifics of physical ability of secondary school students. To achieve this goal, a group of 581 students from 4th, 7th, and 12th grade (the grade levels of elementary, middle school and high school completion) was studied. The analysis of the results aims to reveal the interconnections between motor qualities, as the relationships observed reflect the effect of the subject content mastered by the students as this is defined by the state educational standards. It was observed that speed is the most informative indicator of the structure of physical ability among students from 1st grade to 7th grade, and the strength of the lower limbs is the most indicative indicator for students from 8th to 12th grade. Female students from the primary and secondary levels of education have a more harmonious structure of physical ability in comparison with the one of male students. The interconnections revealed lead to the creating specific methodological recommendations for the physical preparation of lessons for each educational stage.

Keywords: *motor qualities, interrelations, students, educational content*

INTRODUCTION

Physical ability is a key criterion for measuring the quality of instruction in physical education and sport classes in school. It represents the physical capability of students on the basis of the complex development of their motor qualities (Rachev, 2006). Therefore, physical capability is the subject of numerous scientific works. Nonetheless, in these works, the information presented relies mostly on tracking the quantitative changes in the condition of the qualities measured (Petkova, 2016; Borisov et al., 2019). Little attention is given to the topic of clarifying its structure, which depends on the iter-connections in the manifestation of the dynamic qualities, and the changes in the determination of the motor skills that have been the object of training by means of a given methodology are not analyzed. If this is done, however, the interconnection is sought between specific motor qualities and indicators of physical development (Borisov, 2017; Mavrudieva, 2017), or with the manifestation of the motor skills and habits (Borukova, 2017; Ivashchenko, Berezhna, Cieślicka, 2020). Scientific literature also provides works that reveal the underlying factors of the structure of physical capability in their order of importance, yet they do not provide an in-depth analysis of the interdependence of the manifestation of the studied capabilities (Borukova, 2019; Andrieieva, 2020; Aleksieva, 2021). This, however, is of great importance to practice, since revealing the structure of physical capability can provide for more precise planning of the physical preparation work in the lesson. This is extremely important at the present day, since a new assessment system for the physical capability of middle-school students was recently introduced in Bulgaria (Marinov, 2019, 2020). By applying the new tests and after an in-depth analysis, it is possible to develop methodological recommendations for improving the level of physical capabilities by optimizing the work on general physical preparation in the lesson. All of this requires tracking the quantitative changes of the condition of motor qualities and the qualitative specifics in the structure of physical capability of students from various grade levels where specific requirements exist regarding the mastery of the curriculum specifics. Based on this point of view, we set the aim of the present study.

Aim and objectives of the study

The aim of the study is to reveal the specifics in the structure of the physical capability of middle school students. To accomplish it, we set the following objectives:

1) Developing the theoretical foundation of the problem

2) Studying the physical capability of the students from 4th, 7th and 12th grades
3) Revealing the structure of the physical capability of the students of specific ages and generating recommendations for future practice.

The subject of the study is the examination of the specifics of the structure of physical capability and the correlation between the physical qualities of the students.

METHODOLOGY

A total of 581 students were tested at the end of the school year 2021/2022. The students were from the 4th, 7th and 12th grades – the grades when the elementary, the middle school and the high school educational stages are completed. The students were from three schools in Sofia: 81 Middle School „Victor Hugo", 143 Elementary School „Georgi Benkovski", the Professional High school of Telecommunication and from Middle School "Lyuben Karavelov" in Dimitrovgrad. The total number of students from the 4th grade is 117 boys and 138 girls, from the 7th grade – 85 boys and 104 girls, and from the 12th grade – 76 boys and 51 girls. Students who participated in this study had signed informed consent from their parents. Information about the study was sent to the parents in advance in written form and a printed informed consent was attached.

METHODS

A *complex methodology* was applied, consisting of studying sources, observations and interviews. In order to reveal the structure of physical capability, the following key components were measured by means of applying a test: 1) „30 meters run" (s) – for speed; 2) „Long jump on two legs from still position" (cm) – for explosive strength of the lower limbs; 3) „Tossing a heavy ball" (cm) – for explosive strength of the upper limbs; 4) „200-meter run"(s) – for durability; 5) "T- test" (s) – for agility; (Miladinov, 2019). The results from the survey were processed by means of correlation analysis with calculating a quotient of a common linear correlation of Pearson (r) and a coefficient of determination (r^2) (Gigova, 2019).

RESULTS

The analysis was related to revealing the correlation between the motor qualities, as the correlations revealed rely on the impact of academic content of the subject at the end of each stage (elementary, middle-school, high-school), which is documented by the state educational standards (NAREDBA №2, 2015).

Table 1 presents the results from correlation analysis between the indicators of physical capability of the students at the end of the elementary stage (4th grade). Among both genders, a number of moderate correlations can be observed (from 0, to 0,5). This is completely justified given the specifics of the curriculum that needs to be mastered at this level of primary education. The education here aims to develop the basic motor actions from the types of sports studied and the physical education has a more complex nature, and the focus is prioritized on developing the speed and the agility.

Table 1. *Correlation matrix of of physical activity of the students from the 4th grade.*

Indicators	Speed	Explosive strength of the lower limbs	Explosive strength of the upper limbs	Durability	Agility	*gender*
Speed	**1**	-.358**	-.196	.523**	.541**	GIRLS
Explosive strength of the lower limbs	-.392**	**1**	.390**	-.509**	-.410**	
Explosive strength of the upper limbs	-.146	.279*	**1**	*-.334***	-.308**	
Durability	.557**	-.348*	-.223*	**1**	.344**	
Agility	.569**	-.333**	-.320**	.347*	**1**	
gender	**BOYS**					

Legend: *(**) – for statistical significance* $\alpha = .01$*; (*) – for statistical significance* $\alpha = .05$

It is speed that appears to be the most informative indicator of the structure of the physical capability among the students studied from the 4th grade. For both genders the statistically important correlations of speed with the other motor qualities are identical. The connection to explosive strength of the lower limbs is moderate (rboys = -.392; rgirls = -.358, α = .01). Speed is strongly connected to durability (rboys = .557; rgirls = .523, α = .01) and agility (rboys = .569; rgirls = .541, α = .01). The determination between speed and the strength of the lower limbs and speed and agility are within the range of 27,4% до 32,4%.

Another significant correlation is observed among girls between the explosive strength of the lower limbs and durability rgirls = -.509, α = .01 with a determination of 25,9%.

As a whole the structure of the physical capability of the girls is more harmonious than the one of the boys. The criterion for this is the presence of more and stronger correlations determining the manifestation of the students motor abilities when performing the physical exercises. It was also observed that speed correlates weakly with the explosive strength of the upper limbs of students (rboys = -.146; rgirls = -.196). Similarly, there is a weak correlation between the explosive strength of the upper and lower limbs among boys rboys = .279.

In order to provide for maximum efficiency of the manifestation of the basic motor actions in track and field, basketball, and handball during the initial stage of education, it is needed to increase the application of exercises that focus on the development of the speed and strength components of motions. This will contribute to increasing the correlations and the determination among all indicators and is going to improve the structure of the physical capability of the students. This will provide for a more efficient realization of the educational activity and the achievement of higher results at mastering the curriculum during the middle school stage where the focus is on training the technique of the basic types of sports and the motor actions need to develop in a way that their performance should be efficient with teg application of minimum effort.

The teaching job of middle school teachers when it is well planned and well done brings positive effects to the structure of the physical capabilities of students. Table 2 presents the results from the correlation analysis of the physical capabilities of boys and girls in the 7th grade.

Table 2. *Correlation matrix of physical activity of the students from the 7th grade.*

Indicators	Speed	Explosive strength of the lower limbs	Explosive strength of the upper limbs	Durability	Agility	*gender*
Speed	**1**	-.735**	-.117	.577**	.552**	GIRLS
Explosive strength of the lower limbs	-.728**	**1**	.292*	-.558**	-.532**	
Explosive strength of the upper limbs	-.189	.312**	**1**	-.368**	-.341**	
Durability	.741**	-.590**	-.250*	**1**	.287*	
Agility	.504**	-.331**	.074	.268*	**1**	
gender	**BOYS**					

Legend: *(**) – for statistical significance α = .01; (*) – for statistical significance α = .05*

We observed that at the end of highschool stage the correlation between the studied indicators of the structure of physical capability are ones of higher values. It is the student's speed again that is the most informative indicator. Among the boys the statistically significant and strong correlation is the one between speed and the explosive strength of the lower limbs. (rboys = -.728, α = .01); with durability (rboys = .741, α = .01), and between agility and strength the correlation is strong (rboys

= .504, α = .01); Among the girls, speed displays a strong correlation with the explosive strength of the lower limbs (rgirls = -.735, α = .01) and two other significant ones: with durability (rgirls = .577, α = .01) and with agility (rgirls = -.565, α = .01). The determination between the speed and strength characteristics of motion measured by means of running and jumping tests is high: 53% for the boys and 54% for the girls. Determination is also high between the speed component of running and durability – 54,9% forthe boys and 33,3% for the girls. All of these predetermine favorable conditions for achieving high efficiency when performing the basic motor habits in track and field (high jump, long jump, sprint), in sports games at pouncing in volleyball, basketball, and handball, and when sprinting in football , basketball and handball.

The speed and the strength component of the motions completed with the lower limbs naturally reveal greater correlations with agility, as the students from the survey indicate. This is most evident among the boys from the 7th grade.

We discovered a weak correlation (r < 0,3) between the speed of running and the strength of the upper limbs as well as between the durability and the agility of the students. Another weak correlation was discovered between the explosive strength of the upper limbs with the durability and with the agility among the girls. On The whole, for this age group, speed and speed-and-strength capabilities of the lower limbs turn out to be predominant ones in the structure of the physical abilities of the students.

In the highschool stage the focus of physical education relates to improving the technical-tactical motions of the basic types of sports. Physical preparation is connected tightly to providing the possibility for maximum efficiency of the performance of the various motor habits and this suggests giving more attention to the development of those motor qualities that provide for this. In compliance with these specifics, the work in the high school physical education classes leads to considering a number of similar correlations regarding the structure of the physical capability of the boys and the girls from the 12th grade. Table 3.

Table 3. *Correlation matrix of of physical activity of the students from the 12th grade*

Indicators	Speed	Explosive strength of lower limbs	Explosive strength of upper limbs	Durability	Agility	*gender*
Speed	**1**	-.528**	-.149	.411**	.453**	GIRLS
Explosive strength of lower limbs	-.668**	**1**	.467**	-.607**	-.657**	
Explosive strength of upper limbs	-.274*	.554**	**1**	-.353**	-.448**	
Durability	.301*	-.684**	-.198	**1**	.410**	
Agility	.200	-.771**	-.263*	.391**	**1**	
gender	**BOYS**					

Legend: *(**) – for statistical significance α = .01; (*) – for statistical significance α = .05*

Explosive strength measured by the Long jump from still position is the most informative indicator regarding the structure of the physical capability of students. For girls, this indicator is in a strong correlation with agility (rboys = -.771, α = .01). A significant correlation can be observed between this and the remaining three physical qualities: with durability (rboys = -.684, α = .01); with explosive strength of the upper limbs (rboys = .554, α = .01) and with speed (rboys = -.668, α = .01); During the highschool stage it is completely natural that the muscle mass of boys will increase and this leads to the effect of this motor quality on the possibilities for further developing and for influencing others. The largest determination in the structure of physical activity is the one between explosive strength of the lower limbs and agility 59,4%, followed by the durability one – 46,8% and also with speed –

44,6%. It is interesting that in this case the explosive strength of the upper limbs appears to be an independent skill among boys independent of their speed, durability or agility.

The explosive strength of the lower limbs of the girls has significant importance for the display of agility, durability, and the speed and strength of the lower limbs. With the first three motor qualities the correlation is significant; respectively with agility (rgirls = -.657, α = .01), with durability (rgirls = -.607, α = .01) and with speed (rgirls = -.528, α = .01). There is a medium correlation between the explosive strength indicator of the upper and the lower limbs (rgirls = .467, α = .01).

The structure of physical capability of the girls from the 12th grade is more harmonious than that of the boys. A larger number of medium and significant correlations have been observed between the measured motor qualities. Consequently, when performing the separate physical exercises, the girls apply in a much more complex way their motor capabilities. For the boys the primary manifestation is the explosive strength of the lower limbs.

DISCUSSION

We found out that there is a limited number of studies that deal with revealing the structure of the physical capabilities of students. The quantitative changes in the development of motor qualities do not provide an opportunity to assess the efficiency of general physical training in its entirety. The structural specifics of the physical capabilities reveal the effect of the work done during the stages of education. At the end of the primary stage, considering the mastery of the basic curriculum in physical education, the motor qualities develop in a more complex way. This is a specific feature of the motor capabilities manifestation with regard to their age. (Rachev, 1992). The efficiency of the motor actions of the students from the 4th grade to the largest degree rely on the speed and agility. For the students from the 7th grade, speed becomes the most informative indicator for the respective physical activity. There is a stronger interaction between the speed and the strength components, which can be found in running and jumping. At the highschool stage the explosive strength of the doler limbs manifests itself the strongest as the other qualities emerge. This is more specific of the boys, to whom strength is defined for the efficiency of their motor actions. The girls from grades 4, 7, and 12 display a more harmonious structure of physical capability when compared to the boys.

Explosive strength of the upper limbs manifests itself independently, without a direct influence by the speed component of motion. This feature has been observed in another study as well (Marinov, Lazarova, Borisov, 2014). Therefore, from the primary stage, together with building the motor habits for throwing and pushing form the track and field disciplines, for the types of shooting and th epasses in the sports games, there should be applied directed physical exercises that develop the explosive component of motion with a focus on speed.

REFERENCES

Aleksieva, M. (2021). Faktorna struktura na fizicheskata deesposobnost na 9-godishni uchenitsi za 12-godishen period. *Godishnik na Natsionalna sportna akademia „Vasil Levski“*. NSA PRES, Sofia, s. 307-313.// Алексиева, М. (2021). Факторна структура на физическата дееспособност на 9-годишни ученици за 12-годишен период. Годишник на Национална спортна академия «Васил Левски». НСА ПРЕС, София, с. 307-313.

Andrieieva, O. et al. (2020). The factor structure of physical and motor fitness of 12-year-old children while playing basketball. *Journal of Physical Education and Sport (JPES)*, Vol.20 (3). p. 1613-1620.

Borisov, L. (2017). Vzaimovrazki mezhdu pokazatelite za fizichesko razvitie i fizicheska deesposobnost pri momicheta ot 5 do 7 klas. *Aktualni problemi na fizicheskata kultura*. NSA PRES, Sofia, s.131-136.// Борисов, Л. (2017). Взаимовръзки между показателите за физическо развитие и физическа дееспособност при момичета от 5 до 7 клас. Актуални проблеми на физическата култура. НСА ПРЕС, София, с.131-136.

Borisov, L., Naydenova, K., Kostova, Nancheva, D. (2019). Prouchvane varhu nyakoi strani na fizicheskata deesposobnost pri 6-18-godishni uchenitsi za 60-godishen period. *Godishnik na Natsionalna sportna akademia „Vasil Levski“*: Tom 1. Sofia, NSA PRES, s.14-21. // Борисов, Л., Найденова, К., Костова, Н., Нанчева, Д. (2019). Проучване върху някои страни на физическата дееспособност при 6-18-годишни ученици за 60-годишен период. Годишник на Национална спортна академия «Васил Левски»: Том 1. София, НСА ПРЕС, с.14-21.

Borukova, M. (2017). Management and control of sports preparation of 14-15-year-old female basketball players.

Journal of Applied Sports Sciences, Vol.2. p. 19-30.

Borukova, M. (2019). Factor structure and major factors of physical ability of 13-14-year-old pupils. *Journal of Applied Sports Sciences*, N 1. p. 77-84.

Gigova, V. (2019). *Statisticheski metodi s SPSS Statistics: Rakovodstvo za studenti ot OKS „Magistar" i ONS „Doktor" na NSA „Vasil Levski"*. Sofia, NSA PRES.// Гигова, В. (2019). Статистически методи с SPSS *Statistics: Ръководство за студенти от ОКС „Магистър" и ОНС „Доктор" на НСА „Васил Левски"*. София, НСА ПРЕС.

Ivashchenko, O., Berezhna, H., Cieślicka, M. (2020). Motor skills in the structure of physical fitness of 7-year-old boys. *Journal of Learning fieory and Methodology*. Vol. 1, № 1. ISSN 2708-7581 (Online); p. 14-18.

Marinov, T., Lazarova, K., Borisov, L. (2014). Osobenosti v proyavlenieto na skorostno-silovite sposobnosti na momcheta ot 5 i 7 klas. *Sport i nauka*. Sofia, LVIII, N 3, s.106-111// Маринов, Т., Лазарова, К., Борисов, Л. (2014). Особености в проявлението на скоростно-силовите способности на момчета от 5 и 7 клас. Спорт и наука. София, LVIII, N 3, с.106-111

Marinov, T., Georgieva, K., Alipieva, L. (2019). Sastoyanie na sistemata za otsenka na fizicheskata deesposobnost na uchenitsite ot srednite uchilishta v Republika Bulgaria. *Godishnik na Natsionalna sportna akademia „Vasil Levski"*: Tom 1. NSA PRES, Sofia, s.7-13.// Маринов, Т., Георгиева, К., Алипиева, Л. (2019). Състояние на системата за оценка на физическата дееспособност на учениците от средните училища в Република България. Годишник на Национална спортна академия «Васил Левски»: Том 1. НСА ПРЕС, София, с.7-13.

Marinov, T. (2020). *Osnovi na fizicheskoto vazpitanie. Teoria i metodika*. NSA PRES, Sofia. // Маринов, Т. (2020). Основи на физическото възпитание. Теория и методика. НСА ПРЕС, София.

Mavrudieva, N. (2017). Faktorna struktura na fizicheskoto razvitie i fizicheskata deesposobnost na studenti. *Aktualni problemi na fizicheskata kultura*. Sofia, NSA PRES, 2017, s.46-50.// Маврудиева, Н. (2017). Факторна структура на физическото развитие и физическата дееспособност на студенти. Актуални проблеми на физическата култура. София, НСА ПРЕС, 2017, с. 46-50.

Miladinov, O. (2019). *Sistema za otsenyavane na fizicheskata deesposobnost na uchenitsiteot I do* XII *klas*. NSA PRES, Sofia.// Миладинов, О. (2019). Система за оценяване на физическата дееспособност на учениците от *I до XII клас*. НСА ПРЕС, София.

NAREDBA № 2 za uchebnoto sadarzhanie (Prilozhenie 8). obn. – DV, br. 95 ot 08.12.2015 g.//НАРЕДБА № 2 за учебното съдържание (Приложение 8). обн. – ДВ, бр. 95 от 08.12.2015 г.

Petkova, P. (2016). Dinamika na razvitie na fizicheskata deesposobnost na 7-10-godishni uchenitsi pri prilagane na programa s lekoatleticheska nasochenost. *Leka atletika i nauka*. Sofia, N 1, s.92-98.// Петкова, П. (2016). Динамика на развитие на физическата дееспособност на 7-10-годишни ученици при прилагане на програма с лекоатлетическа насоченост. Лека атлетика и наука. София, N 1, с.92-98.

Rachev, K. (1992). *Optimizirane na podgotovkata na mladite sportisti*. IPB NSA, Sofia.// Рачев, К. (1992). Оптимизиране на подготовката на младите спортисти. ИПБ НСА, София.

Rachev, K. (2006). Teoria i metodika na fizicheskoto vazpitanie. NSA-PRES, Sofia.// Рачев, К. (2006). Теория и методика на физическото възпитание. НСА-ПРЕС, София.

Corresponding autor:
Todor Marinov, PhD
Department of „Theory of the physical education"
National Sports Academy „Vassil Levski"
21 Acad. Stefan Mladenov, str.
Sofia,1700, Bulgaria
E-mail: stunty@abv.bg

EFFICIENCY OF SPORTS GAMES TRAINING FOR 12 AND 13-YEAR OLD STUDENTS

Stanislav Gruev
National Sports Academy „Vassil Levski", Sofia, Bulgaria

ABSTRACT
Training in physical ability, the development of motoric qualities and the formation of knowledge in sports are fundamental educational components of the subject of Sports Education. Interrupting their unity and interconnection may be considered as the cause for the lower levels of motoric activity in schools. A suitable program in sports games, through its complex effects and emotional impact may contribute to alleviating this problem. The goal is to develop and approbate a methodology that improves the training in football and volleyball for 12 and 13-year old students, which relies on general learning about sports, coordination training, game drills, and education through playing the games. The specifics of the program focus on mastering the gamers components in a dynamic environment, varying conditions, physical training, a positive emotional atmosphere, and applying the game approach. The pedagogical experiment was carried out for the duration of two semesters with 98 male and female students from the sixth grade. The data from the sports and pedagogical testing was processed by mathematical and statistical methods and expert conclusions were drawn on the specifics of the inclusion of football and volleyball games. The results indicate the presence of a positive change in the motoric qualities and technical skills during the experimental games, which results from the methodology used and the active participation on behalf of the students. The assessment results in game condition reflect the positive effect of the game method.

Keywords: *motoric habits, motoric qualities, football, volleyball*

INTRODUCTION

Over the recent years, technological progress and its subsequent advantages have lead to a significant reduction of the physical activity of students. Immobilization is a serious problem that has led to a series of negative health outcomes. Additional causes of immobilization can be discovered in the inefficient and outdated approaches to physical education classes in school. In its essence, education is a unity of teaching and learning by means of which the student's activity is regulated in order to provide knowledge, skills, and habits. (Andreev, 1996). The new approach that we are trying to introduce to the Physical education instruction emphasizes this dual process by primarily stimulating the students' activity since its absence would make developing motoric skills, habits and qualities impossible. It has been estimated that there are three motivational factors that determine the intensity and productivity of sports classes: fulfillment, outcomes, and prospective motivation. (Tseneva, 1998).

Undoubtedly, games bring fulfillment through the dynamics and emotional release. The outcomes of games relate to building new skills, developing the motoric ability and improving health. Therefore, we believe that by using games and game-like drills in combination with teaching knowledge about the benefits of doing sports, all three motivational factors are fulfilled and thus, the level of motor ability can be raised. This suggests complex work during the class time, which completely reflects the correlation stating that achievements in various sports rely on the unity and interconnections between motor qualities, motor skills and habits. (Marinov, 2020). Applying the games method allows for the simultaneous improvement of skills and physical capabilities, which in turn leads to better achievement in the sports games. The third feature of this sort of education relates to limiting the time spent in monotonous and stereotypical drilling of game components outside the game, which often leads to lesser interest and desire to play among students.

On the other hand, the time spent on improving the technical skills in dynamic and varied conditions leads to increasing the efficiency when applying them in the game. A good example of alternative training is presented by Doncheva & Dimitrova (2007), who develop a methodology of volleyball with an increased period of play-time spent in groups of three or four in smaller-size play-area. Antonova (2015) optimizes initial volleyball training by focusing on the exercises that in terms of their dynamic structure resemble the elements studied and their use in game-like con-

ditions. These approaches are very different from what the traditional methods of training and further improvement offer in volleyball, whose main representatives are Gigov (1981), Stoyanov & Kyuchukov (1982), Mihaylov (2017).

Regarding football, an alternative method of training is presented by Tsolov's algorithm of training. (Tsolov, 1998). It includes demonstration, a game combined with fragments of training in relatively static and dynamic conditions, and focuses on the fact that right after the demonstration, the technical element needs to be further studied through using it in games and game-like exercises. Similarly, Stoyanov (2005), too, opposes the traditional understanding of initial training in football regarding the techniques from stand-still position aimed at a stationary ball, acceleration techniques applied at a stationary ball, and motion techniques, and states that this kind of training develops certain skills and habits that cannot be of any use in the football game. Other authors that promote the traditional methods of football training are Angelov & Petrov (1972), Angelov et al. (1977).

The training methodologies viewed are used separately in both sports. We believe that improving the training of volleyball and football, the two most popular sports games among students, by applying a new approach that contains the specifics we listed above will lead to increased physical activity, technical level of preparation and physical capability among students.

Aim and objectives of the study

The aim of this study is to develop and approbate a methodology of improving the instruction in football and volleyball for 12-13-year-old students. *The objectives* are the following:

1. To develop the theoretical foundations of this problem
2. To apply in teaching practice the experimental methodology developed
3. To analyze the experimental data received

The subject of this study is the instruction in physical education and sports with regard to the efficiency of the proposed experimental methodology of teaching sports games.

METHODS

The pedagogical experiment was carried out in the school year of 2021/2022. Our study group includes a total of 98 students from the sixth grade of 34th school "Stoyu Shishkov" in Sofia. The students were randomly divided into an experimental group (EG) consisting of two sections (26 males and 18 females) and a control group (CG) consisting of two sections (29 males and 25 females). Before starting the pedagogical experiment, we obtained informed consent from students' parents. The experimental methodology of teaching football and volleyball was used for the whole school year. The methodology relied on providing exposure to the game, physical preparation, game skills, learning the game through playing the game, mastering the technical components in dynamic circumstances and varying conditions, training in physical activity and a positive emotional environment. At the same time, for a school year, the control group (CG) were trained by means of the existing and commonly accepted school methodology. The instruction of both groups included 40 class periods (20 classes of football and 20 classes of volleyball). The students of both groups were tested in the following ways: 1. 72 meters of shuttle run from a high start (s); 2. Long jump with two feet from a standing position (cm); 3. Volleyball pass with the two hands from above at a target (n from 10 tries); 4. Volleyball passes with two hands from below at a target (n from 10 tries); Spikes at a wall per 30 seconds (n). The test results were processed with the following mathematical-statistical methods: 1) Variations analysis; 2) Hypothesis check.

RESULTS

Analyzing the results from the survey, we discovered the following: At the start of the experiment there were no credible differences in the average values of the indicators measured for both groups. (Table 1).

Table 1. *Comparison of average values before the experiment*

Tests / Indicators	Control Group		Experimental Group		d	t	P(t)
	$\bar{X}1$	S_1	$\bar{X}2$	S_2			
males							
Shuttle run - 72 m	25.12	2.24	24.00	2.25	1.12	1.84	92.9
Long jump	157.1	0.26	161.2	0.28	4.10	0.48	36.3
Pass with two hands from above	2.21	1.84	2.58	1.75	0.37	0.76	55.1
Pass with two hands from below	1.07	0.96	1.31	1.09	0.24	0.87	60.9
Shots at a wall per 30s	12.79	5.72	14.35	5.66	1.55	1.01	68.3
females							
Shuttle run - 72 m	25.35	2.24	25.81	2.45	0.46	0.65	47.8
Long jump	155.89	0.23	162.20	0.21	6.31	0.90	62.8
Pass with two hands from above	1.72	1.51	2.06	1.51	0.34	0.72	52.3
Pass with two hands from below	0.92	0.81	1.11	1.08	0.19	0.66	48.9
Shots at a wall per 30s	7.96	2.39	8.78	2.39	0.82	1.11	72.5

At the initial testing, we did not observe a statistically credible difference in the indicators of males and females from the two groups. The empirical values of Student's t-criterion do not exceed its critical value (The critical value of Student's t-criterion at k = n1 + n2 - 2 = 53 and α = .05 equals 2,01 for the male students, and 2,02 for the females at k = n1 + n2 - 2 = 41 and α = .05). The warranty probability in both tests is below the commonly accepted 95%.

After concluding the experiment, significant statistical differences emerged between the two groups, which proved the efficiency of our experimental methodology. The differences in the average values for the mail participants are presented in Table 2.

The empirical values received for Student's t-criterion range from 3,11 to 7,74 and for all indicators exceed the critical value of 2,01. For all five tests, the credibility of the differences is supported by a 95% warranty probability.

The game-like drills from the experimental methodology have produced a beneficial effect on improving the speed capabilities of the male participants from the Experimental Group. These group members have much better capabilities of quick motion in the horizontal plain. Their results are 2,98s better than those of the Control Group when covering the 72-meter Shuttle Run Test. This improvement is the precondition for a better mastery of the football game (moving with and without the ball during the game's time). The volleyball test performance also indicated beneficial changes of motion speed. This results from the multiple repetition of the specific motions in play-time conditions along the court's sides as well as from the improved spatial and visual orientation of the male participants from the experimental group.

Table 2. *Comparison of the average values of boys after the experiment*

Tests / Indicators	Control Group		Experimental Group		d	t	P(t)
	$\bar{X}1$	S1	$\bar{X}2$	S2			
Shuttle run - 72 m	24.60	2.68	21.62	1.89	2.98	4.71	99.9
Long jump	165.2	0.34	190.2	0.24	25.0	3.11	99.7
Pass with two hands from above	3.24	2.26	6.12	1.93	2.87	5.04	99.9
Pass with two hands from below	1.21	1.08	3.65	1.26	2.45	7.74	99.9
Shots at a wall per 30s	12.93	6.02	21.92	6.34	8.99	5.39	99.9

The significantly higher average result of the EG, 190,2 cm (S = 0,24) at the Long Jump test, when compared with the result of the CG, 165,2 cm (S = 0,34), can be attributed to the specific work done through the game drills that develop the reaction speed and the explosive power of the lower limbs. The difference of 25,0 cm is P=99,7%. The emotional intensity of games and the content presentations on the benefits of physical activity also contributed to the better development of the motor

qualities of the boys in the TG, who shared that they felt encouraged to further develop their qualities in their free time.

The significant differences in the volleyball elements of passing with both hands from above (d = 2,87 precise landings) and passing with both hands from below with d = 2,45 precise landings to the benefit of the TG also results from the regular practice of the game drills with the ball, which developed the coordination skills targeted by the experimental methodology. The analysis of Shots at a Wall per 30 seconds, showed a significantly better mastery of this football component on behalf of the TG. The average number of shots of 21,92 repetitions (S = 6,34) in this group compared to the significantly lower number of 12,93 repetitions (S = 6,02) in the CG can be attributed to the game-like drills aimed at building a feel for the ball and at developing the kicks on the ball as parts of our methodology.

The favorable changes in the technical skills and the development of the motor skills and their growth can be observed among the female participants. The final data is presented in Table 3.

Table 3. *Comparative indicators of females after the experiment.*

Indicators / Tests	Control Group		Experimental Group		d	t	P(t)
	$\bar{X}1$	S_1	$\bar{X}2$	S_2			
Shuttle run - 72 m	25.05	1.85	23.21	2.49	1.84	2.79	99.2
Long jump	161.4	0.23	186.3	0.22	24.9	3.56	99.9
Pass with two hands from above	2.72	2.07	5.22	1.99	2.50	3.97	99.9
Pass with two hands from below	1.16	1.07	3.22	1.22	2.06	5.90	99.9
Shots at a wall per 30s	8.64	3.04	14.67	3.77	6.03	5.80	99.9

The calculated empirical values are higher than the norm (t_α = 2,02). The empirical values of Student's t-criterion range from 2,79 to 5,90 and P(t) is higher, at all five indicators than the generally accepted norm of 95%. The higher results received among the girls from the EG, just in accord with the results received from the boys, can be attributed to the new educational approach and the alternative methodology. The analysis conducted about the girls, completely overlaps with the one about the boys, since sports education is not divided according to the students' gender. Differentiation, however, may be needed since the age of the students falls within the puberty when the anatomic and physiological differences between the two genders occur. The higher levels of physical activity resulting from the higher number of games and game-like drills and the active participation on behalf of the student significantly improved the physical qualities. In addition, mastering the games' components in game-like conditions and not in a static situation, significantly improved the level to which they were mastered. All of this can be considered evidence of the efficiency of our experimental methodology, aimed at improving the training in football and volleyball for 12-13-year-old students.

In order to emphasize the efficiency of the methodology regarding the improvement of the technical skills, we are presenting the results from the grading in volleyball and in football after conducting this experiment (Table 4 and Table 5).

Table 4. *Results from the grading in volleyball (%)*

Group	Poor 2	Average 3	Good 4	Very Good 5	Excellent 6
Control Group (CG)	21.0	31.5	23.5	19.8	4.3
Experimental Group (EG)	0.0	4.5	15.2	38.6	41.7
CG Males	16.1	29.9	21.8	25.3	6.9
EG Males	0.0	5.1	7.7	37.2	50.0
CG Females	26.7	33.3	25.3	13.3	1.3
EG Females	0.0	3.7	25.9	40.7	29.6

We find that among the grades in volleyball, the students from the EG, did not receive any poor grades while among the CG students, the poor grades are 16.1% for boys and 26.7% for girls re-

spectively. Over 80% of the students trained with the alternative methodology received very good and excellent grades, and over three quarters of those who were trained by means of the standard methodology received poor, average and good grades.

Table 5. *Results from the grading in football (%)*

Group	Poor 2	Average 3	Good 4	Very Good 5	Excellent 6
Control Group (CG)	17.9	42.0	17.3	17.3	5.6
Experimental Group (EG)	0.0	10.6	22.0	36.4	31.1
CG Males	9.2	37.9	17.2	25.3	10.3
EG Males	0.0	6.4	12.8	34.6	46.2
CG Females	28.0	46.7	17.3	8.0	0.0
EG Females	0.0	16.7	35.2	38.9	9.3

A similar trend can be discovered in the grading of football. Again, there are no poor grades in the EG, and in the CG the percentage is 9,2% for the boys and 28,0% for the girls, respectively. There are no excellent grades in the CG among the girls, while in the EG group there are 9,3% of excellent grades. Just like in the volleyball grading, more than two-thirds of the students trained by means of the alternative methodology received very good or excellent grades, and more than three-quarters of those that were trained by the standard methodology received poor, average, or good grades. The cumulative percentage of very good and excellent grades for the boys and for the girls graded in the two games in the EG shows the percentage of the students who apply successfully the technical skills learned in game-like conditions ranges respectively from 80,8% to 87,2% and from 48,2% to 70,3%. This percentage sum for the CG for the boys and for the girls ranges from 32,2% to 35,6% and from 8,0% to 14,6%. The significantly higher results of the EG result from the methodology applied and from the training in dynamic and varying conditions.

DISCUSSION

The results from the experiment show that the methodology for teaching football and volleyball that we have developed leads to a significant improvement in the technical skills of the students of both genders in the experimental group. The speed durability and explosive power of the lower limbs are affected favorably, which in turn relates to the technical skills and habits taught by the methodology. The students' skills of passing with two hands from above and from below in volleyball and the skill of shooting at the goal in football improved significantly. The meaningful application of the game method, which is characterized by its emotional impact in the process of teaching, brings positive effects on the students' capabilities to successfully apply the newly learned material in a playtime situation.

REFERENCES

Andreev, M. (1996). *Protsesat na obuchenie.* Universitetsko izdatelstvo Sv. Kliment Ohridski, Sofia.// Андреев, М. (1996). Процесът на обучение. Университетско издателство Св. Климент Охридски, София.

Angelov, V., M. Chervenyakov, S. Petrov, N. Aladzhov, S. Stoyanov, A. Shishkov (1977). *Rakovodstvo za uprazhnenia po futbol.* Meditsina i fizkultura, Sofia.// Ангелов, В., М. Червеняков, С. Петров, Н. Аладжов, С. Стоянов, А. Шишков (1977). Ръководство за упражнения по футбол. Медицина и физкултура, София.

Angelov, V., S. Petrov. (1972). *Futbol.* Meditsina i fizkultura, Sofia.// Ангелов, В., С. Петров. (1972). Футбол. Медицина и физкултура, София.

Antonova, V. (2015). *Optimizirane na nachalnoto obuchenie po voleybol.* Bolid - Ins, Sofia.// Антонова, В. (2015). Оптимизиране на началното обучение по волейбол. Болид – Инс, София.

Doncheva, M., P. Dimitrova. (2007). *Voleybol za 9 klas.* Slavena, Varna.// Дончева, М., П. Димитрова. (2007). Волейбол за 9 клас. Славена, Варна.

Gigov, D. (1981). *Da igraem voleybol.* Meditsina i fizkultura, Sofia. // Гигов, Д. (1981) Да играем волейбол. Медицина и физкултура, София.

Marinov, T. (2020). *Osnovi na fizicheskoto vazpitanie. Teoria i metodika.* NSA PRESS, Sofia.// Маринов, Т. (2020). Основи на физическо възпитание. Теория и методика., НСА ПРЕС, София.

Mihaylov, D. (2017). *Voleybol.* NSA PRESS, Sofia.// Михайлов, Д. (2017). Волейбол. НСА ПРЕС, София.

Stoyanov, S. (2005). *Uchebna programa po futbol za detsa i yunoshi.* NSA PRESS, Sofia.// Стоянов, С. (2005). Учебна програма по футбол за деца и юноши. НСА ПРЕС, София.

Stoyanov, D., B. Kyuchukov. (1982). *Obuchenie i trenirovka po voleybol. ECNPKFKS - Izdatelsko-pechatna baza*, Sofia.// Стоянов, Д., Б. Кючуков (1982). Обучение и тренировка по волейбол, ЕЦНПКФКС – Издателско-печатна база, София.

Tseneva, E. (1998). *Sportna pedagogika.* NSA PRESS, Sofia.// Ценева, Е. (1998) Спортна педагогика. НСА ПРЕС, София.

Tsolov, B. (1998). *Upravlenie na podbora i nachalno-to obuchenie po futbol.* NSA PRESS, Sofia.// Цолов, Б. (1998). Управление на подбора и началното обучение по футбол. НСА ПРЕС, София.

Corresponding autor:
Stanislav Gruev
PHD student
Department of „Theory of the physical education"
National Sports Academy „Vassil Levski"
21 Acad. Stefan Mladenov, str.
Sofia,1700, Bulgaria
e-mail: mtel_gruev@abv.bg

LONGITUDINALLY RESEARCH ON THE PHYSICAL FITNESS OF 10-14 YEARS OLD FEMALE PUPILS

Iva Radkova, Kornelia Naydenova
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
Physical education is focused on the development of the essential qualities of pupils which is at the base of the learning process in Physical Education. This process requires the observation of changes within the limit of boundaries and other qualities, which is one of the main testimonials of a teacher. Another possibility is that allows observation in the changes of the essential qualities and provides improvements and updating the approach and methods of developing the above-mentioned qualities.
In this process, we set a goal for the current research which follows the changes that apply to the essential qualities as a main point of physical education on 10-14 years old pupils for a four-year period. In order to achieve those goals, here are the following steps that needs to be considered:
1. Issue research in literature resources.
2. Apply a sport pedagogy tests.
3. Analise and interpretation of the test results.
We have tested a group of pupils based on the system for assessing the physical fitness for students from first grade to twelfth grade on Miladinov and colleagues. This test took place in the following years 2018/19 and 2021/22. The collected results were processed via SPSS software v.19. The data analysis was based on a variety of comparing analyses.
The result of the above-mentioned research shows some changes within the five essential qualities among pupils of the same age. Based on the research, we were able to establish some recommendations to improve the methods of developing essential qualities of pupils' same age.

Keywords: *physical education, schoolgirls, fitness test, motor abilities*

INTRODUCTION

Physical fitness is a topic of particular topicality among specialists in the field of physical education. In the scientific literature, a large number of sources can be found that examine the problem thoroughly or its individual components. Physical Fitness is generally defined as the ability to function efficiently in an active environment that suits your personal interests and goals. Boeva & Ivanova (2018) consider physical fitness as the set of potential opportunities for the individual to realize effective motor activity. Components of physical fitness most important for health are cardiorespiratory endurance, muscular strength and endurance, flexibility, and body composition, while that of Physical fitness includes speed, power, coordination, reaction time, and agility (Insel, Roth & Price, 2006). One can reach a permanent or high level of good physical fitness if the frequency and the intensity of the workout is maintained, but this becomes difficult to achieve if one reaches a high level of physical fitness, stops the program and expects to be fit (Basel, 2007). All of these findings reinforce the need to include physical fitness testing in health monitoring systems (Ortega et al., 2008). Moreover, the World Health Organisation (WHO) advocates that regular testing of physical fitness and physical activity should be considered a public health priority (WHO, 2010).

Periods of development of motor ability, during which the means and methods of impact used to provoke an increased reaction leading to the maximum effect, Marinov (2020) defines as sensitive, forming periods. In those periods, both their targeted development and the follow-up of changes occurred. Welk and Meredith (2008) indicate out that applying fitness tests to track changes in motor ability are important for a number of reasons, such as providing information to teachers that they can use to make informed changes to the curriculum, helping set goals, highlighting the importance of physical activity, educating children and parents about the cognitive aspects of physical fitness and how it develops. Harris and Cale, on the other hand (2006), add that fitness tests can have the potential to raise students' awareness of their physical fitness status and their desire to maintain or increase their physical activity levels. Cale and Harris (2009); Rice (2007) argued that if fitness tests were performed in isolation from the curriculum, it could have a negative impact on students' interest in physical education and their desire to be physically active. A Finnish study on students between the 5th and 8th

grades showed that students exhibited lower cognitive anxiety and higher somatic anxiety during fitness tests. This is important for students who perform with lower scores. What they present is that tests should not be done in isolation from receiving new information in lessons to reduce anxiety (Huhtiniemi et al, 2021).

Physical fitness is determined mainly by physical activity but is also influenced by growth, gender, genotype, as well as variable factors such as obesity, drugs, and others (Martínez Vizcaíno et al., 2008). As such, Zheleva-Terzieva (2020) looks at the impact of the COVID pandemic on changes in motor ability strength in primary school students, revealing some influences and changes in quality parameters. However, regardless of the factors that affect physical fitness, it is important to know that physically healthy individuals exhibit a better quality of life. These children are also less likely to suffer from obesity or suffer from the early stages of various metabolic disorders. They also tend to have more self-esteem, better mental health and better academic performance (Janssen & LeBlanc, 2010); (Strong et al., 2005).

Aim and objectives of the study

Based on the analysis of literary sources and our own observations on the manifestations of physical fitness in school age, we set as the aim of the present study the changes that apply to the essential qualities as a main point of physical education on 10-14 years old pupils for a four-year period. In order to achieve those goals, here are the following steps that needs to be considered:

1. Issue research in literature resources.
2. Apply a sport pedagogy tests.
3. Analise and interpretation of the test results.

METHODS

Based on the purpose and tasks as the subject of research, we can determine the physical capacity of schoolgirls over a three-year period. The subject of the study is the dynamics of changes in the individual motor qualities, which brings information about the physical fitness of the selected group of students. The contingent of the study covered 27 girls who at the beginning of the study were in 5th grade, aged 12 years, and at the end of 7th grade at the age of 14 respectively. The testing period covered the 2019/2020, 2020/2021, and 2021/2022 years. We tested once a year, at the end of the school year at 122. Nikolay Liliev, Sofia. Parents of tested students are informed and give consent for this study.

The test battery includes a total of 5 tests - Running 30 m - high start; Jump in length from place two legs; Throwing a heavyweight ball; 200 m shuttle run; T-test, developed by Miladinov et al. (2019) and applied from the same year to assess the physical capacity of students.

We processed the data from the tests conducted through SPSS v.19. The results were varied and comparative.

RESULTS

Table 1 presents the parameters of the variation analysis indicators from the results obtained from the study. The results of the testing of the schoolgirls in the 5th grade show values of the coefficient of variation of the run test of 30 m below 10%, indicating that the sample is highly uniform and homogeneous. In the running tests of 200 m, the agility test (T-test) and the jump in length from a two-legged place, the variation is between 10 %-20 % and the sample is permissible uniform, and in the test the throwing of a dense ball V=20,35 %, again is below 30 %, indicating that it has an average dissipation. The high values of the coefficient of variation in these cases indicate the presence of divergent influence of the applied means and methods in the learning process, which affects students individually. The distribution of values is normal in the first test, asymmetry and excess are within normal range.

In the second test, the coefficient of variation was less than 10%, again on the 30 m run, as well as the running of 200m and the agility test, and in the tests the jump in length from a two-legged place V=10,45% and the throwing of a solid ball V=20,35 % below 30 %, indicating that the sample was on average uniform. In the second test, the asymmetry coefficient was above the critical (As 0.05=0.854) in the tests 30 m running and throwing a solid ball. In the third test, the variation was less than 10 % of the same tests as in the second test, in the other tests the coefficient V% was less than 30 %, which speaks to an average homogeneous sample. Asymmetry is above critical again in test scores throwing a solid ball, but this time also in the agility test.

Table 1. *Results of the analysis of variance of the test data*

	N	R	Xmin	Xmax	X	S	V%	As	Ex
Vth grade	30 m	1.68	5.88	7.56	6.46	.44	6.85	.82	.38
	200 m	20.56	39.20	59.76	48.18	5.20	10.81	.37	-.15
	Throwing a heavyweight ball	300	300	600	401	81.80	20.35	.58	-.38
	Jump in length	75	125	200	166	21.68	13	-.13	-.87
	T-test	6.88	12.48	19.36	15.20	1.86	12	.69	-.09
VIth grade	30 m	2.08	5.43	7.51	6.17	.554	8.9	.98	.35
	200 m	17.17	38.67	55.84	46.48	4.22	9.07	.46	-.03
	Throwing a heavyweight ball	400	300	700	438	112.15	25	.91	.27
	Jump in length	70	130	200	172	17.99	10.45	-.35	-.30
	T-test	6.26	14.05	20.31	16.34	1.57	9.6	.77	.20
VIIth grade	30 m	1.72	5.31	7.03	6.14	.479	7.8	.25	-1.08
	200 m	12.92	37.38	50.30	43.07	3.49	8.10	.17	-.57
	Throwing a heavyweight ball	450	300	750	447	111.15	24	.99	.98
	Jump in length	70	130	200	170	17.65	10.38	-.38	-.37
	T-test	4.03	14.00	18.03	15.32	.965	6.29	.98	1.25

In figures 1 to 5, we present the dynamics of the average achievement values of the surveyed persons in age with the corresponding differences between the three tests and the values of the Student's t-criterion. Figure 1 presents the dynamics of changes in test performance, which brings information on motor quality speed. On the first test, the mean was X=6.46 sec., in the second decreased to 6.17 sec., with an increase (d) of both tests being 0.29 or 4.48%, the difference being also statistically significant, since applying the Student's t-criterion for dependent samples the value was above the critical table = 2.05 was lower than temp = 2.68. Comparing the mean values of a second study (X=6.17) and a third study (X=6.14) growth was only 0.03 sec (d%=0.48) and the t-criterion value of the stewed 0.28. The values compared between the first and third classes (5th and 6th grade) had an increase of 0.32 (d%=4.97), statistically reliable growth. What the three tests show is positive continuous growth during the study period, which is high between the first and second tests and very low between the second and third, what needs to be improved is more targeted work in the 6th grade oriented towards improving motor qualities.

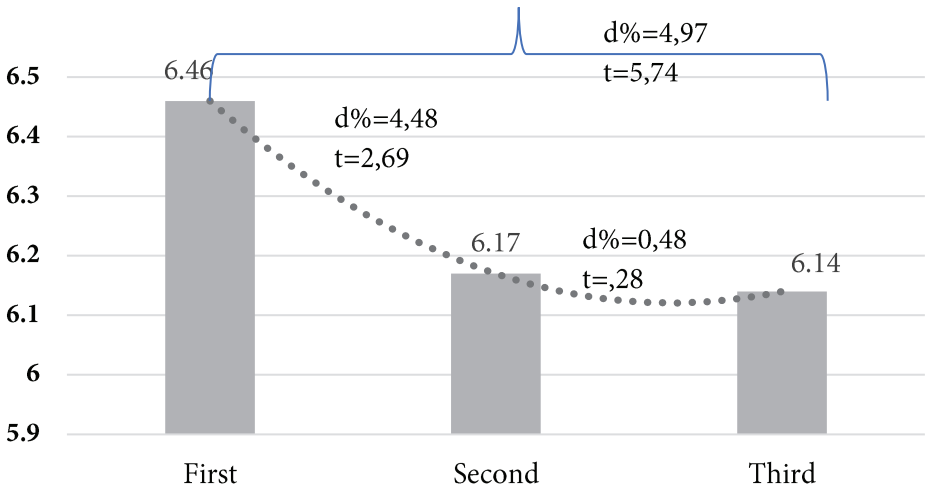


Figure 1. *Average performance dynamics in test- 30m run*

The results in Figure 2 present the data from the test throwing a dense ball. When testing schoolgirls in the 5th grade, the average of achievements is 600 cm. or 1 meter (d%=9,22), the growth has a statistical significance above the critical values. In the second and third tests, the average is X2 = 700 cm and X3=750 cm, the growth is only 50 cm (d%=2,05), (a) the value of the t- criterion is below the critical one, indicating a lack of statistical credibility of the achievement gap. Between the first and third tests, there was an increase of 11.47% which was statistically significant. In this test (throwing a dense ball), low scores are again noted in the transition 6th and 7th grade where we do not notice significant growth.

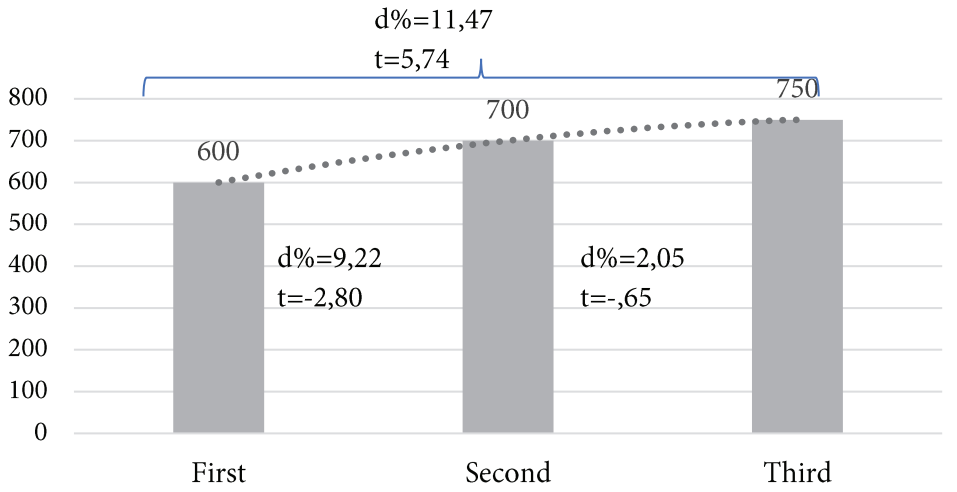


Figure 2. *Dynamics of average test achievements throwing a heavyweight ball*

The results of the first test, presented in Figure 3, showed an average of 48.18 sec. for running the 200-meter distance, in the second measurement this value decreased to 46.18 sec., and in the third decreased by another 3.41 sec. Comparing the values we notice an increase of 2 sec between V and VI class, this growth of 3.52% is statistically significant, since t=3.52 and is above critical. In those compared between the second (6th grade) and the third test (7th grade), the increase was 3.41 sec., which also possesses the necessary level of credibility. Comparing the first and third surveys, growth was 10.6%, again of statistical significance. In this test (running 200 meters), the growth between decks is significant and an improvement we notice in all three years of student learning. This gives us reason to mark the age period considered as key in terms of the manifestation and development of speed endurance in schoolgirls.

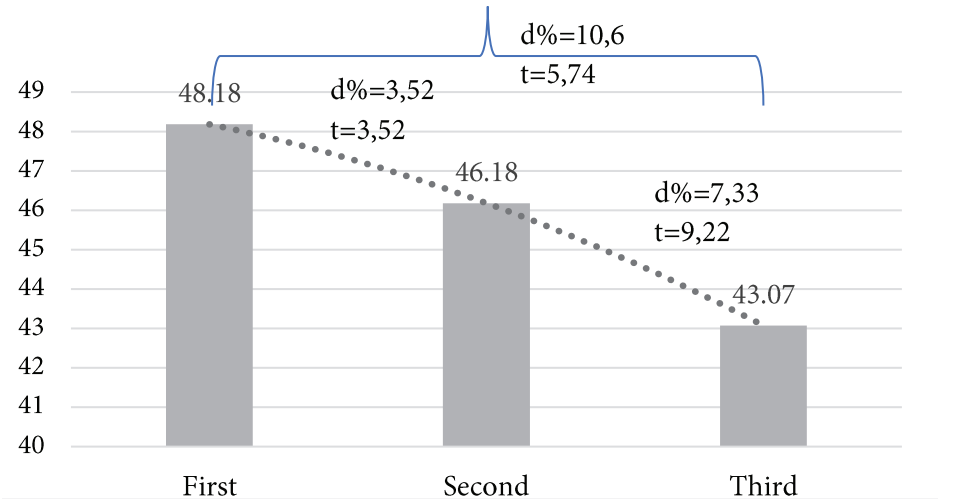


Figure 3. *Dynamics of test average achievements 200 meters shuttle run*

The difference between the first and second testing differences in T-test results is 1.14 sec., but this value is in the direction of increasing the test time, which we should note as negative since in the second year the results are weaker in this test. Between the second and third tests, the difference is 1.01 sec., but already in a positive direction in terms of achievement, but at the same time, this growth is negligible, given the values of the Student's t-criterion. Between the first and third tests, the difference is 0.85 sec., in the use of the first test. The results commented on above reveal the period between 11 and 12 years as such, in which age prerequisites are available to develop motor quality agility.

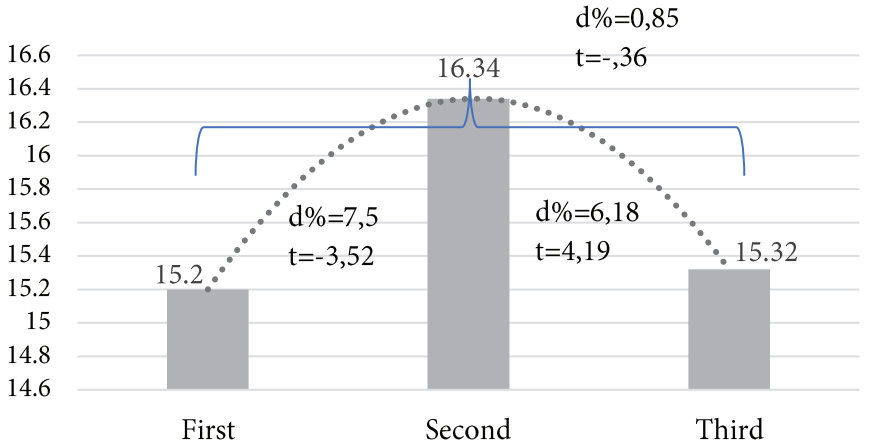


Figure 4. *Dynamics of test average achievements T-test*

The results of the latest Figure 5 present the average achievements of the test jump in length with two legs from the spot. In the 5th grade, the average values of girls in the test under consideration were 166 cm, on the next test this result increased to 172 cm, with a reported growth of 6 cm, and was statistically significant, taking into account the value of the T-criterion presented in Table 1 of the Student's t-criterion. Between the results in the 6th and 7th grades, we also observe the achievement gap, but we should mark it as a decline, and the difference of 2 cm is not statistically significant. Comparing the first and third tests, the growth of the achievement is 4 cm., but again it is not significant.

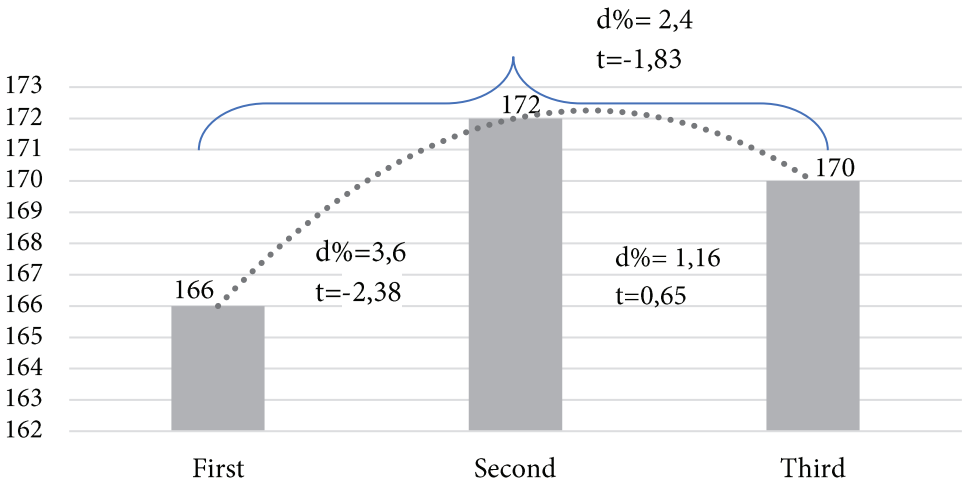


Figure 5. *Dynamics of average test performance Jump in length from place two legs*

DISCUSSION

By analyzing and interpreting the data obtained from our study, it should be noted that during the age period under consideration there are prerequisites for the purposeful development of speed, blast force of the upper extremities and speed endurance. With regard to the agility and explosive force of the lower extremities are not

on the face of such prerequisites. From the analysis carried out, it can be noted that the state of the physical capacity of the persons surveyed by us in the age period considered has changed by a positive sign. Improvements are observed, but the VI class is marked by poor results, this statement is found in other authors such as Brestnicki, (2019) and Pancheva (2019), according to which the explosive force of the upper and lower extremities begins to manifest and develop after the 6th grade. The increase on physical fitness in ascending order is also due to age characteristics, where this is a sensory period of many qualities and the increase corresponds to this period.

Although, muscle strength has been continuously upward development throughout the school period, at a different rate over different ages in this study the data are fluctuating. By year 10, the student's muscle strength gradually increased, by year 11 the rate of increase increased. This Rachev (1972) explains with the fact that girls enter earlier in the pre-puberty period, in this regard, it enters faster and more intensively in the development of their motor abilities.

From the presented results, we recommend to monitor more sensory periods and to work purposefully on specific motor qualities, especially in the 6th grade. In this study, work on the strength of the lower and upper extremities should be strengthened. Strength as quality is at the heart of other tests where development will help improve other qualities as well.

REFERENCES

Basel, K. (2007). Physical Fitness of Children and Adolescents in the United States:

Status and Secular change: *Medical sports science*, Vol.3 No 5, pp.67-90.

Boeva, B., Ivanova, V. (2018). Theory and methodology of physical education. Textbook for students from Trakia University, Part One: Theoretical and Methodological Basis of Physical Education. Stara Zagora: Publ. Faculty of Education, Trakia University.

Brestnicki, G. (2019) Razlichia v osnovni kondicionni kachestva pri blizki vazrasti. Godishnik na Natzionalna Sportna Akademiq "Vasil Levski", (str.68-81). Sofiq:NSA PRES *Годишник на Национална спортна академия "Васил Левски"* (стр. 68-81). София: НСА ПРЕС.

Cale, L. & Harris, J. (2009). Fitness testing in physical education – a misdirected effort in promoting healthy lifestyles and physical activity? *Physical Education and Sport Pedagogy* Vol.14 No.1, pp. 89–108

Harris, J. & Cale, L. (2006). A review of children's fitness testing. *European Physical Education Review* Vol.12 No.2, pp.201–225

Huhtiniemi M, Salin K, Lahti J, Saakslahti, A., Tolvanen, A., Watt, A., & Jaakkola, T. (2021). Finnish students' enjoyment and anxiety levels during fitness testing classes. *Physical Education and Sport Pedagogy*, Vol.26 No.1, pp.1–15.

Insel, M., Roth, T., Prince, K. (2006). *Core Concept in Health (10th ed).* McGraw Hill, New York

Janssen, I., & LeBlanc, G. (2010). Review systematic review of he health benefits of physical activity and fitness in school-aged hildren and youth. *International Journal of behavioral Nutrition and Physical Activity,* Vol. 7 No.40, pp.1-16.

Marinov, T (2020). Osnovi na fizicheskoto vazpitanie i sport. Teoriq i metodika. Sofiq. NSA PRES. // Маринов, Т. (2020) *Основи на физическото възпитание. Теория и методика*. София: НСА ПРЕС.

Ortega, F., Ruiz. J, Castillo, M., Sjostrom, M. (2008). Physical fitness in childhood and

adolescence: a powerful marker of health. *Int J Obes (Lond),* Vol.32 No1, pp. 1-11.

Pancheva. T. (2019). Harakteristika na fizicheskata deesposobnost na uchenici ot 5 do 8 klas. Godishnik na Natzionalna Sportna Akademiq "Vasil Levski", (str.105-109).Sofiq:NSA PRES. // Пачева, Т. (2019). *Характеристика на физическата дееспособност на учениците от 5 до 8 клас. Годишник на Национална спортна академия "Васил Левски"* (стр. 105-109). София: НСА ПРЕС.

Rachev, K. (1972). Vyzrastova dinamika i metodika na razvitieto na osnovnite fizicheski kachestva. Problemi na detsko- iunosheskiq sport. Sofiq.// Рачев К. (1972*). Възрастова динамика и методика на развитието на основните физически качества. Проблеми на детско-юношеския спорт*. София.

Rice, C. (2007). Becoming "the fat girl": Acquisition of an unfit identity. *Women's Studies International Forum,* Vol.30 No.2, pp. 158–174.

Strong, B., Malina, M., Blimkie, J., Janiels R., Dishman, K., Gutin, B., Pivarnik, M. (2005). Evidence based physical activity for school-age youth. *The Journal of Pediatrics,* Vol.146 No 6 pp.732–37.

Vizcaíno, V., Aguilar, F., Gutiérrez, R., Solera, M., Sánchez, M., Martínez S., Garcia, E., Artalejo, F. (2008).

Assessment of an after-school physical activity program to prevent obesity among 9- to 10-year-old children: a cluster randomized trial. *Int J Obes (Lond)* Vol.32 No.1 pp.12–22

Welk, G., Meredith, M. (2008). *Fitnessgram/ Activitygram Reference Guide* (3rt ed.), The Cooper Institute, Dallas, TX

WHO. (2010). World Health Organizoation - *Global recommendations on physical activity for health*. WHO Publications. Geneva

Zheleva-Terzieva, D. (2021). Impact of distance learning on the motor abilities of primary school-aged pupils. *Proceedings of CBU in Social Sciences* Vol. 2, https://doi.org/10.12955/pss.v2.247, 362-365.

Corresponding author:
Iva Radkova, PhD
Department of Theory of Physical Education
National Sports Academy „Vassil Levski"
21, Acad. Stefan Mladenov str.
Sofia, Bulgaria
Email: irradkova@abv.bg

SPORTS MANAGEMENT

 DOI: 10.37393/ICASS2022/127 339 - 345

FINANCING OF ELITE BULGARIAN SPORT

Daniela Dasheva, Hristo Andonov, Mihail Konchev, Antoaneta Boeva, Hristo Hristov

National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT

The achievement of international and mainly Olympic sporting success is increasingly vital to a country with a well-developed sport system. The number of medals won in Olympics Games and, other international sports competitions offer the most self-evident and transparent measure of success in high-performance sport. Increasing competition between nations to succeed in international sporting events also leads to increased financial investments in elite sports from state sources. Many countries invest in sports in which they have built traditions of success or are their social capital. In this article, the theoretical framework assumes that nations that give priority to the financing of certain sports improve the efficiency of the allocation of funds. The purpose of this study is to identify the indicators (criteria) for financial support of elite Bulgarian sports and answer the following questions:

(1) whether and to what extent it is necessary to prioritize the financing of sports in Bulgaria; (2) if it is a guarantee of success; (3) and which are the sports that are given the highest priority.

The technique of the coefficient of concentration or the share of funding allocated to the four most funded sports within this Olympic cycle was used.

In 2021, 46 sports were funded, of which 33 were Olympic and 13 non-Olympic, with a budget of 27.459 million. The data collected show that the first four federations receive about 33.3% of the total budget share for the year — the next four -24.125%. So, the first eight funding proposals receive about 60% (59.175%) of the MMC's total budget, the remaining -40%.

Establishing the link between performance (sports performance) and the country's policy on sports funding is a rather ambitious task. International sporting success in both summer and winter Olympic sports is primarily determined by factors that cannot be controlled solely by a country's sporting policy, which makes success relatively relative.

Keywords: *top-level sports estimate, medals, top sports competitions.*

INTRODUCTION

Increasing competition between nations to succeed in international sporting events is also leading to an escalation of financial investment in elite sport from state sources. A number of nations have almost doubled their spending on elite sports in the last decade, but this has not significantly affected sporting success (De Bosscher, Shibli, Westerbeek, van Bottenburg, 2015; Mavrudiev and Mavrudiev, 2019). This non-return on investment requires a new approach to streamlining the process. This conclusion is the basis of the so-called. An approach to prioritizing sports and "directing resources only to a relatively small number of sports that have a real chance of success at the Olympic and world levels" (Green & Oakley, 2001). Of course, this approach is not new, it existed in the early '90s in the former countries of the socialist bloc - Germany, Russia, Bulgaria, Hungary, etc., and today is reproduced to varying degrees and worldwide. A number of nations are looking for strategic solutions to increase the number of medals won by focusing on sports where competition is weak and competitive balance is high (Zheng, Oh, Kim, Dickson, & De Bosscher, 2018) and also, where they have an advantage (Du ois & Heyndels, 2007; Tcha & Pershin, 2003). Many countries invest in sports in which they have built traditions of success or are their social capital - ice skating in the Netherlands, wrestling and rhythmic gymnastics in Bulgaria, judo in Japan, winter sports in Norway and Sweden, swimming and athletics in the USA, etc.

This prioritization is determined by various factors - geographical, political, cultural, or the dynamics of growing competition in international sports competitions. These sports receive increased funding, often at the expense of other sports. Such a targeted funding decision approach has also proven its ef-

fectiveness (Robinson & Brumby, 2005; Sam, 2012; Van Thiel & Leeuw, 2002) and effectiveness. The financing of elite sports is suitable for this type of efficiency targeting, due to the clearly measurable end goal - results and medals.

However, to this day, the extent to which targeted funding for only a few sports (i.e., prioritization) is more effective (i.e., in terms of success) than broader funding approaches (i.e., diversification) has not yet been confirmed econometrically. Bosscher & Kempf (2018) believe that there is little evidence of the degree of prioritization and whether this approach leads to success. However, it is difficult to cover the whole complexity of prioritization, but a better understanding of the target funding approach in elite sports is on the agenda. Some researchers note that it may have possible side effects over time, not only for those sports that are not funded but also for those with high funding that fail to achieve the expected results (Sam, 2012).

Zheng and Chen (2016) describe in detail the technology of prioritization in China for the country's success at the Summer Games in the 1980s. They prove that this strategic prioritization is supported by the theory of cluster-based sports training and five keywords (small, fast, women, water, and agile).

Weber et al. (2018) analyze how nations position themselves in the Winter Olympics through prioritized funding. Their findings lead to a diversified portfolio that includes targeted sports that are highly correlated with past and present success.

A theoretical framework is positioned on the assumption that nations that give priority to funding certain sports are aimed at improving the efficiency of resource allocation. Thus, the allocation of funds between inputs and outputs is commonly used in strategic management/ marketing and policy (De Peuter et al., 2007; Hooley et al., 2001; Weber et al., 2018) and is a basic approach, which was previously applied in the years to evaluate the effectiveness of an elite sports policy (De Bosscher, Shilbury, Theeboom, Van Hoecke, & De Knop, 2011). The "entrance" is the flow of financial resources into the "system" that determines political support. It is assumed that targeted funding (i.e., contribution) only for a relatively small number of sports (i.e., prioritization) is a deliberate strategic choice (i.e. form of productivity) made to increase the overall chances of a given nation for success.

Hypothetical basis: Is it possible to prioritize the financing of Bulgarian elite sports and to what extent is diversification possible as an alternative, as some authors are critical and argue that prioritization can lead to suboptimization of funds and results (Sam, 2012).

The purpose of this study is to identify the indicators (criteria) for financial support of elite Bulgarian sports and answer the following questions: (1) whether and to what extent it is necessary to prioritize the financing of sports in Bulgaria; (2) if, is it a guarantee of success; (3) and which are the sports that are given the highest priority.

METHODS

The study is conducted on a specific sports basis, using data and results from national funding over the past 12 years, the results of major sports forums, and a logical-deductive analysis of programs and subprograms for financial support of sports federations and athletes.

Funding data

Source of funding - means and criteria for inclusion and exclusion. A difficult task, especially in the field of sports, where the full picture of financial investments in elite sports is needed or prioritization focuses only on resources that are coordinated at the national level and are used specifically to invest in the development of elite sports. Such national funding is defined as "public expenditure on sport for excellence", broken down into specific programs (Table 1 and Figure 1).

Table 1. *Financial resources from the budget of the Ministry of youth and sports (2010-2022)*

Year	Total budget of the MYS* (in top-level BGN)	Top-level sport (in millions of BGN)	% of the total budget for the TLS	TLS and OP programs
2010	41761.9	32016.9	76.66	
2011	33625.8	25338.9	75.35	
2012	36810.0	26407.7	71.74	
2013	39135.9	26387.6	67.43	
2014	66202.5	46317.3	69.96	
2015	66253.1	47443.6	71.61	
2016	71211.2	50721.3	71.23	
2017	73428.7	49641.2	67.60	
2018	75732.0	50479.7	66.66	
2019	79718.0	52699.1	66.10	27 940.0
2020	82269.0	53905.5	65.52	26580.0
2021	90603.3	60636.0	66.92	27459.0
2022	123535.9	73138.5	59.20	31880.0

**MYS – Ministry of youth and sports*

Estimates show that an average of 68% of the IMC's total budget is spent on Excellence Sports Policies.

Data analysis

Data on sports results - won awards during the Olympic Games in Tokyo -20 and the World and European Championships held in 2021.

The funds under the Olympic Training Program of the IMC for the last Olympic cycle are as follows: for 2021 - BGN 7,824,300; for 2020 - BGN 8,005,754; for 2019 - BGN 7,312,595; for 2018 - BGN 7,158,400; for 2017 - BGN 3,650,589; The total amount is BGN 33,951,638. The effectiveness and efficiency during the last Olympic cycle are - Tokyo 2020 Olympic Games - 6 medals and 30th place in the ranking by nations, eight prize rankings -4-8th place or 17% efficiency. As for the awards won at world and European championships, the picture is as follows:

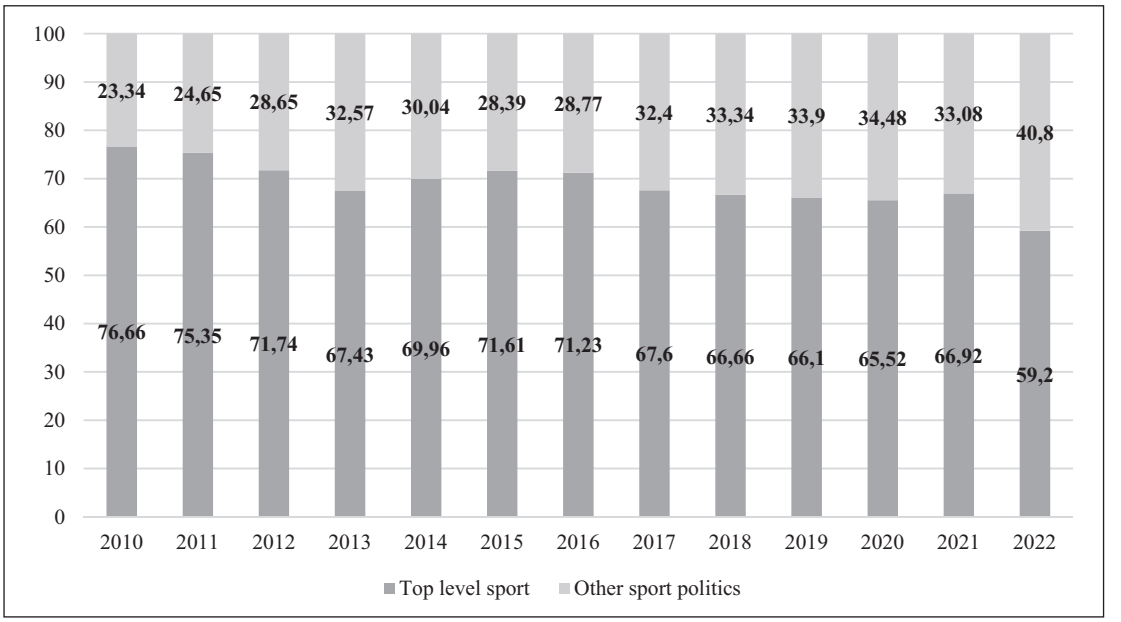


Figure 1. *% Financing of elite sports to the total percentage of financing of sports (100%)*

- Weightlifting EP for men and women -Moscow -8 first places, 8-second, 3-third, 7-fourth, and 2 fifth; SP (men and women) - 1 second place, 1 fourth, and 1 fifth;
- Karate - 1 second place and 1 first place - EP;
- Wrestling - 1 second place; 1 sixth and 1 eighth place - EP;
- Rhythmic gymnastics - 1 first place, 1 - second, 1 - fourth, 1 - fifth - EP;
- Swimming - 1 seventh place - SP.

The technique of the coefficient of concentration or the share of funding allocated to the four most funded sports within this Olympic cycle was used.

In economic research, the concentration ratio is used to quantify the market share of the largest companies in the industry and to illustrate the extent to which an industry is traded (is market-based). It is standard practice to focus on the market shares of the four or eight most considerable bids, or in this case, the amount of funding allocated to a "sport", as an indication of prioritization (Clarke & Davies, 1983). Therefore, the CR4 or CR8 concentration ratio means the share of funding allocated to the four highest funded sports. When the maximum value is 100%, this means that all funding is allocated to four major sports.

The Hirschman-Herfindahl Index (HHI) is also a comparison for prioritization policy. Unlike the concentration ratios described above (CR4 and CR8), HHI includes all data on funded sports, not just the first four or eight, and gives a different view (Sutton, 2001). Therefore, HHI combines two numbers of financed sports and the share of funding for sports. If only one sport is funded, the index reaches its upper limit of 1.0. The lower limit depends on the maximum number of Olympic sports funded. If national funding is distributed equally among 20 sports, then each sport receives 1/20 of the funding (i.e., without prioritization), then the value of HHI will be 0.05.

For example, in 2021, 46 sports were funded, of which 33 were Olympic and 13 non-Olympic, with a budget of 27.459 million (Table 2 and Figures 2).

Table 2. *Budget for top-level sport (2021 -2022)*

№	Sport	Budget 2021г. (BgLev)	%	Budget 2022 г. (BgLev)	%
1	Wrestling	3000000	10.9	2998123	9.6
2	Athletics	2085000	7.6	2211110	7.08
3	Rhythmic gymnastics	2050000	7.5	2285424	7.32
4	Volleyball	2000000	7.3	1981626	6.35
5	Boxing	1900000	6.9	2038218	6.53
6	Weightlifting	1200000	4.4	1232872	3.95
7	Skiing	1100000	4.0	1631258	5.23
8	Swimming sports	1038000	3.8	1162661	3.73
9	Judo	990000	3.6	1053840	3.38
10	Canoeing	970000	3.5	826800	3.20
11	Biathlon	970000	3.5	750 399	2.40
12	Shooting	854000	3.1	999759	2.95
13	Basketball	800000	2.9	859996	2.76
14	Tennis	720000	2.6	728733	2.34
15	Badminton	700000	2.5	703 496.80	2.26
16	Gymnastics	700000	2.5	935378	2.76
17	Karate	700000	2.5	672107	2.15
18	Rowing	690000	2.5	934 882	2.8
19	Taekwondo WT	400000	1.5	569454	1.82

20	Figure skating	400000	1.5	668188	2.14
21	Fencing	330000	1.2	346198	1.11
22	Modern pentathlon	320000	1.2	312454	1.0
23	Horse riding	320000	1.2	347512	1.11
24	Trampoline jumps	250000	0.9	272018	0.87
25	Handball	250000	0.9	262774	0.84
26	Water ball	200000	0.7	280312	0.9
27	Table tennis	150000	0.5	261 271.50	0.84
28	Sailing	150000	0.5	228672	0.73
29	Cycling	150000	0.5	128711	0.41
30	Archery	70000	0.25	124 109	0.4
31	Grass Hockey	60000	0.21	127990	0.41
32	Trap, double trap and skeet	40000	0.14	192934	0.61
33	Triathlon	40000	0.14	167 968	0.54

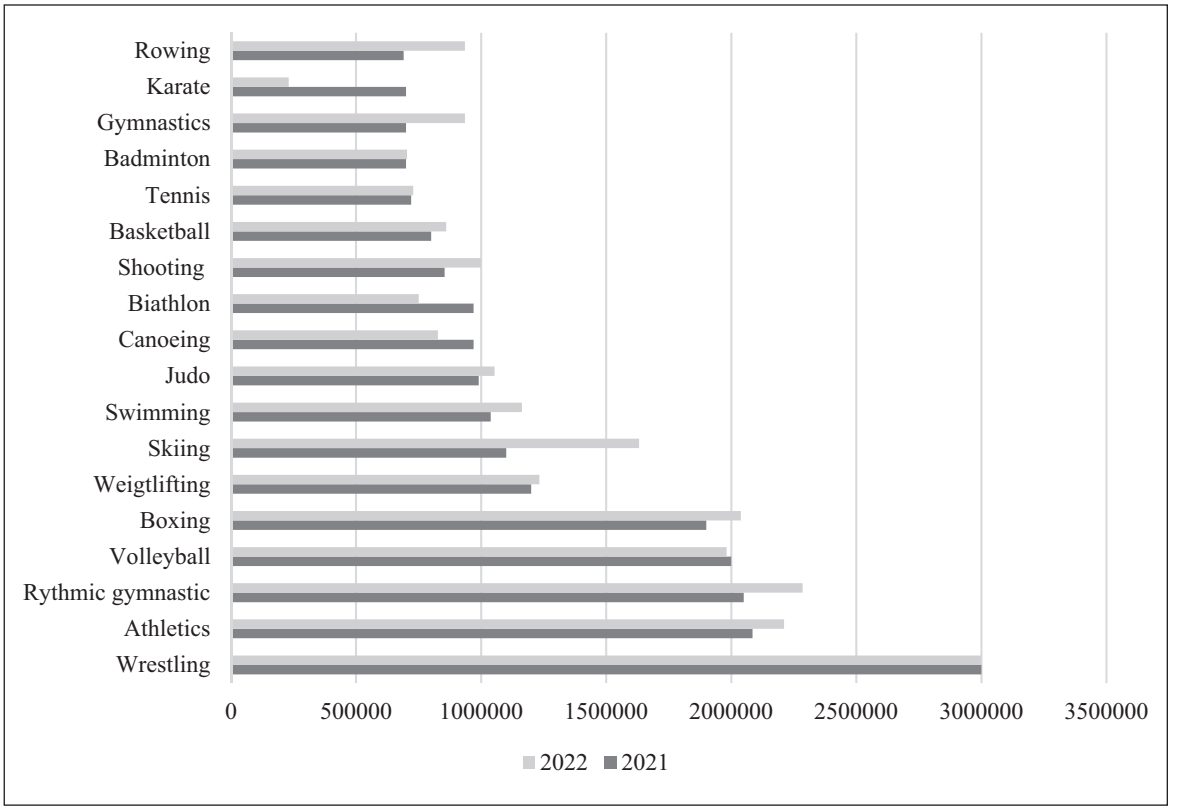


Figure 2. *Comparative analysis of the funding of the top 18 sports in the last two years (absolute values)*

Do the collected data show that the first four federations receive about 33.3% of the total budget share for the respective year? The next four -24.125%. I.e., the first eight funding proposals receive about 60% (59.175%) of the total MMC budget, the remaining - 40%.

In 2022 (Table 2), the budget for financial support for sports federations has increased by 13.64% compared to the previous year. The first four federations, here again, receive the highest percentage of the total budget share for 2022 - 27.6% (6% less than the previous year). The next four -15.95%, i.e., the first eight federations receive about 44% (15% less than the previous one, but again a higher percentage), the remaining 53% or 13% more than in 2021.

The reason is the change in the methodology of the program for financing sports federations in 2022, which includes two areas - Olympic training and RRSVP and the derivation of criteria such as:

A. Won awards in competitions of the highest rank and prestigious ranking of the Olympic Games,

B. Sports results obtained in the current year,

C. Starting efficiency and priorities of the state body of sports management,

D. The importance of a sport for achieving the goals of the state body for the development of sport in Bulgaria, according to the strategic documents:

E. National programs for the development of physical activity, physical education, sports, and sports tourism - Implement sports programs for excellence and provide an effective training process to achieve sports results at the international level, achieve better efficiency and expediency in spending funds through introduced precise parameters of the programs and control over the implementation of the objectives set in the projects,

F. National strategies for the development of physical education and sports in the Republic of Bulgaria - Development of long-term plans for participation in the Winter and Summer Olympic Games, reflecting the experience gained, the basic principles of sports training, trends in world sports, and scientific and technological achievements in this field,

G. Funds from the budget of the state body for the respective year or a 4-year Olympic cycle.

DISCUSSION

The main goal of this research is to develop a system for objective financing of elite sports in the Republic of Bulgaria. Establishing the relationship between performance (sports results) and the country's policy regarding financing sports in general and elite sports, in particular, is quite an ambitious task. In both summer and winter Olympic sports, international sporting success is primarily determined by factors that a country's sports policy cannot solely control, making success relative. According to Van Bottenburg (2000), elite sport is absolute by definition, and this makes the relativistic assessment false. The total number of medals won counts! Determining success depends on the purpose for which the ranking is being made. The competition for success in elite sport is also intensifying. More and more nations are adopting strategic approaches to developing elite athletes, and as a result, more and more nations are winning medals. This requires the determination of precise and objective criteria- – a point of departure can be linear regression analysis (OLS) of socio-economic factors that influence (absolute) sporting success was carried out using the Statistical Package for the Social Sciences (SPSS). Here the logarithm of the weighted medals (gold=3, silver=2, bronze=1) for the Olympic Games is taken as the absolute success measurement. A regression analysis serves two purposes. First, it identifies the determinants for international success on the macro-level. Second, under ceteris paribus conditions, an analysis of residuals allows comparing countries and thus determines their relative success. The analysis of residuals compares this "prediction" with the weighted number of medals won. Using a "case-by-case" analysis, we can answer the question: "which countries are successful if one accounts for socio-economic variables?"

REFERENCES

de Peuter, B. & Wayenberg, E. (2007). *Belgium: Flemish Inter-Municipal Cooperation Under Reform.* Inter-Municipal Cooperation in Europe pp. 23–38.

Clarke & Davies (1983). Aggregate Concentration, Market Concentration, and Diversification. *The Economic Journal*. Vol. 93, No. 369 (Mar., 1983), pp. 182-192 Published by: Oxford University Press. https://doi.org/10.2307/2232172;

De Bosscher, V., Shibli, S., Westerbeek, H., & Van Bottenburg, M. (2015). Successful elite sports policies. An international comparison of the Sports Policy Factors Leading to International Sporting Success (SPLISS 2.0) in 15 nations Aachen: Meyer & Meyer De Bosscher, Shilbury, Theeboom, Van Hoecke, & De Knop (2011).

Du Bois & Heyndels (2007). Revealed Comparative Advantage and Specialization in Athletics. *IASE/NAASE Working Paper Series*, Paper No. 07-17.

Green, M., & Oakley, B. (2001). Elite sport development systems and playing to win: Uniformity and diversity in international approaches. *Leisure Studies*, 20(4), 247-267.

Hooley, G., Greenley, G., Fahy, J., & Cadogan, J. (2001). Market-focused resources, competitive positioning, and firm performance. *Journal of Marketing Management*, 17(5-6), 503-520.

Mavrudiev, I. Mavrudiev, P. (2019). Analysis of financial indicators from the Winter Olympic Games in Sochi 2014, *Sport and Science,* Issue 3, 4/2019, 100-114 // Маврудиев, И. Маврудиев, П. (2019). Анализ на финансовите показатели от Зимните олимпийски игри в Сочи 2014, *Спорт и наука*, Брой 3, 4/2019, 100-114.

Robinson, M. & Brumby, J. (2005). "Does Performance Budgeting Work? An Analytical Review of the Empirical Literature," *IMF Working Papers* 2005/210, International Monetary Fund.

Sam, M. P. (2012). Targeted investments in elite sport funding: Wiser, more innovative, and strategic? *Managing Leisure*, 17(2-3), 207-220.

Sutton, J. (2001). Market structure and performance. In N. J. Smelser & P. B. Baltes (Eds.), *International encyclopedia of the social & behavioral sciences* (pp. 9211-9216). Amsterdam: Elsevier Science.

Tcha & Pershin (2003). Reconsidering Performance at the Summer Olympics and Revealed Comparative Advantage. *Journal of Sports Economics*. https://doi.org/10.1177/1527002503251636

Van Bottenburg M. (2000). *Het top sport klimaat in Nederland [The elite sports climate in the Netherlands],* 's Hertogenbosch, The Netherlands, Diopter-Janssens and van Bottenburg bv.

Van Thiel & Leeuw (2002). van Thiel, S. & Leeuw, F. (2002). The performance paradox in the public sector. *Public Performance & Management Review*, 25, 267-281.

Veber, A., De Bosscher, & Kempf (2018). Modeling international sporting performance. The impact of national sport policy factors. Sport and Society Movement and Sport Sciences Sports Policy Factors Leading to International Sporting Success. *Conference paper presented at 50th Annual Conference of the French Society of Statistics, 28 May* – 1 June 2018, Paris-Saclay, France.

Weber, A. C., Kempf, H., Shibli, S., & De Bosscher, V. (2016). Measuring competition in the Olympic Winter Games 1992–2014 using economic indices. *Managing Sport and Leisure*, 21(6), 399-420.doi: 10.1080/23750472.2017.1304232

Zheng, J., & Chen, S. (2016). Exploring China's success at the Olympic Games: A competitive advantage approach. *European Sport Management Quarterly*. doi:10.1080/16184742.2016.

Zheng, Oh, Kim, Dickson, & De Bosscher. (2018). Competitive balance trends in elite table tennis: The Olympic Games and World Championships 1988-2016. *J Sports Sci*. Dec;36(23): 2675-2683.doi: 10.1080/02640414.2017.1375174. Epub 2017 Sep 7.

Corresponding author:
Prof. Daniela Dasheva, DSc
Department "Theory of Sports"
National Sports Academy "Vassil Levski"
21, Acad. Stefan Mladenov, str.
Sofia, Bulgaria
E-mail: danieladasheva@abv.bg

KNOWLEDGE AND SKILLS OF MIGRANT SPORTS PROFESSIONALS IN BULGARIA

Roberto Solinas
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
Sports individuals encounter different problems when they migrate and have difficulty adjusting since they run into restrictive policies and rules that differ from their own country. Careers in sports and related fields, such as coaches and trainers, are also affected by the same concerns. These gaps can be addressed through the "Education through Sports" (ETS) methodology. This methodology can enhance the managerial skills of sports managers, coaches, and trainers. However, this methodology has not been tested among migrants in Bulgaria.
This study was conducted to evaluate the knowledge and skills of migrant sports professionals in Bulgaria and determine the trainers' expertise. It also assessed the effectiveness of "Education through Sport" as a new methodology.
The quasi-experimental research design was utilized. Paired sample T-test was used to determine whether the ETS program enhanced the migrants' level of knowledge and skills. ANOVA was utilized to determine the significant difference between the pre-test and post-test results. The Mean was used to determine the level of knowledge and skills using the 5-point Likert scale. Standard deviation was also used to determine the variations in the participants' responses.
After the intervention, a significant difference was computed between the respondents' knowledge and skills, $p = .000$. This means that the ETS methodology was effective in developing the knowledge and skills of migrants, providing a solution to their under-representation in leadership roles. Trainers providing the ETS program also showed a high level of expertise resulting in the effective acquisition of knowledge and skills. This methodology should be continuously used as a strategy to advance sports management skills among migrants in Bulgaria and other parts of Europe.

Keywords: *Knowledge, migrants, skills, sports professionals.*

INTRODUCTION

In 2017, the EUROSTAT reported that 20.7 million non-EU nationals lived in European Union (EU) countries as of 2016, accounting for a total of 4.1% of the total EU population. Most of these third-country migrants living in the EU belonged to a relatively younger age than the local population. Working-age adults represented the most consistent category. In 2020, according to the European Commission's Statistics on Migration to Europe, the employment rate in the working-age population was higher for EU citizens (73.1%) than for non-EU citizens (57.5). Non-EU citizens were over-represented in some specific economic sectors, such as accommodation and food service activities (11.4%), administrative and support activities (7.1%), domestic work (6.5%), and construction (8.6%). However, they were under-represented in other economic sectors, including public administration and defense, compulsory social security (1.2%), education (3.7%), human health and social work activities (7.6%), and financial and insurance activities (1.1%). On the other hand, non-EU citizens were under-represented in terms of occupation among teaching professionals (2.5%), business and administration associate professionals (2.5%), general and keyboard clerks (1.4%), science and engineering associate professionals (2.0%), business and administration professionals (2.1%), and market-oriented skilled agricultural workers (1.3%). Integration into the host community plays a vital role in this aspect.

According to Elliot and Maguire (2008), migrants are classified into three levels: within nation-states, between nation-states, within the same continent, or transcontinental. Whether athletes, coaches, or support staff, individuals encounter different problems when they migrate. Schinke (2011) also disclosed that the problems these migrant personalities encounter might be categorized into three primary identifiers: (a) community, (b) cultural, and (c) sports contexts. In the specific field of sports, the under-representation of migrants is particularly evident and challenging in their exclusion from positions of authority and overall representation in non-playing positions. Molnar and Maguirre (2008) iterated that sports labor migrants have difficulty adjusting in all cases since they run into restrictive policies and rules that are different from their own

country. Careers in sports and related fields, such as coaches and trainers, are also affected by the same concerns. The respect and acknowledgment of the migrants' potential depend upon the perception of the host community. Thus, building the community of native and migrant members with equal treatment lies in the experiences they share over time.

Migrants or foreigners and transnational sports managers, coaches, and trainers are an integral part of the workforce of any sports-related activities. One significant problem is that most foreign sports specialists, particularly non-EU citizens, specifically migrants, and those born outside the EU, are not handling key functions in sport management such as coaching and training. These observed gaps pose issues that affect the lives of migrants and host European countries, not only in sports development but also in cultural and educational integration.

Edwards (2015) noted that community capacity building through sports is important. It involves building works with sport and physical activities, which refers to developing critical competencies of migrants and the host European countries to contribute to personal development and sustainable social transformation. He also emphasized that community capacity is critical for supporting and promoting community-level health. Through the Sport for Development (SFD) model, there is evidence of sport being an essential practice for community development. SFD is supported by The European Commission's "White Paper on Sport" (2007), which highlights that "sport makes an important contribution to economic and social cohesion and more integrated societies" while also facilitating "the integration into society of migrants and persons of foreign origin."

One strategy that can address this intermediate step is the ETS methodology which, according to ISCA (2013), aims to integrate sports elements for an educational purpose to address a social issue, develop various competencies and initiate lasting and transversal results. This methodology can also be used as a new strategy to advance the management skills of sports managers, coaches, and trainers among migrants in their sports development programs.

However, this methodology has not been tested on migrants, foreigners, and transnational sports managers, coaches, and trainers in Bulgaria.

This study evaluated the effectiveness of the ETS as a methodology. The knowledge and skills of migrant sports professionals in Bulgaria and the trainers' expertise were also determined. The trainers and migrants involved in the local activities did not have the knowledge, skills, and competencies characterizing high-quality sports manager profiles before the experiment. Specifically, this study sought to answer the following questions: 1. What is the level of Knowledge and Skills of the Migrants in Bulgaria as reflected in the results of the pre-test and post-test?; 2. What are the overall Knowledge and Skills of the Migrants in Bulgaria as revealed in the pre-test and post-test?; 3. Is there a significant difference in the level of knowledge and skills of the migrants in Bulgaria as potential sports managers? and 4. What is the level of the trainer's expertise in Bulgaria?

The present research sets the following working hypothesis: The tools and methods of "Education through Sports" can be effectively used for improving the professional skills of non-European sports professionals working in the field of sports management in the European Union. Thus, this present study aims to evaluate the effectiveness of a customized training format based on the principles of ETS.

METHODS

In this study, the quasi-experimental research design was utilized. 25 migrants in Italy were selected to participate. They are sports professionals aged between 19 to 45 years old, either male or female. These migrant participants were selected based on their interest in working in the development of sports manager profile, competence, and previous experience in the field of sports. They were assessed through specific application forms filled in by them. The application form included consent on their participation once selected, and was produced in English, and translated into the national language used by the candidate.

On the other hand, six (6) local sports panels were also chosen as trainers. They were either a. Sports professionals, b. Professor in the field of Sports, c. Education Sports Curriculum Specialist, d. Coaches, e. Trainers, and f. Sports Manager. These sports panel has a 1-3 years, 4-6 years, and more than 10 years of experience among them. They were selected through an open call application released and sent through their own websites and social media

accounts. Their selection was based on motivation in the field of sports and career as assessed through the application form filled in by them. The application form also included questions regarding their consent to participate in the program as trainers. The study was conducted from October 2020 to April 2021.

The use of intervention through the ETS program determined the migrants' knowledge and skills improvement. The study's theoretical foundation focused on the experiential learning cycle of the sports professionals measured quantitatively by a survey questionnaire. To determine the level of knowledge and skills of the migrants, the Mean was used with the 5-point Likert scale. Standard deviation was also used to determine the variations in the responses of the respondents.

Paired sample T-test was used to determine whether the ETS program enhanced the level of knowledge and skills of the migrants. ANOVA was also employed to determine the significant difference between the migrants' results in the pre-test and post-test. In addition, Statistical Package for Social Sciences (SPSS) version 21 was used in the computation and analysis of the data.

This study also utilized a multifaceted approach in developing alternative programs that enhanced the essential skills of foreign nationals or migrants engaged in sports management. This study was divided into three parts. The first part expounds on the theoretical foundations of the study by delving into a review of academic reflection on the concept and educational potential of ETS. The second part discloses and details the methodological approach of the research, setting it in the broader frame of the theoretical frame that the latter intends to establish through a tested experiment. It also includes the setting of a working hypothesis and aim, the structure of the tasks, and the work organization. The third part was the analysis of the experiment's results and the study's general conclusion.

RESULTS

Table 1 shows the migrants' knowledge and skills in Bulgaria as reflected in the Pretest. They strongly disagree that they are knowledgeable and skilled in sports administration and human resource management, with Mean = 1.1282; SD = 0.16538. Likewise, the respondents acknowledged that they are not yet knowledgeable and skilled in coaching and mentoring, with a mean of 1.6538; SD = 0.13269. Regarding digital skills for sports managers, they neither agree that they are knowledgeable nor have basic skills on how to use IT like computers, PCs, tablets, and mobile technology, Mean = 3.0128; SD = 0.74524.

Table 1. *Overall Knowledge and Skills of Migrants in Bulgaria as reflected in the Pretest.*

Knowledge and Skills	Mean	SD	Qualitative Descriptor
1. Administration and Human Resource Management in Sport	1.1282	0.16538	SD
2. Coaching and Mentoring	1.6538	0.13269	D
3. Digital Skills for Sport Managers	3.0128	0.74524	ND
4. Management of Sports Events	1.2436	0.21721	D
5. Financial Sustainability Strategies and Mechanisms for Sport Organizations	1.5128	0.43442	D
6. Marketing and Communication in the Field of Sport	1.5872	0.15722	D
7. Good Governance	1.6667	0.13333	D
Overall Mean	**1.779**	**0.303**	**D**

Scale: *1.00 – 1.49 (Strongly Disagree or SD); 1.50 – 2.49 (Disagree or D); 2.50 – 3.49 (Neither nor Disagree or ND); 3.50 – 4.49 (Agree or A); and 4.50 – 5.00 (Strongly Agree or SA)*

In terms of the management of sports events (Mean = 1.2436; SD = 0.21721), financial sustainability strategies and mechanisms for sports organizations (Mean = 1.5128; SD = 0.43442), marketing and communication in the field of sports (Mean = 1.5872; SD = 0.15722), and good governance (Mean = 1.6667; SD = 0.13333), all the respondents strongly disagree of being knowledgeable and skilled.

The overall Mean = 1.779; and SD = 0.303) implies that the respondents have insufficient knowledge and skills before the ETS intervention. In the pre-test, the overall assessment of the respondents from Bulgaria suggests a lack of knowledge and skills of being potential sports managers in the different areas of concern from administration to coaching, digital skills, management of sports events, finances, marketing, and good governance.

It is interesting to note that the respondents need training and interventions to prepare them to be actual sports managers in the future. Hence, ETS as an intervention program can be a suitable platform for training these potential sports managers.

Table 2. *Overall Knowledge and Skills of Migrants in Bulgaria as reflected in the Post-test.*

Knowledge and Skills	Mean	SD	Qualitative Descriptor
1. Administration and Human Resource Management in Sport	4.1410	0.09058	A
2. Coaching and Mentoring	3.8397	0.03269	A
3. Digital Skills for Sport Managers	4.0385	0.14382	A
4. Management of Sports Events	3.8782	0.14574	A
5. Financial Sustainability Strategies and Mechanisms for Sport Organizations	4.0385	0.14382	A
6. Marketing and Communication in the Field of Sport	4.1795	0.19392	A
7. Good Governance	3.8718	0.13587	A
Overall Mean	**3.974**	**0.133**	**A**

Scale: *1.00 – 1.49 (Strongly Disagree or SD); 1.50 – 2.49 (Disagree or D); 2.50 – 3.49 (Neither nor Disagree or ND); 3.50 – 4.49 (Agree or A); and 4.50 – 5.00 (Strongly Agree or SA)*

Table 2 implies that the respondents have acquired the following skills; administration and human resource management in sport (Mean = 4.1410; SD = 0.09058); coaching and mentoring (Mean = 3.8397; SD = 0.03269); digital skills for sport managers (Mean = 4.0385; SD = 0.14382); management of sports events (Mean = 3.8782; SD = 0.14574); financial sustainability strategies and mechanisms for sport organizations (Mean = 4.0385; SD = 0.14382; marketing and communication in the field of sport (Mean = 4.1795; SD = 0.19392); and good governance, Mean = 3.8718; SD = 0.13587.

Overall, the respondents agree that they have acquired this knowledge and skills (Mean = 3.974; SD = 0.133). Therefore, using the ETS program as an intervention is an effective tool in training the migrants as potential sports managers.

Table 3. S*ignificant difference in the knowledge and skills of migrants 'in Bulgaria in the Pre-test and Post-test.*

Knowledge and Skills		Mean	N	Std. Deviation	Std. Error Mean	t	df	Sig. (2-tailed)
1. Administration and Human Resource Management in Sport	Pre-test	1.1282	26	0.16538	0.03243	-71.24	25	.000
	Post Test	4.1410	26	0.09058	0.01776			
2. Coaching and Mentoring	Pre-test	1.6538	26	0.13269	0.02602	-77.42	25	.000
	Post Test	3.8397	26	.03269	0.00641			
3. Digital Skills for Sport Managers	Pre-test	3.0128	26	0.74524	0.14615	-6.58	25	.000
	Post Test	4.0385	26	0.14382	0.02821			
4. Management of Sports Events	Pre-test	1.2436	26	0.21721	0.04260	-59.39	25	.000
	Post Test	3.8782	26	0.14574	0.02858			
5. Financial Sustainability Strategies and Mechanisms for Sport Organizations	Pre-test	1.5128	26	0.43442	0.08520	-25.73	25	.000
	Post Test	4.0385	26	0.14382	0.02821			
6. Marketing and Communication in the Field of Sport	Pre-test	1.5872	26	0.15722	0.03083	-51.98	25	.000
	Post Test	4.1795	26	0.19392	0.03803			
7. Good Governance	Pre-test	1.6667	26	0.13333	0.02615	-59.06	25	.000
	Post Test	3.8718	26	0.13587	0.02665			
Overall	**Pre-test**	**1.6864**	**26**	**0.13731**	**0.02693**	**-67.94**	**25**	**.000**
	Post Test	**3.9982**	**26**	**0.07436**	**0.01458**			

Table 3 shows a significant difference between the respondents' knowledge and skills before and after the infusion of the ETS program, p= .000.

It shows that their pre-test evaluation is lesser than the post-test evaluation. This means that the ETS methodology was effective in developing the knowledge and skills of the migrants in Bulgaria, as respondents showed improvement in the different areas of concern. Moreover, this study reveals that ETS is an effective intervention program to enhance the knowledge and skills of migrant sports professionals as potential sports managers.

This result validates that the ETS methodology was influential in developing the knowledge and skills of the migrants in Bulgaria as potential sports managers. Further, this study reveals that education through sports is an effective intervention program to enhance the knowledge and skills of migrant sports professionals.

Table 4. *Level of Trainer's Expertise in Bulgaria as reflected in the Post-test.*

Trainer's Expertise	Mean	SD	Qualitative Descriptor
1. Expertise	4.9615	0.19612	VH
2. Clarity	4.9231	0.27175	VH
3. Culturally	4.9231	0.27175	VH
4. Time Management	4.9231	0.27175	VH
5. Responsiveness	4.9615	0.19612	VH
Mean	**4.9385**	**0.21740**	**VH**

Scale: *1.00 – 1.49 (Very Low or VL); 1.50 – 2.49 (Low or L); 2.50 – 3.49 (Medium or M); 3.50 – 4.49 (High or H); and 4.50 – 5.00 (Very High or VH)*

Meanwhile, the respondents rated their trainers after the intervention using the ETS program. It can be gleaned in Table 4 that the trainers were rated very high with a mean of 4.9385; SD = 0.21740. The highest rated were the Expertise and Responsiveness of the trainers, Mean = 4.9615; SD = 0.19612, while the lowest were the Clarity, culturally, and time management, Mean = 4.9615; SD = 0.27175.

It can be inferred that the trainers facilitating the intervention program using the ETS methodology also showed a high level of expertise resulting in the effective acquisition of knowledge and skills by the migrants. Before the program, migrants and trainers involved in the local activities showed a deficient level of knowledge, skills, and competencies characterizing an excellent sports manager profile. It means that the training series leads to acquiring knowledge and skills, and they demonstrated these among the migrants, resulting in high ratings the participants gave. As a result, the ETS affected the development of sport manager profiles on migrants, providing a solution to their under-representation in leadership roles within Sports organizations. This methodology should be continuously used as a new strategy to advance sports management skills among migrants in Bulgaria and other parts of Europe.

ACKNOWLEDGEMENT

I sincerely give acknowledgment to all valuable people assistance that helped them in crafting this research study: To all the participants for their full cooperation and active engagement in the conduct of this ETS project; to all collaborators, trainers, and youth workers, for their significant contribution in doing the project; and to their family and friends, for their support and encouragement which contributed significantly to substantiate this piece of work.

REFERENCES

Andonova, D., Acs, M., & Holmes, D. (2013). *Move And Learn. https://www.moveandlearn.org/*. International Sport and Culture Association. Retrieved October 1, 2020, from www.isca-web.org. Edwards, Michael. The Role of Sports in Community Capacity Building: An Examination of Sport for Development Research and Practice. *Sport Management Review*. January 2014.

Elliot, R., & Maguire, J. (2008). Thinking outside of the box: Exploring a conceptual synthesis for research in the area of athletic labor migration. *Sociology of Sport Journal*, pp. 25, 482–497. https://doi.org/10.1123/ssj.25.4.482

European Commission's "Statistics on Migration to Europe." https://ec.europa.eu/info/strategy/priorities-2019-2024/promoting-our-european-way-life/statistics-migration-europe_en. Accessed September 27, 2020.

Eurostat Press Office. (2017, July 10). First population estimates EU population up to almost 512 million at 1 January 2017 Increase driven by migration. *Eurostat Press Office*. Retrieved October 1, 2020, from http://ec.europa.eu/eurostat.

Figel', Ján. (2007, July 11). *White Paper on Sport - European Commission*. https://ec.europa.eu/. Retrieved August 30, 2020, from https://ec.europa.eu/assets/eac/sport/library/documents/whitepaper-full_en.pdf

Molnar, Gyozo, and Joseph Maguire. "Hungarian footballers on the move: Issues of and observations on the first migratory phase." *Sport in Society* 11.1 (2008): 74–89.

Schinke, Robert J., et al. "The challenges encountered by immigrated elite athletes." *Journal of Sport Psychology in Action* 2.1 (2011): 10-20.

Corresponding author:
Roberto Solinas
PhD Student
National Sports Academy "Vassil Levski"
Sofia, Bulgaria
E-mail: president@minevaganti.org

NEW MANAGEMENT APPROACHES TO IMPROVE THE QUALITY OF SWIMMING RESULTS AND SPORT

Natalia Stoyanova
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
Every governing sport organization is looking for ways and approaches to improve the quality of sports results and to increase its mass of active athletes. Those are the key indicators for long-term development.
The aim is to make a more in-depth analysis of the decisions taken by the Management Board of the Bulgarian Swimming Federation for the next competition period and how they will affect the swimming sport in Bulgaria. The focus is on the new standards of swimming results, which will entitle the athletes to participate in National swimming age group championships and the new format of those championships.
The analysis of the results shows that those new standards will enforce the competitors to improve their swimming results too fast during the transition from one to another age group. The competitors in one age group are in a range of 2 or 3 birth years and they need to achieve the same standards no matter whether they are 15 or 17 years of age. The younger ones remain at a disadvantage. The new model of Rules for conducting National swimming age group championships is the other researched item. Previously competitions from this rank were held separately for every age group. The new format includes 2 or 3 age groups competing together. That doesn't allow for diversity in the competition program. The perspective in front of the athletes is to have in 5 consecutive years (from 12 to 17 years) the same type of competition with a repeating competition program.
Discussions over taken decisions are that they will lead to the elimination of a large percentage of athletes, depersonalize the results achieved in their age groups, disappointment, and dissatisfaction. Prolonged stays in such kind of competition are unnecessary and costly in terms of money and time for both - athletes and coaches.
The conclusions are that a set of more precise standards for separate ages and revised regulations for conducting the National swimming championships will preserve the mass and the desire to perform.

Keywords: *swimming standards, age group, national competition rules*

INTRODUCTION

In the modern world athletes, organizers, administrators, and fans are faced with some new challenges which they need to take care of it. Our country's main administrator of swimming sports is the Bulgarian Swimming Federation (BSF). The governing swimming body is also looking for ways to develop, keep and maintain the interests of the people. Improving sports results in all age groups and achieving better international competitiveness is one of the main tasks on the way to enhancing the prestige and quality of swimming sport in the country.

Major activities planned by BSF are in unison with the largest sports event on the planet - the Olympic Games. Due to the one-year postponement of the last Olympic Games - TOKYO 2020 (held in 2021), the next sports and competitive period are three years (2022 - 2024).

Regarding this, the Management Board (MB) of BSF, voted on new standards that will entitle swimmers to participate in the different age groups of National swimming championships - Individual and Team (NSC or "championships") in 25m and 50m pools. The voted changes aim to lay on a strong foundation in swimming opportunities in the lower age groups, which would eventually lead to improved quality of sports results during the period of maximum realization - after 18 years of age. (Konstantinov, 1986; Angelov, 2021)

The current study *aims* to make a more in-depth analysis of the decisions taken by the MB of BSF and how they will affect the development of swimming sport in Bulgaria for the next competition period (2022 – 2024).

METHODOLOGY

The object of study is the decisions taken by the Management Board of BSF (Protocol No. 9, dated 04.11.2021).

The subjects are:

- *The new standards* of swimming results achieved in 50m pool, which will entitle to participate in

the different age group National championships during 2022.

Prepared standards are converted to the point equivalent according to the table of the International Swimming Federation (FINA), which are measured according to the formula P = 1000 * (B / T) 3 (where P - are the achieved points according to the FINA table; B - time of the world record in the discipline, T - the time achieved by the competitor (FINA, 2022).

- *The changes in the form of conducting* different National swimming age group championships.

Applied *methods* include:
- Research, analysis, and summarization of information sources and documents.
- Mathematical - statistical methods for data processing - Variation analysis.
- The statistical indicators that are studied are:
  - Swimming achievements eligible for participation in National swimming championships - *are presented in (min: sec, tenths and hundreds) 00: 00, 00*
  - Percentage (%) of the participants from the last National swimming championship in 50 m pool for the respective ages, which will fall into the developed new standards *(rounded to the decimal point).*
  - Average percentage ($\overline{x}$ %) of competitors meeting the standards
- Systematization and pedagogical analysis of data.

RESULTS

The path for the development of swimming sport in our country for the next 3 years period (2022 - 2024) was determined at the end of competitive 2021 by the MB of BSF. The Board took some administrative, sports, and technical decisions that will follow that path.

Some of the decisions are based on the conclusions from the swimming competitions held during the last 2 years. We need to keep in mind that they took place according to the anti-epidemic situation related to overcoming the consequences of the COVID pandemic.

Due to that, there are raised some comments and suggestions which should be taken into mind if we are searching for different roads and approaches to the development of swimming results while preserving the mass of active athletes, sports longevity, and opportunities for our children to be active and to have chances to perform their favorite sport.

- ✓ One of the key decisions of the Board is under ITEM 3 of the agenda in their meeting *"Adoption of a new standard in the 25m and 50m pool for 2022, entitling to participate in the National swimming championships"*. (Bulgarian Swimming Federation, 2022). This new model challenges the coaches and athletes to work harder to match them.

The currently operating model and the new one are presented in Table 1. It summarizes the FINA points that swimmers must cover to participate in the National swimming championships. The age groups are:
- JUNIOR (boys and girls 12-14 years old);
- SENIOR (boys and girls 15-17 years old);
- MEN AND WOMEN (over 18 years old).

Table 1. *FINA points, which gives rights to participate to different National age group's swimming championships*

Age groups	FINA points *(up to 2021)*	sex	FINA points (voted by MB of BSF)	Approximately % improvement of the standards
JUNIOR	250 p. – 13 years of age 300 p. – 14 years of age	boys girls	350 p.	29 % 15 %
SENIOR	350 p.	boys	430 p.	20 %
		girls	400 p.	13 %
MEN / WOMEN	400 p.	men	480 p.	17 %
		women	450 p.	11 %

A studying of other international swimming organizations - countries from the Balkan region (Granični Rezultati hrvatskog PLIVAČKOG Saveza Listopad 2021; Plivacki Savez Srbije - Serbian Swimming Federation, 2022), about the existence of those kinds of standards showed that they also have such ones for each discipline. It can be confirmed that they are higher than the ones that our swimmers have to cover.

This shows that BSF is trying, by raising the standards, to look for approaches to improve sports results to make Bulgarian swimming competitive with other countries.

Another aspect that we have considered and which is related to the decision taken by the Board is whether these new standards will support the development of our sport and will preserve and increase the mass of competitors. It is an indisputable fact that if there are more athletes, better sports selection can be made by talented and promising young competitors. In order to reach a high level of sports achievements, they have to pass a long way and many years that will lead them to elite swimming performance.

In the context of this problem is prepared Table 2, which examines the percentage (%) of the participants from the last held National swimming championship at the 50m pool that would fall within the developed new standards.

Table 2. *The new standards and the percentage of participants which will fall under those standards*

events	JUNIOR				SENIOR				MAN	%	WO-MAN	%
	boys	%	girls	%	boys	%	girls	%				
50 m Freestyle	29.67	53	33.58	86	27.70	67	32.12	87	26.70	66	30.88	80
100 m Freestyle	1:06.56	57	1:13.37	62	1:02.15	67	1:10.18	70	59.91	76	1:07.47	77
200 m Freestyle	2:24.73	47	2:40.31	69	2:15.13	58	2:33.33	86	2:10.27	88	2:27.43	80
400 m Freestyle	5:12.27	79	5:35.53	83	4:51.56	73	5:20.92	100	4:41.07	70	5:08.57	74
50 м Backstroke	34.05	42	38.28	25	31.79	68	36.61	63	30.65	56	35.20	73
100 m Back-stroke	1:13.57	40	1:21.69	64	1:08.69	38	1:18.13	70	1:06.22	51	1:15.12	60
200 m Back-stroke	2:38.81	45	2:55.03	68	2:28.28	56	2:47.41	61	2.22.94	41	2:40.96	48
50 м Breast-stroke	36.82	30	41.71	51	34.38	50	39.90	60	33.14	56	38.36	70
100 m Breast-stroke	1:20.71	39	1:30.99	57	1:15.35	47	1:27.03	64	1:12.64	44	1:23.68	58
200 m Breast-stroke	2:58.96	54	3:17.39	74	2:47.09	61	3:08.80	67	2:41.07	57	3:01.53	72
50 m Butterfly	31.60	35	34.66	47	29.50	51	33.15	40	28.44	60	31.88	45
100 m Butterfly	1:10.24	46	1:18.72	54	1:05.58	56	1:15.29	69	1:03.22	64	1:12.39	61
200 m Butterfly	2:37.12	42	2:52.84	50	2:26.70	54	2:45.32	55	2:21.42	39	2:38.95	31
200 m Medley	2:41.76	55	2:58.96	78	2:31.03	61	2:51.17	91	2:25.59	50	2:44.58	74
400 m Medley	5:46.00	73	6:17.96	88	5:23.05	75	6:01.50	81	5:11.42	57	5:47.58	68
$\bar{X}$**%**	**49 %**		**64 %**		**59 %**		**71 %**		**58 %**		**65 %**	

The processed data show that a significant percentage of the participants so far would drop out in the coming year, as they will not be able to meet the requirements for the new standards. Already in the first year of the transition to an older age group, a small number of athletes will be able to qualify for participation - only 49% of the boys in the age group "JUNIOR" and 64% of the girls should be able to cover the limited times.

There are swimming standards for the smallest age group, "CHILDREN" (10 – 11 years old), in the basic events – 200m and 400m freestyle. They are presented in Table 3.

Table 3. *Swimming standards for age group CHILDREN*

25m pool		
	man	woman
200m freestyle	2.55	3.05
400m freestyle	6.00	6.20
50m pool		
200m freestyle	3.00	3.10
400m freestyle	6.10	6.29

In support of the data presented above, we also give an example with "the sharp jump" in the requirements for performance results:

- Boys 200m Freestyle entry standard for the age group "CHILDREN" (11 - 12 years old), 50 m pool is 3:00.00 minutes. In their next competition year, in the age group "JUNIOR" (13 - 14 years), the standard entitling the boys to participate in the same discipline is 2:24.73 minutes. This difference means that in just one year, competitors must make a 20% 'jump' in their swimming results.
- The presented example is valid also for the other disciplines, as well as for the other age group - "SENIOR" (15 - 17 years), where the age range is 3 years.

The differences in swimming achievements from one age group to another are huge. Our opinion is that this will lead to the elimination of a large percentage of children in these and subsequent age groups.

Another aspect that needs to pay attention to is that athletes from two or three birth years are included in one age group - JUNIOR and SENIOR. At first glance, this is normal but sometimes a year of age difference can be a "key factor" for improving swimming performance.

Great progress in swimming capabilities is seen at the beginning of the period of puberty. The individual biological and mental development of athletes is manifested in this period. Children with delayed biological development (retardants) are disadvantaged in these age groups. They have to compete not only with competitors two years older but also with standards that are too much for their age development. Therefore there needs to be found an additional way to keep the athletes with delayed development to have a chance to remain active in swimming.

The next decision that directly concerns the development of swimming sport in our country was taken by the Board with *ITEM 2* of the agenda, *"Adoption of internal and international sports calendar for the competition year 2022"*.

The administration, preparation, and implementation of the most important competitions in the internal sports calendar of each federation are the National swimming championships for different age groups. They are the next "key" through which the development of each sport can be influenced. These competitions are the most important and prestigious events that provide an opportunity to perform within the country.

The main document that describes specific requirements for eligibility of participation, how is organized the competitions for the different age groups, and indicates the competition program is the "Rules for conducting National championships in swimming, artistic swimming, and diving".

The format of the championships was changed with the new voted decision. The changes were included in the last held competition at the 25m pool (November 24-28, 2021).

Previously there were separate competitions for the age group "CHILDREN", "JUNIOR", and "SENIOR", and were running for 3 days (4 swimming sessions) each. The championships for "MEN and WOMEN" was OPENED and allowed participation of swimmers over 13 years of age and were held in 4 days (8 sessions), including series and finals - A and B finals.

A decision by the Board was whereby no championships for different age groups. They combined into one competition – Open National swimming championships in 5 competition days (9 sessions) for all age groups "JUNIOR", "SENIOR" and "MEN / WOMEN". The rankings were reported by the morning swimming sessions for "JUNIOR" and "SENIOR", and by the finalists in "MEN and WOMEN".

The analysis of the finalists in the competition (Figure 1) shows that a large part of the participants (especially those in the age group "JUNIOR") found it difficult to get to the final swims and their prolonged stay in the competition was unnecessary and costly in terms of money and time for both - athletes and coaches.

Participation in only one National championship (for "MEN and WOMEN") for all age groups, during the summer or winter seasons, undoubtedly will lead to disappointment and dissatisfaction in the competitors of the younger age groups and depersonalizes the results achieved at their age groups.

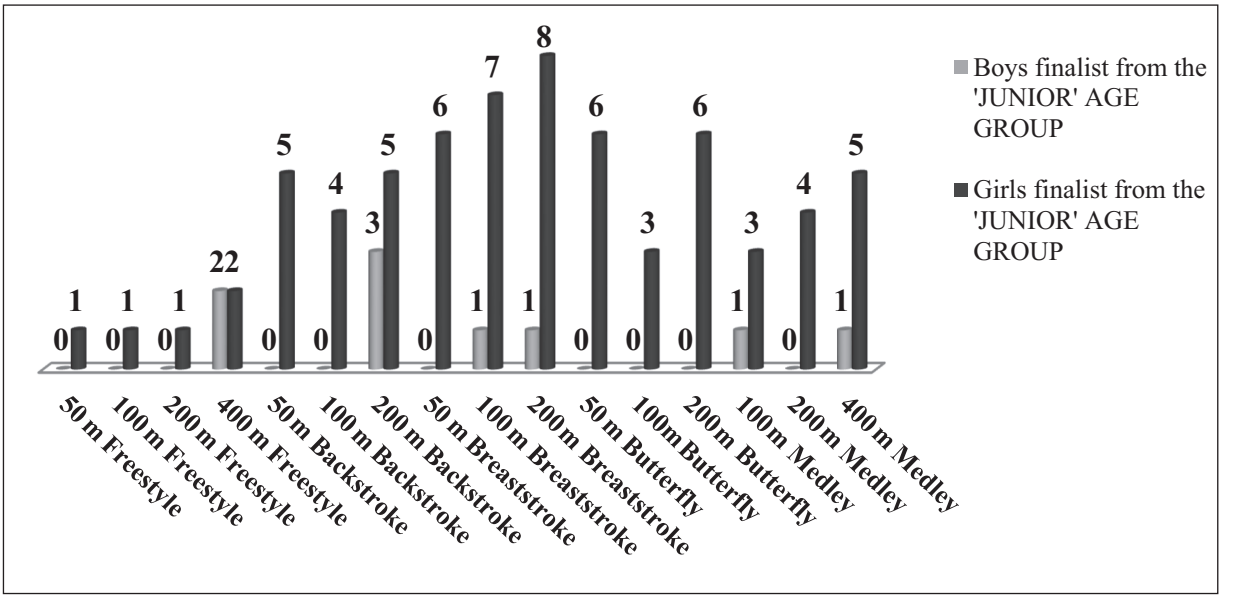


Figure 1. *Number of competitors from the age group of boys and girls "JUNIOR" who made it to the finals in the individual disciplines*

Following the above arguments, the voted decision to merge the National swimming championships according to the internal sports calendar for 2022, will not contribute to maintaining the mass.

There are will be no separate competitions for the "JUNIOR" and "SENIOR" age groups during the summer and winter championships. Those held in the 50m pool in the summer and the 25m pool in the winter will be merged, respectively - "JUNIOR" and "SENIOR" together in summer, and in winter there will be only one open National swimming championship for all ages. The competition events for the age group "CHILDREN" will hold by themselves.

The other point of view is that *the proposed model for conducting championships does not allow for diversity in the competition program. The perspective in front of the boys and girls "JUNIOR" and "SENIOR" age is to have in five consecutive years (from 12 to 17 years) the same type of competitions, with a repeating competition program*. That is another way of losing focus on variety and enjoyment.

CONCLUSIONS

1. The difference in standards from one age group to another is huge. Our opinion is that this will lead to the elimination of a large percentage of athletes in these and subsequent age groups.

To avoid this big difference and to optimize the requirements for participation in the National age group championships, we propose the preparation and inclusion of sufficient standards for all ages - 13, 14, 15, 16, and 17-year-old athletes.

For example, in Table 4 we have given the following FINA points, which are consistent with the desire to improve the quality of achievements in our sport, but not with the cost of drastically reducing the number of participants in National swimming championships.

Table 4. *Standards entitling to participate in National swimming championships*

Age groups	FINA points *(up to 2021)*	sex	FINA points (voted by MB of BSF)	FINA points Our proposal
JUNIOR	250 p. - 13 years of age 300 p. - 14 years of age	boys girls	350 p.	300 p. - 13 years of age 320 p. - 14 years of age
SENIOR	350 p.	boys	430 p.	380 p. - 15 years of age 400 p.- 16-17 years of age
		girls	400 p.	
MEN / WOMEN	400 p.	men	480 p.	450 p.
		women	450 p.	

It shouldn't be forgotten that as a part of the fundraising and categorization of sports clubs are taking into account the number of athletes who participated in National championships. The elimination of a large number of competitors will lead to an even greater reduction in the budgets of the clubs, which will further complicate their existence.

2. Merging the competitions for different age groups isn't a prerequisite for maintaining and increasing the interest of athletes, parents, and coaches. That decision should be carefully analyzed and discussed with the swimming community.

REFERENCES

Angelov, B. (2021). Prodaljitelnost na etapa "maksimalna realizaciya na individualnite vazmojnosti" pri svetovniya elit – maje", *Sport I nauka*, Vol.3, 4/2021, p. 34-42 // Ангелов, Б. (2021). Продължителност на етапа „максимална реализация на индивидуалните възможности" при световния плувен елит – мъже, *Спорт и наука*, кн. 3, 4/2021, p. 34-42

Konstantinov H., (1986). Nastavlenie – mnogoggodishna trenirovka na pluveca // Константинов, Хр., 1986 „Наставление – многогодишна тренировка на плувеца", p. 10

Protokol 9 (2021) ot zasedanie na Upravitelniya savet na Balgarska federaciya pluvni sportove, provedeno na 04.11.2021g, e-mail sent to the swimming clubs on 11.11.2021, 13:27 // ПРОТОКОЛ No 9, от заседание на Управителния съвет на Българска федерация плувни спортове, проведено на 04.11.2021 г.

Bulgarian Swimming Federation (2022). Pravila za provejdane na darjavni parvenstva po pluvane, artistichno pluvane I skokove vav voda. // Българска федерация плувни спортове (2022). "Правила за провеждане на държавните първенства по плуване, артистично плуване и скокове във вода", Retrieved (1 October, 2022) at: https://www.bul-swimming.org/images/STOEV/%D0%9F%D1%80%D0%B0%D0%B2%D0%B8%D0%BB%D0%B0%20%D0%B7%D0%B0%20%D0%BF%D1%80%D0%BE%D0%B2%D0%B5%D0%B6%D0%B4%D0%B0%D0%BD%D0%B5%20%D0%BD%D0%B0%20%D0%B4%D1%8A%D1%80%D0%B6%D0%B0%D0%B2%D0%B-D%D0%B8%D1%82%D0%B5%20%D0%B-F%D1%8A%D1%80%D0%B2%D0%B5%D0%B-D%D1%81%D1%82%D0%B2%D0%B0%20%D0%BF%D0%BE%20%D0%BF%D0%B-B%D1%83%D0%B2%D0%B0%D0%BD%D0%B5%20%D0%BD%D0%BE%D0%BD%D0%BD%D0%BE%D0%B0%D1%80%D0%BE%D0%BD%D0%B8%D1%81%D1%82%D0%B8%D1%87%D0%BD%D0%BE%20%D0%BF%D0%B-B%D1%83%D0%B2%D0%B0%D0%BD%D0%B5%20%D0%B8%20%D1%81%D0%BA%D0%BE%D-0%BA%D0%BE%D0%B2%D0%B5%20%D0%B2%D1%8A%D0%B2%20%D0%B2%D0%BE%D0%B4%D0%B0_compressed.pdf

Bulgarian Swimming Federation (2022). Postjeniya davashti pravo na uchastie v DLOP 2022 – 2024 godina na 25 i 50 metrov baseyn, postignati na 50 metrov baseyn. // Българска федерация плувни спортове (2022). Постижения даващи право на участие в ДЛОП 2022-2024 година, на 25 и 50 метров басейн, постигнати на 50 метров басейн , Retrieved (1 October, 2022) at: https://www.bul-swimming.org/images/Bobby%20Doc/%D0%9D%D0%BE%D1%80%D0%BC%D0%B0%D1%82%D0%B8%D0%B2%D0%B8%202022/%D0%9F%D0%BE%D1%81%D1%82%D0%B8%D0%B6%D0%B5%D0%BD%D0%B8%D1%8F%20%D0%B4%D0%B0%D0%B2%D0%B0%D1%89%D0%B8%20%D0%BF%D1%80%D0%B0%D0%B2%D0%BE%20%D0%BD%D0%B0%20%D1%83%D1%87%D0%B0%D1%81%D1%82%D0%B8%D0%B5%20%D0%B2%20%D0%94%D0%9B%D0%9E%D0%9F%202022-2024%20%D0%B3%D0%BE%D0%B4%D0%B8%D0%BD%D0%B0%20%D0%BF%D0%BE%D1%81%D1%82%D0%B8%D0%B3%D0%BD%D0%B0%D1%82%D0%B8%20%D0%BD%D0%B0%2050%D0%BC.%20%D0%B1%D0%B0%D1%81%D0%B5%D0%B9%D0%BD.pdf

Granični Rezultati hrvatskog PLIVAČKOG Saveza Listopad 2021. 50m ML ... (n.d.). Retrieved October 1, 2022, from https://www.croswimspace.org/Sadrzaj/Rezultati/GRANICNI_REZULTATI_2021-2022.pdf

Swimming points. FINA. (n.d.). Retrieved October 10, 2022, from https://www.fina.org/swimming/points

Plivacki Savez Srbije - Serbian Swimming Federation. (n.d.). Retrieved October 10, 2022, from https://www.serbia-swim.org.rs/images/2022/UO/2022PSS-Propozicije-drzavnih-prvenstava-V.2.06Usvojeno.pdf

Corresponding author:
Natalia Stoyanova, PhD
National Sports Academy "Vassil Levski",
"Water sports" department
1 Gurgulyat str.
Sofia, Bulgaria
E-mail: nat_stoyanova@abv.bg

 DOI: 10.37393/ICASS2022/130 359 - 365

THE MAIN RISKS AND THREATS RELATED TO THE ORGANIZATION AND CONDUCT OF SPORTING EVENTS

Ivaylo Zdravkov, Yoanna Dochevska
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
Since ancient times, the sport has been a symbol of peace, unity, and strength of the human spirit and physical endurance. Sport is an essential component of the life of modern societies. Major sporting events attract the interest of many people from all over the world. This report analyses the main risks and threats related to the organization and conduct of sporting events. The sports incidents are of different natures and could be caused by different factors - bloody terrorist attacks against sportsmen and the public, violence caused by hooligans, or casualties caused by construction demolition or similar incidents. How one prepares, responds, and recovers to mitigate the consequences of emergencies at sports events is a matter of how one prepares, responds, and recovers. Sport managers need to be aware of risk assessment methodologies to detect threats, identify vulnerabilities, and reduce consequences. Information gathered through this process is extremely valuable for enhancing security measures.

Keywords: *safety in sport, risks, risk assessment, security, sport event*

INTRODUCTION

Ever since, the sport has been a symbol of peace, unity, and strength of the human spirit and physical endurance. Sport is an essential component of life in modern societies. Major sporting events attract the interest of many people from all over the world. The development of new and modern technologies has accelerated media coverage of World, European and international sporting events, sports competitions, and tournaments have become more accessible than ever before. The rapid speed of globalization has allowed fans to get together and travel as part of an organized group of supporters or to attend sports events on their own. These general public gatherings to support a particular player or a team have come to represent the unity of mankind, regardless of race, gender, or social status. Yet during these major sports events, the riskstof security and safety of persons are the highest. Sport security is an umbrella term covering a variety of threats emerging either from man-made factors, such as terrorism and negligence regarding safety regulations, or from external phenomena, such as natural disasters, political instability, and pandemics. In recent years, youth radicalization and violence have become significant global issues. It has led to an increase in hate speech, xenophobia, and racist violence, as well as religious and political violent extremism and, ultimately, terrorism. There have been numerous examples in the past where prominent athletes and/or spectators have fallen victim to sports disruptions due to various risk factors. As a result, such incidents could cause considerable damage to both the safety of people and the integrity of the organizations involved.

Some of the most serious incidents during major sporting events are Peru, 1964 (300 fans died and 500 were injured during an Olympic qualifying match), Great Britain, 1971 (Ibrox stadium, "Old Firm" game, 66 deaths and more than 200 injuries), Nepal, 1988 (A stampede towards exits at the stadium in Kathmandu killed more than 90 fans), Great Britain, 1989 (96 people were killed and 200 injured in the English F.A semi-final), Guatemala, 1996 (82 people died at a World Cup qualifying match), and Ghana, 2001 (126 people were killed at Accra's stadium).

Sports events and the threat of terrorism

Terrorism is a global threat. We have witnessed different terrorist attacks carried out in different countries and by different methods. Terrorist attacks can be carried out by terrorist groups, lone-actor terrorists, or radicalized individuals. Many terrorist attacks were perpetuated against sportsmen or the public or were associated with sports games. Some of the major sporting events in the past depicting the link between terrorism

and sport are - the 1972 Summer Olympics (11 Israeli athletes and coaches were taken hostage and then killed), Boston Marathon, 2013 (3 people died, and more than 200 were injured), Stade de France, 2015 (137 casualties, 4 people died).

It is, therefore, reasonable to conclude that security measures and activities are an essential component of the preparation and conduct of sports events. All sports organizations must know the main risks and threats related to the organization and conduct of sporting events, have a risk assessment strategy and take all necessary measures to protect the athletes, the spectators, and officials. It is paramount to identify the greatest threats and eliminate or reduce vulnerabilities, which will help minimize risks.

METHODS

To be as accurate as possible, we have combined two data collection methods that could be synthesized into the following groups - structural content analysis and survey. Obtained data were analyzed statistically through one-dimensional frequency analysis.

RESULTS

To find the main risks and threats related to the organization and conduct of sporting events, the sports organizations should be able to gather and analyze correct data and make a quality and relevant strategy to improve and optimize the safety and security of a sporting event. They should answer two basic questions - what is "Sports security" and do they have a detailed plan of action for a situation that threatens the safety and security of the sporting event - does the organization responsible for hosting a sporting event have a verified and working "Security and Safety Protocol for Sporting Events", and if not, does the organization have the capacity and capability to create, verify and if necessary to implement it.

What is sports security?

To identify the main risks to the organization of sports events, it is important to have an understanding of what sports security means and what it entails. The Council of Europe Convention on an Integrated Safety, Security and Service Approach at Football Matches and Other Sports Events (CETS No. 218) conceptualizes sports security as "*all measures related to the protection of people from being injured or facing a risk to their health and well-being during sports events. This comprises stadium infrastructures and certification and contingency plans*."

Both safety and security, incorporated into risk management and assessment plans, could help reduce risks to the threat of terrorism, violent extremism, natural disasters, and negligence to the safety of critical infrastructure. We have already witnessed bloody terrorist attacks against sportspeople and the public, violence caused by hooligans, or casualties caused by construction failures or similar incidents. We may even anticipate that incidents will happen, emergencies will arise, and attacks might become even more sophisticated. How one prepares, responds, and recovers to mitigate the consequences of emergencies at sports events is a matter of how one prepares, responds, and recovers. Sport managers need to be aware of risk assessment methodologies to detect threats, identify vulnerabilities, and reduce consequences.

Security and Safety Protocol for Sporting Events

Creating a quality and effective "Security and Safety Protocol for Sporting Events" requires in-depth knowledge, experienced experts, and quality strategic, tactical, and operational analysis. These are needed to analyze and assess the risk to the sports facility's vulnerability, develop a strategy for a safe environment and the proper prevention and avoidance of incidents, and create an impact management strategy.

In a survey, part of the Erasmus plus co-funded project "SafeSPORTevent", performed among 214 representatives of sports clubs, sports federations, and organizations from Europe (Bosnia and Herzegovina, Bulgaria, Greece, and Turkey), through the method CAWI (Computer Assisted Web Interviewing) only 42% of respondents stated that their organizations always implement a risk assessment before each sport event. The analysis of this data shows that in terms of optimizing and ensuring security at sporting events, there are many more measures that we can and should take to ensure the safety of viewers, athletes, participants, and officials. (Figure 1)

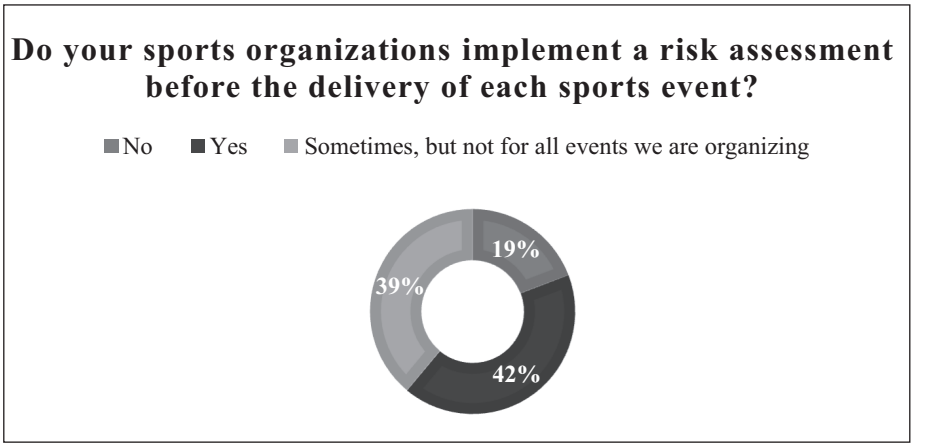


Figure 1. *Do your sports organizations implement a risk assessment?*

A strategic risk assessment delivers wide-ranging financial and operational benefits to sports organizations. By operating in an environment where its risks are fully understood and appropriately controlled, sports organizations can focus confidently on achieving their goals – developing their sport, maximizing event success, and ensuring stakeholder confidence. According to the "SafeSPORTevent" survey, only 57% of sports organizations rely on „Sport & Security "experts to prepare, monitor, and execute a risk assessment. The remaining 43% of organizations prepare and conduct their "Risk assessment" through untrained and inexperienced employees. No efficient and effective safety strategy can be devised by inexperienced or untrained employees. (Figure 2).

Figure 2. *Does your organization count on safety and security experts?*

Risk is an integral element of the sport. This unique aspect of sport must be factored into any discussion of risk assessment and management within sports facilities, programs, and events. A second unique aspect of risk in sports is that the overwhelming majority of opportunities to participate in sports arise out of the efforts of private, non-government, or voluntary organizations. Governments may fund sports and may provide facilities. Private businesses may own professionals and operate sports facilities, but participation in sports is almost entirely the domain of the non-government sector. For this reason, sports organizations must conduct effective, regular, and relevant training on security and safety with speakers who are experienced experts on these topics. Unfortunately, only 17% of the respondents in this survey conduct training on a regular basis, and 47% of sports organizations have no such practice at all. Analysis of this data shows that we need to make serious efforts to improve security and safety at sporting events. (Figure 3).

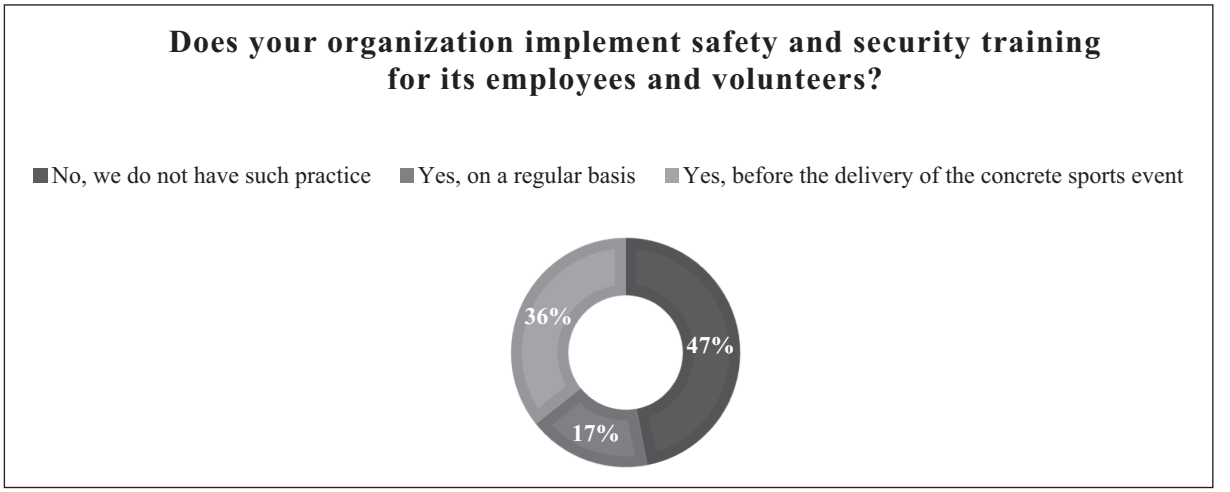


Figure 3. *Does your organization implement safety and security training?*

Different data has been revealed in the following parts of the "SafeSPORTevent" research such as:

- Only 54% of the analyzed sports organizations possess a safety and security procedure (strategy, protocol, guidelines);
- Only 20% of the sports organizations apply risk assessment during the preparatory activities before the sporting event, and only 13% of them apply risk assessment during the event;
- Only 20% of the sports organizations deliver a risk assessment training to the main team of their sports organization;
- Only 17% of the sports organizations deliver a risk prevention training to the participants in the sporting event.

Based on the information above, the factors that could cause security incidents at sports events can be grouped as follows:

Man-made incidents: terrorism, hooliganism, negligence of safety norms, etc.

In recent years, we have witnessed a variety of terrorist attacks - politically or ideologically motivated activities - directed against people and/or infrastructure. In most cases, terrorist activities are motivated by Islamic radicalism or far-right or far-left radicalism. The primary objective of terrorists is to carry out attacks, causing a maximum number of victims, mainly civilians, thus creating panic and chaos. Regarding the methods of committing terrorist activities, actors can make use of bombs, firearms, cold steel – knives, swords, and others. Over the past few years, we have witnessed common means, such as cars and trucks, becoming weapons of mass terrorist attacks. The media coverage of the events, including recording the actions carried out by the terrorists themselves, is an integral component of the desired results. In this way, their goals of achieving greater public response and causing fear and chaos are more easily achieved. Terrorists target sports events for several reasons. First, there is a gathering of many people - athletes and spectators. Secondly, sporting events are the media's focus and a very large circle of people. Third, with an unlimited number of participants and spectators, it becomes more challenging to carry out inspections and security checks and control the movement and behavior of people.

A sample tool used to determine the risk of terrorism incidents is the EU Terrorism Risk Assessment of Public Spaces for Practitioners. A critical evaluation of the probability of certain public spaces becoming a target for terrorist activities includes the following indicators:

- People attendance and site symbolism (for example, cultural, religious, ideological, historical, economic);
- Size and Importance of the facility (consequences if the public space is attacked – human life, logistical, economic, social);
- Specific event and presence of VIPs;
- Accessibility (free, access control, pedestrian, vehicles, etc.).

Even though these weighing factors might be subjective relative to a particular venue, it is reason-

able to conclude that sports events enjoy great attendance, have specific symbolic importance and large-scale nature, and thus possess the attributes of becoming attractive targets of malicious activity. In terms of potential consequences, terrorist attacks are considered low-probability, high-consequence events.

Hooliganism
Hooliganism is widespread in many countries. Sports events could be used as an opportunity to disseminate propaganda. Very often, the participation of hooligans in sports events is accompanied by the use of alcohol and/or drugs, which trigger aggressive behavior. This behavior of hooligans can be life-threatening for many people or can be materialized into vandalism and other illegal activities. A study on the youth and hooliganism in sports events conducted by the Organization for Security and Co-operation in Europe divided risk factors for hooliganism into two groups; personal traits of an individual and external factors.

RAND Europe has also examined the factors associated with violent and antisocial behavior at football events, identifying the following:

- Internal and external or relational psychological factors (rush of adrenaline, sense of meaning, etc.);
- Sporting rivalries and Socio-political factors, such as unemployment, repression by state agents, and ethnic-nationality tensions;
- Situational and atmosphere-related factors: these include, but are not limited to, the size of the football game, the match venue, and the crowd size.

Overall, the threat of hooliganism can be considered a multi-layered occurrence, which is very often unpredictable and bears serious consequences.

Lack or negligence of safety regulations
Failure to perform regulated activities or non-compliance with safety rules and regulations are also common actions or omissions that can lead to accidents at sporting events. These can be non-compliance with fire regulations, which can lead to fires, the admission of more people in certain facilities, which could cause the destruction or collapse of infrastructure under pressure from spectators, and many others.

Natural disasters (tornadoes, hurricanes, floods, earthquakes)
Natural disasters are diverse and rarely predictable. It is very difficult to predict exactly when, with what force, and in what way they can influence one or another event. For example, in 2010, due to a volcanic eruption, all air traffic over Northern Europe was suspended. All these require sporting bodies to adapt to the changing climate environment.

Political instability, wars, pandemics
Political instability and wars create severe risks to sporting events, athletes and spectators. A good risk analysis should be made when deciding to send athletes to participate in sports competitions in risky regions and individual unstable countries. The risk posed by pandemics can be seen in the example of COVID-19. The pandemic has caused major disruptions to the planning and conduct of sporting competitions. This has affected both athletes and organizers. Holding sporting events with a mass gathering of people can be a factor in the spread of the disease, thus compromising the measures of the health authorities. According to the World Health Organization (WHO), "sports events can attract a particularly high attendance of domestic and international spectators who come together at stadiums, pitches and fan zones but also before and after the events themselves.

Hybrid risks
Hybrid risks are relatively new and are mostly associated with the mass penetration of social networks into human life and the ability to receive and send information anytime and from any place. Generating and sending fake news related to a sporting event, athletes, or the public can provoke unwanted actions and cause negative consequences. It is important to analyze the possible risks and identify channels and ways to share valid and reliable information. The spread of inaccurate or false information could directly affect major sporting events. A recent case showing the impact of hybrid threats to sports security was the spread of disinformation and fake news on the spread of Zika during the 2016 Olympic Games in Rio de Janeiro, Brazil.

Cyber attacks
Cyber-attacks can affect any high-tech activity, leading to negative consequences for systems and

equipment. The advent of Internet-based solutions will make systems increasingly risky in terms of cyber-attacks. This is why cybersecurity must be a priority for every activity, including the organization and holding of sporting events. Preliminary assessment of vulnerabilities and taking adequate measures for protection and defense are mandatory for sports managers. The "t*echnification*" of sports is set to continue, and digital technologies will be incorporated into every aspect of the sporting experience. From the scoring systems and the care of athletes to "smart" stadiums and device-enhanced viewing experiences for fans. Despite the improvements that come with the development of technology, many future risks include hacks that would cut to the integrity of the sporting event results and the key operations at stadiums. Hacks affecting the integrity of sports are particularly concerning because they can be difficult to identify. It is problematic to detect when a digital system has been compromised.

Threats from new and disruptive technologies

Technological developments have undoubtedly contributed to the progress of mankind. Yet, the rapid advancement of IT systems and electronic devices comes with certain downsides in terms of predicting and detecting the negative impact of their application. One of the technological developments with the highest risk of disrupting a sports event is the so-called unmanned aerial vehicles (UAVs), commonly known as drones. Drones can be used for potentially attaching an explosive device to a drone, which may cause serious damage.

In the field of security, the European Union has developed the following policies:

- EU Counter-Terrorism Strategy, adopted by the European Council in 2005, commits the Union to combat terrorism globally while respecting human rights and allowing its citizens to live in an area of freedom, security, and justice. It is built around four strands - prevent people from turning to terrorism and stop future generations of terrorists from emerging, protect citizens and critical infrastructure by reducing vulnerabilities against attacks, pursue and investigate terrorists, impede planning, travel, and communications, and cut off access to funding and materials and bring terrorists to justice;
- European Agenda on Security - based on its objectives, the Commission adopted several measures to deny terrorists as much as possible the means to carry out attacks, strengthening the defenses and building resilience against the terrorist threat;
- Directive on combating terrorism that reinforces the legal framework so that it covers more comprehensively conduct related to terrorism. Member States should have in place mechanisms to provide for efficient emergency response, including access to reliable information, thereby avoiding any additional suffering for victims of terrorism.

DISCUSSION

A central element for minimalizing and reducing the main risks and threats related to the organization and conduct of sporting events is to support the sports organizations in protecting society and critical infrastructures from attack. Those efforts involve a broad spectrum of governmental, private, and non-government partners. Specific areas of focus should include the prevention of terrorist attacks using chemical, biological, radiological, and nuclear materials, the protection of public spaces, explosives, and critical infrastructure protection. Sports organizations should work to track threats and develop „Safety & Security" training, guidance, manuals, and protocols. The sports sector should work on specific policies on reaction and preparedness for biosecurity and medical emergencies such as the COVID-19 pandemic that can also be applicable for any kind of huge group gatherings - concerts, festivals, exhibitions, and others. Last but not least, specific security training of sports entities is critical for ensuring the safety of all involved in them as officials, athletes, and/or spectators.

REFERENCES

Council of Europe. (2022, March 22). The Convention on Safety, Security and Service: now in force! Retrieved September 17, 2022, from https://www.coe.int/en/web/sport/-/the-new-convention-on-safety-security-and-service-now-in-force-;

How to Enhance Public Safety With Emerging Technologies. (2020, April). *https://securitytoday.com/*. Retrieved from https://securitytoday.com;

Sporting events during the COVID-19 pandemic considerations for public health authorities. (2021, May 28). *https://www.euro.who.int/*. Retrieved from https://www.euro.who.int;

Terrorism Risk Assessment of Public Spaces for Practitioners. (n.d.). Retrieved September 17, 2022, from https://ec.europa.eu/newsroom/pps/items/674909;

Violent and Antisocial Behaviours at Football Events and Factors Associated with these Behaviours. (2018). Retrieved September 17, 2022, from https://www.rand.org/content/dam/rand/pubs/research_reports/RR2500/RR2580/RAND_RR2580.pdf;

Youth and Hooliganism in Sports Events. (n.d.). Retrieved September 17, 2022, from https://www.osce.org/serbia/118397;

Zika Outbreak of 2016. (2021, September). Retrieved from https://link.springer.com/chapter/10.1007/978-3-030-49576-3_32.

Corresponding author:
Ivaylo Zdravkov,
PhD student in
National Sports Academy "Vassil Levski"
Sofia, Bulgaria
E-mail: zdravkov.nsa@gmail.com

REQUIREMENTS FOR PERSONAL QUALITIES AND PROFESSIONAL SKILLS OF SPORTS OFFICIALS IN BULGARIA AND EUROPE

Ivan Slavchev
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
The current study aims to reveal the requirements for sports officials' personal attributes, professional skills, and knowledge in Bulgaria. The article analyzes data gathered during the ONSIDE Erasmus+ project. The research has been conducted through a specially designed questionnaire, available in 18 languages and distributed electronically. There are 220 respondents, which encompass well over 50 different sports. There are 31 countries represented in the study, including some outside of the EU. Responses are divided into three groups: Bulgaria, Eastern Block, and Western Block countries.
The current article examines if there are any differences in the expectations for the sports officials in Bulgaria, compared to the representatives of the other two groups, based on the different political histories of the countries in the three groups. The responses to each question were checked for statistically significant differences between each pair of the three groups using the Mann-Whitney U test. Four personal attributes show differences between Bulgaria and the Western bloc, and two with the Eastern bloc. As for the skills and abilities, there is one in each comparison with Bulgaria. Additionally, a comparison between the western and Eastern bloc countries was conducted, showing no significant differences in attributes, but three in skills and abilities.

Keywords: *sports officials, personal attributes, skills, competencies*

INTRODUCTION

Sports officials have been an integral part of sports since the emergence of organized sports. As the sport has developed and changed with time, so have the requirements for the personal attributes and skills of the officials. Technology has been and continues to be introduced into officiating. The audiences grow bigger and broader, and even the core rules of many sports have been amended to correspond to the different challenges of sports events.

Sports officials are subjected to a lot of stress, which stems from different topics. As Cuskelly and Hoye point out (2013), there are five primary sources of stress for sports officials:

- insufficient time to train, prepare, participate, etc.
- lack of recognition for the position in general, as well as individual performance
- possibility for physical harm from fans or athletes
- fear of making mistakes and poor performance on duty
- conflicts with other officials, coaches, athletes, etc.

In the foreword of *Successful sports officiating,* Grunska (1999) points out that to be a good sports official, one needs to blend many qualities, likening the officials to a judge, a police officer, a diplomat, or a parent. In their book *Sports officials and officiating: Science and practice*, MacMahon et al. (2015) provide some guidelines on the different skills and personal attributes that the officials need to have, such as physical abilities, visual perception, judgment and decision-making, game management, self-awareness, commitment, self-reflection, etc.

One of the significant obstacles in researching sports officiating is the wide variety of sports and duties that the officiating person may have. However, there are a lot of attributes and skills that are common ground for all sports.

In the current article, we examine the responses of representatives of national and regional sports federations and organizations on the requirements they have put forward to the officials in their sport. Such a study can provide critical insights into the most valued personal attributes and professional skills that an aspiring sports official would be willing to develop. It can help guide the establishment

of officials' training and education courses, as well as find overlapping areas that will allow the mobility of officials between countries or sports.

METHODS

The *study sample* is 220 respondents, representatives of national or regional sports federations or multisport organizations. There are 30 countries from the European continent and well over 50 different sports represented in the study.

The respondents were asked to complete a questionnaire, which analyzed 19 personal attributes and 19 professional skills and abilities of the sports officials. There were three options for each of the 38 questions: Not important, Desirable, Essential.

The responses have been divided into three groups:

- Bulgaria – 19 respondents
- Western Block – includes the countries Austria, Belgium, Denmark, France, Germany, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and United Kingdom – 166 respondents
- Eastern Block – includes Croatia, Czech Republic, Estonia, Finland, Hungary, Kosovo, Latvia, Poland, Romania, Russia, Serbia, Slovakia, and Slovenia – 35 respondents.

The results of each group were checked against the other two groups using the Mann-Whitney U test to reveal statistically significant differences.

RESULTS

The results show a similarity in the general order of the analyzed attributes and skills. Figure 1 shows the order of personal characteristics according to the Bulgarian respondents.

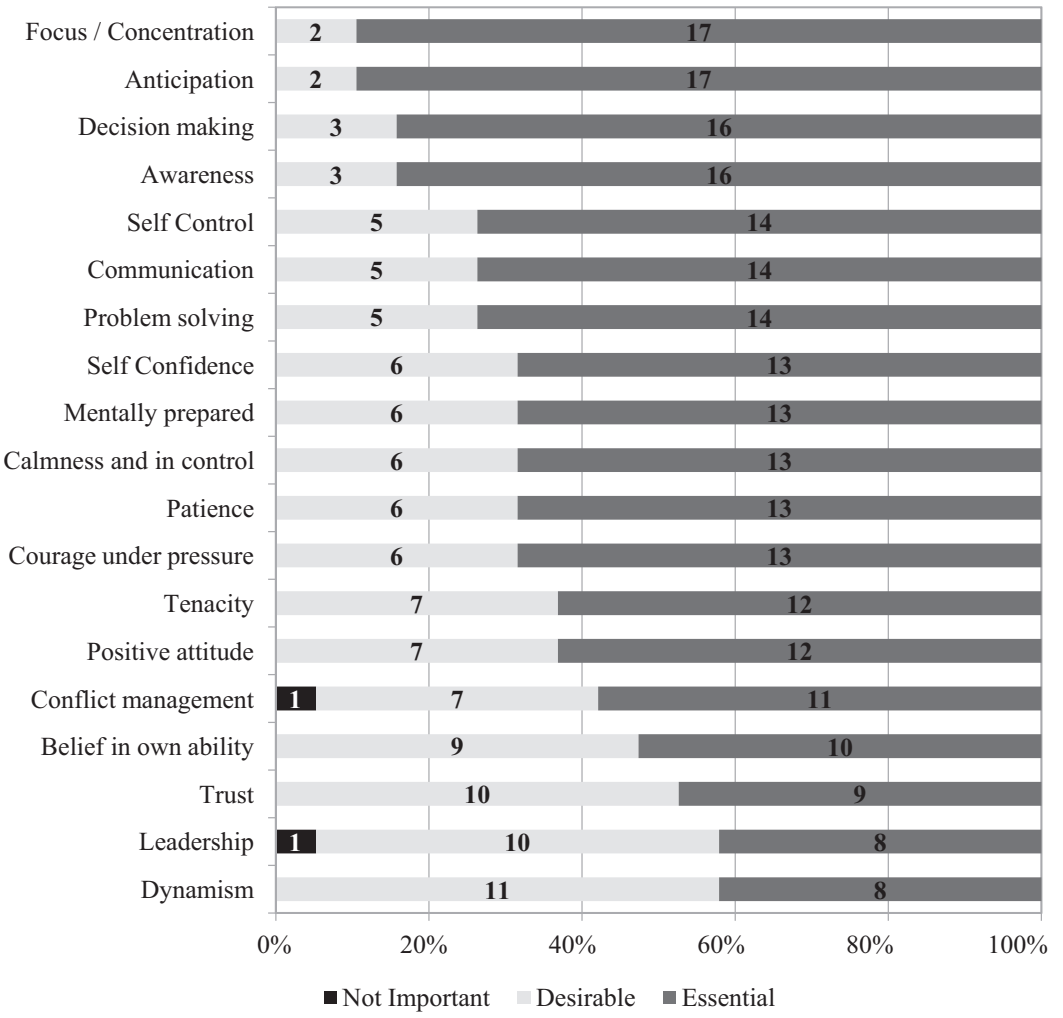


Figure 1. *Personal attributes by importance (data labels show No. of cases)*

Although it's been observed that sports officials operate under much stress, the "calmness and in control" and "courage under pressure" answers are in the middle of the requirements. Interestingly "leadership," "belief in own ability," and "conflict management" are also falling behind.

The results on the order of professional skills and abilities can be observed in Figure 2.

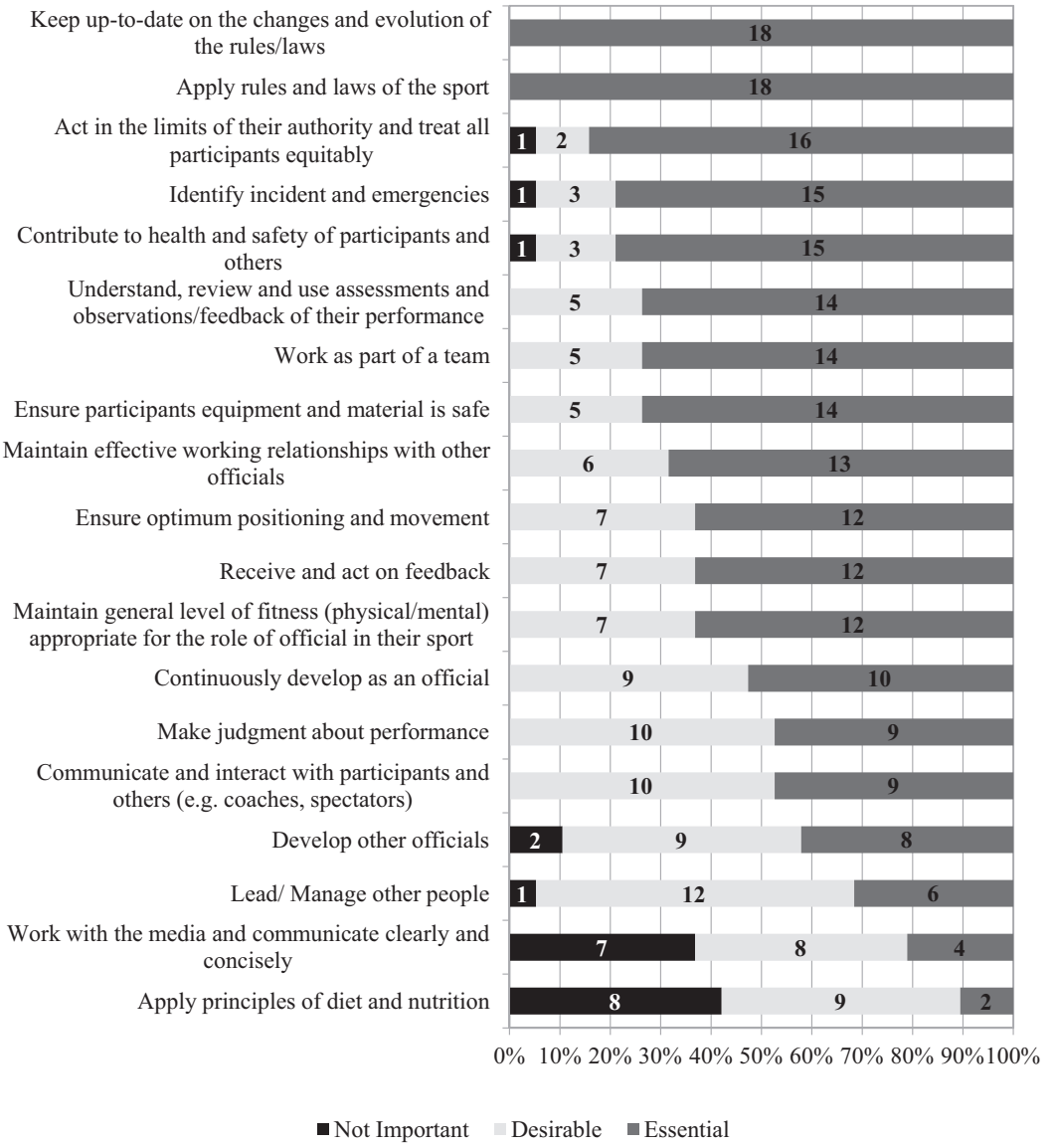


Figure 2. *Skills and competence of sports officials*

Understandably, the most important competence of a sports official is keeping up to date with the changes or evolution of the rules and applying those rules in their duties. On the other end is the ability to apply the principles of diet and nutrition, as well as work with the media and communicate clearly and concisely. The evaluation of developing other officials and leading other people is also very low.

Comparing the responses of the three groups, there was a statistically significant difference in the results on "Trust" between Bulgaria and the Eastern Block (α=.015), as well as between Bulgaria and the Western Block α=.003), shown in figure 3.

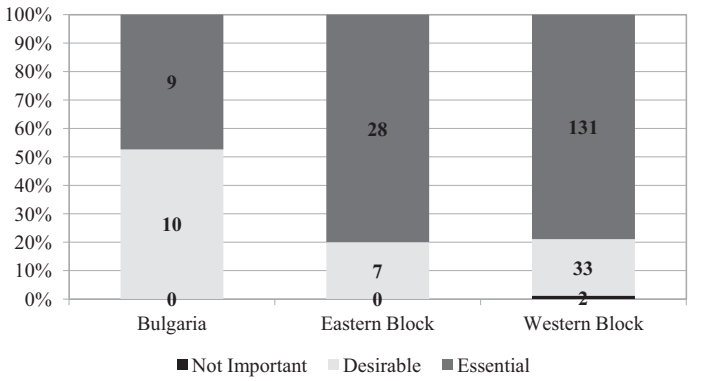


Figure 3. *Answers on the "Trust" as a personal attribute*

We can see that most of the respondents from the Eastern and the Western block countries value that quality as Essential. In contrast, for Bulgarian respondents, it is equally distributed between the answers "Desirable" and "Essential."

Another attribute with a significant difference between Bulgaria and the other two groups is Anticipation (Figure 4).

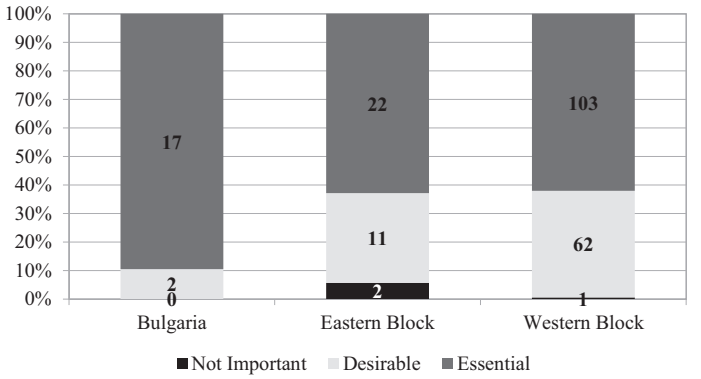


Figure 4. *Responses on the "Anticipation" personal attribute*

In this case, the Bulgarian respondents value anticipation as essential more than the representatives of the Eastern (α=.036) and Western (α=.018) block countries.

Two more personal attributes differ between Bulgarian respondents and only the Western block countries. Those are "Positive attitude" (Figure 5) with α=.031 and "Calmness and in control" (Figure 6) with (α=.001).

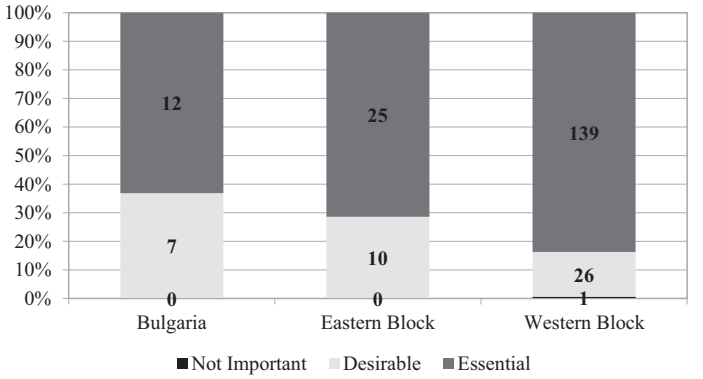


Figure 5. *Answers to "Positive Attitude"*

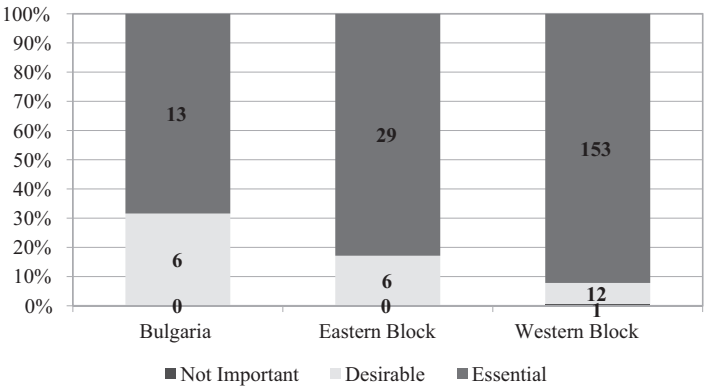


Figure 6. *Answers on "Calmness and in control"*

The figures show that the Western block countries value those two attributes as essential much more than the Bulgarian respondents.

One professional skill for each of the two groups is different compared to the Bulgarian results. The Western block countries seem to have less interest in maintaining the general level of fitness (α = .016, Figure 7), while the Eastern bloc countries are considering "Ensure participants equipment and material is safe" not to be so much essential as desirable (α=.009, Figure 8).

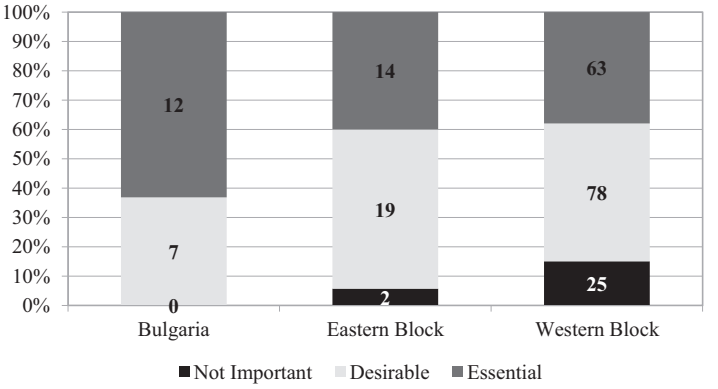


Figure 7. *Maintain a general level of fitness (physical/mental) appropriate for the role of official in their sport*

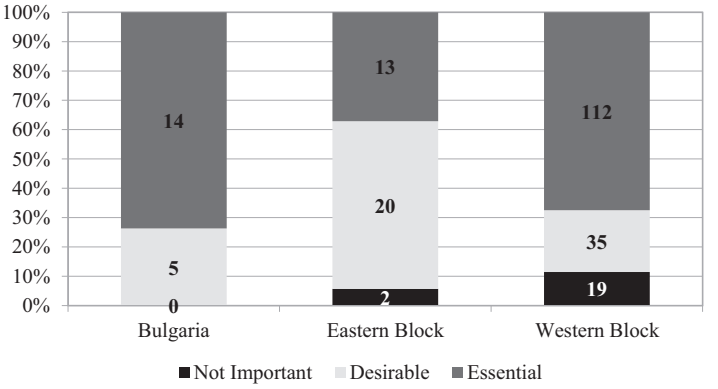


Figure 8. *Ensure participants' equipment and material is safe*

A comparative analysis has been made between the Western and Eastern block countries. Three items from the personal skills and competencies list showed a significant difference. One of those is shown in figure 8. Ensure participants' equipment and material is safe (α=.007), which Eastern block

countries' representatives evaluate as lower than the Western block.

The other two do not coincide with the differences between the answers of Bulgarian respondents and any of the other two groups. The skills to "Work with the media and communicate clearly and concisely" shows a difference at α = .035. While not considered essential by the majority in any of the groups, there is a significant part in Bulgarian (36,8%) and Western Block (38,6%) responses that consider it not necessary.

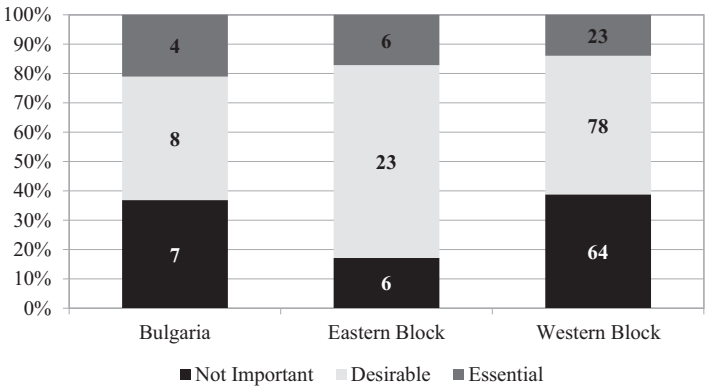


Figure 9. *Work with the media and communicate clearly and concisely*

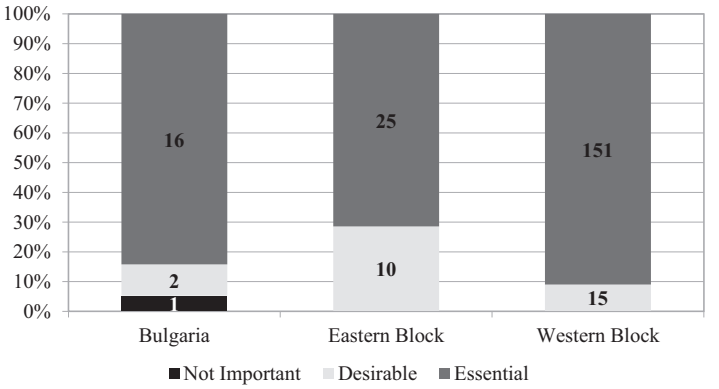


Figure 10. *Act within the limits of their authority and treat all participants equitably*

The other item is "Act within the limits of their authority and treat all participants equitably" at a significance of α=.002 (Figure 10). We can see that the "Essential" option takes a minor part in the Eastern Block respondents compared to the Western.

There were no significant differences concerning the personal attributes between the Eastern and Western block respondents.

DISCUSSION

While most factors showed no significant difference, some items can be deemed different between the three analyzed groups. These differences might be considered due to differences in culture between the countries. For example, sport is still not very inclusive in Bulgaria, compared to the Western Block countries, which might be the reason behind the higher expectation for general fitness.

It also should be noted that while the respondents of Bulgaria are 19 out of the 206 licensed federations, their number is relatively low and is not a solid base to make a general assumption from. Even more – there are differences by sport that are to be analyzed in a later publication that might prove to be more correlated to the answers than the country and its background.

However, not having significant differences between the countries can be considered a positive result, as it shows again that sport transcends borders and provides a common ground for people to express and perform.

ACKNOWLEDGMENTS

The data used in this study was collected during the *ONSIDE Project – Enhancing the Skills of Sports Officials in Europe,* funded by the Erasmus+ Sports program of the European Commission.

REFERENCES

MacMahon, C., Mascarenhas, D., Plessner, H., Pizzera, A., Oudejans, R., & Raab, M. (2015). *Sports officials and officiating: Science and practice.* Routledge/Taylor & Francis Group.

Cuskelly, G., & Hoye, R. (2013). Sports officials' intention to continue. *Sport Management Review*, 16, 451–64.

Grunska, J. (1999). *Successful sports officiating.* Human Kinetics

Corresponding author:
Ivan Slavchev, Ph.D.,
National Sports Academy "Vassil Levski"
Studentski grad, 21 Acad. Stefan Mladenov Str.
Sofia, Bulgaria
E-mail: ivan.slavchev@nsa.bg

IMPLEMENTATION OF NATIONAL YOUTH POLICIES BY MEANS OF A PROGRAM-PROJECT APPROACH

Desislava Ilieva
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
As a result of technological change, demographic trends, discrimination, social insulation and a number of other consequences for society, young people need resilience and the ability to adapt to these challenges. The European Union's (EU) Youth Strategy aims to engage young people aged between 15- 29 and become active citizens, making the most of the potential of youth policy. In such a way, the social and civic participation of young people in democratic life would be encouraged and the necessary resources would be guaranteed. (1) The implementation of youth policy at national level promotes initiatives for the sustainable development of youth.
The main goal of the research is to reveal, analyze and present the role of the program-project activity for imposing state youth policy in Bulgaria through in-depth structural content analysis, as well as through case study. This has a direct bearing on and it contributes to the development of the vision for young people and the stable implementation of the policies pursued in youth sector by the Ministry of Youth and Sports. The object of research and study are legislative acts, programs, and implemented projects in the field of youth policies, and the subject is their impact and importance for the promotion and activation of young people in Bulgaria.
The analysis in the field of the overall youth policy at the national level is a necessary precondition both in the strategic and management, and in the imposition of established European practices.

Keywords: *Management, Youth activities, Sports, Programs, Projects*

INTRODUCTION

Currently, the ambition of the Council of Europe in the field of youth is to promote and support the development of high-quality and effective youth policies at local, national and European level. These are levels based on common basic principles, values and approaches, while taking into account the political, economic, and social differences, historical context and cultural traditions of member states (A European framework for youth policy, 2006). The objectives of these policies are directly linked to the social task of youth "to enable young people, aged 15 to 29, to be active citizens both in society and integrated on the labor market". (Official Journal, 2018). It is necessary for youth policy to promote young people's access to autonomy and identity and their ability to develop and express their ideas, to be responsible, creative and engaged, as well as to reflect and accept values such as pluralistic democracy, human rights, social justice, equal opportunities, social cohesion, solidarity and peace (EU Youth Strategy, 2019-2027).

In Bulgaria, the National Youth Strategy 2021-2030 currently considers young Bulgarians as "Capable, committed and empowered young people, ready to develop their full potential and consciously to contribute to the development of the Republic of Bulgaria in the context of the European family and the global world" (Natsionalna strategia za mladezhta 2021 – 2030). The main goals set in the strategy are: "Promoting non-formal education; Promoting employment and support for young people who are not engaged in education, employment or training (NEETs); Promoting the engagement, participation, and empowerment of young people; Development and confirmation of youth work on a national scale; Connectivity, tolerance and European belonging; Promotion of a healthy and nature-saving lifestyle; Promoting culture and creativity among young people" (Natsionalna strategia za mladezhta 2021 – 2030). The financing of this Strategy is carried out as a priority by means of the national and municipal programs for the youth, within the defined budgets for the respective year (Slavchev, 2016). Funds can also be provided through project financing from active programs of the European Union, the Council of Europe, and other sources (Draganov, Deleva, 2007).

Expanding access to services for young people and their social inclusion is implemented through the National Youth Program (2011-2015, 2016-2020, 2021-2025), which follows the National Youth Strategy (2010-2020, 2021-2030) and is in sync with the opportunities provided by the EU through the hor-

izontal programs "Youth in Action" and "Lifelong Learning" (Global Employment Trends for Youth, 2022). The priorities of the European youth policy and the reported needs of young people inevitably impose the foundations of the National Program at the local level (Winzen, 2008). Until 2013, the implementation of the Program was under the management of the Minister of Education, Youth and Science. By decision of the National Assembly of May 29 of the same year, the Ministry of Physical Education and Sports was transformed into the Ministry of Youth and Sports (MYS), and the Ministry of Education, Youth and Science - into the Ministry of Education and Science (Ustroystven pravilnik, 2022). Control over the implementation of the Youth Program passes to the Minister of Youth and Sports, and the funds for its activities are provided by the budget of the Ministry of Youth and Sports.

METHODS

The main goal of the research is to reveal, analyze and present the role of the program-project activity for imposing state youth policy in Bulgaria through in-depth structural content analysis, as well as through Case study. This has a direct bearing on and it contributes to the development of the vision for young people and the stable implementation of the policies pursued in youth sector by the Ministry of Youth and Sports.

The object of research and study are legislative acts, programs, and implemented projects in the field of youth policies, and the subject is their impact and importance for the promotion and activation of young people in Bulgaria.

Over the period 2013-2020, three National Youth Programs (NYP) were developed and implemented to expand access to services for young people and their social inclusion in the country.

RESULTS

In 2013, the Program financed projects for youth activities of non-governmental organizations (NGOs) under the following sub-programs: Sub-program 1. "Development of the network of youth information consulting centers (YICC)"; Sub-program 2. "National youth initiatives and campaigns"; Sub-program 3. "Youth volunteering and participation in voluntary initiatives"; Sub-program 4. "Development and recognition of youth work".

The Program's target group is young people aged 15 to 29, youth workers and other specialists who are directly involved in the provision of services or other activities supporting youth development, as well as youth informal groups, youth organizations and other institutions, which directly or indirectly support the implementation of initiatives or activities for youth development.

Over the years, under these projects, young people have used the information services provided by the YICCs in this country. Consulting services to support the personal and social development of young people, including the development of life skills, reaches young people aged between 15 and 24 (after which the scope is extended to the age 15 - 29), both in large cities and in small settlements (Zlatev, Bachev, 2019). The services provided to organize free time for young people have reached hundreds of thousands of people, according to the report (Godishen doklad za mladezhta, 2020). A number of regional and national campaigns for the dissemination of health information tailored to the needs of young people by mobilizing youth information networks have been reported (Table 1).

Table 1. *Funded projects under the program for the development of Youth Information Consulting Centers (YICC).*

	YICC 2013	**YICC 2014**	**YICC 2016**	**YICC 2017**
Funded projects under the Sub-program 2 and 3	63	61	32	17
Approved projects and functioning centers under the Sub-program 1	31	32	36	36
		The centers are implemented over a period of 2 years and they are reported in 2015	The centers start work in the beginning of 2017	The centers continue to exist as of 2016
Total number of funded projects	**94**	**93**	**68**	**53**

In 2016, in reference to the expiration of the National Youth Program, a new one had been developed, based on the conclusions and recommendations of the prepared independent evaluation of the previous one. During the evaluation of the Program, measurable indicators were identified and studied, which were used to determine the specific expected results for the period 2016-2020. The vision and priorities of the Program were discussed with the non-governmental sector in the country.

The priorities of the Program during the new period of action are related to creating opportunities to increase the administrative capacity of the organizations implementing projects, increasing the quality of services provided to young people on the territory of the country and covering a larger number of young people in activities, initiatives and campaigns to support youth development. A new regulation is approved that clarifies and optimizes the conditions for applying with project proposals, thereby creating an opportunity to participate in the Program with their project ideas for the implementation of activities for the benefit of the youth in the country and other persons, in addition to legal entities with a non-profit target - informal youth groups (Table 2). In this way, the National Youth Program becomes available to young people who are not members of a non-governmental organization, but want to implement activities related to its goals and priorities.

Table 2. *Funded projects under the National Youth Program (NYP).*

Year	Project financing /BGN/	Number of funded projects	Number of youths at the age of 15 - 29 covered	Number of services and activities provided (consulting and information services, for organizing free time, campaigns, trainings, etc.)
NYP 2013	696 745	94	302 752	31
NYP 2014	1 409 010	93	11 997	5 655
NYP 2015	1 680 259	58	217 075	4 648
NYP 2016	1 537 092	68	7 428	297
NYP 2017	464 992	17	219 133	48 362
NYP 2018	630 699	25	15 637	418
NYP 2019	783 706	53	27 251	722
NYP 2020	714 500	46	12 380	517
TOTAL	**7 917 003**	**454**	**813 653**	**60 650**

The goals of the Program are to support the implementation of the following strategic goals of the National Youth Strategy (2010-2020): Facilitating access to quality services for special support of the full personal and social development of young people in accordance with their needs and interests. Promoting a healthy lifestyle among young people. Development of volunteering among young people as a driving force for personal development, mobility, learning, competitiveness, social cohesion, solidarity between generations, and formation of civic self-awareness. Creating an attractive environment for the development of young people in small settlements and rural areas. Establishing of a favorable, encouraging, and supportive environment for quality professional realization of young people in Bulgaria.

In 2017, the Ministry of Youth and Sports established a new National Program for the implementation of youth activities pursuant to Article 10a of the Gambling Act. The program is a tool for building socially responsible behavior in accordance with the principles of the Youth Law (2012), the priorities of the National Youth Strategy (2010-2020) and the European youth policy.

The target group of the program is young people aged 15 to 29. The program focuses on problematic topics of extreme importance for our mod-

ern society - risky behavior and various forms of addiction (to cigarettes, alcohol, drugs, medicines, gambling, Internet, telephones, television, and others) among young people. The objectives of the Program are to build socially responsible behavior and prevention of various types of addictions and/or aggression, thereby improving the quality of life and the environment in which young people live and communicate in this country.

The program has been developed in different thematic areas and directions and is in response to the observed negative trends regarding various forms of aggression, addictions, and risky behavior amongst young people.

Table 3. *Funded projects under the National Program for the Implementation of Youth Activities (NPIYA).*

Year	Project financing /BGN/	Number of funded projects	Number of youths in the activities	Number of services provided
NPIYA 2017	1 927 549	63	149 124	505
NPIYA 2018	1 988 974	42	94 352	1 419
NPIYA 2019	1 968 487	41	231 438	1 062
NPIYA 2020	1 976 177	38	272 369	591
TOTAL	**7 861 187**	**184**	747 283	3 577

Table 3 shows the total number of approved and funded projects over the years under the National Program for the Implementation of Youth Activities - 184 worth BGN 7 861 187. The number of young people covered in the various activities is 747 283, and the services provided number 3577, including activities for the implementation of awareness and publicity measures; seminars and trainings; initiatives; discussion forums, round tables; tools for influencing the target group; sporting events, etc.). The idea is to create conditions for building socially responsible behavior by promoting a healthy lifestyle, prevention of aggression and various forms of addiction amongst young people.

DISCUSSION

For the purpose of realizing successful youth policies, it is necessary to shed light on the importance of youth in building a better future with opportunities for learning, shared vision, meeting people and participating in social activities throughout the country.

The dynamic development of youth concerning policies requires the provision of an effective mechanism for assessing the impact and effectiveness of the applied program-project approach. The analysis of the implemented policies and measures following the National Youth Strategy clearly distinguishes the promotion of social inclusion and the opportunities for sustainable development of young people. However, a timely update based on data analysis and trends is needed for the purpose of tracking the impact of the imposed youth policy.

The impact assessment should be formulated by the degree of synchronization with the national and European framework in the field of youth policies, as well as by an analysis of the indicators for tracking a sustainable and stable policy.

REFERENCES

Council of Europe. (2006). *A European framework for youth policy*, pp. 26-27.

Draganov, G., Deleva, N. (2007). Vazmozhnosti za finansirane v sporta chrez uchastie s proekti. *Sport i nauka*, br. 4. pp. 125-129. // Драганов, Г., Делева. Н. (2007). Възможности за финансиране *в* спорта чрез участие *с* проекти. *Спорт и наука*, бр. 4. с. 125-129.

EU Youth Strategy. (2019-2027). *European union.* Available at: https://youth.europa.eu/strategy_en#:~:text=The%20EU%20Youth%20Strategy%20focuses,European%20Youth%20Goals%20were%20developed (accessed 06 June 2022).

European Union. (2018). *Information and Notices*, Official Journal, 18 December, pp. 2-3,6-7.

Global Employment Trends for Youth. (2022). *Investing in transforming futures for young people*. Geneva: ILO, pp. 7-8, 42-44.

Godishen doklad za mladezhta. (2020). Natsionalna informatsionna sistema za mladezhta/ Годишен доклад за младежта. (2020). Национална информационна система за младежта. Available at: https://nism.bg/bg/

(accessed 28 July 2022).

Natsionalna programa za mladezhta. (2011-2015) / Национална програма за младежта. (2011-2015). Available at: https://www.strategy.bg/StrategicDocuments/View.aspx?lang=bg-BG&Id=707 (accessed 30 June 2022).

Natsionalna programa za mladezhta. (2016-2020) / Национална програма за младежта. (2016-2020). Available at: https://www.strategy.bg/StrategicDocuments/View.aspx?lang=bg-BG&Id=986 (accessed 30 June 2022).

Natsionalna programa za mladezhta. (2021-2025) / Национална програма за младежта. (2021-2025. Available at: https://www.strategy.bg/StrategicDocuments/View.aspx?lang=bg-BG&Id=986 (accessed 30 June 2022).

Natsionalna strategia za mladezhta. (2010-2020)/ Национална стратегия за младежта. (2010-2020). Available at: https://www.strategy.bg/StrategicDocuments/View.aspx?lang=bg-BG&Id=641 (accessed 26 June 2022).

Natsionalna strategia za mladezhta. (2021-2030)/ Национална стратегия за младежта. (2021-2030). Available at: https://www.nism.bg/bg/documents/nacionalni/bgstrategii?view= frontlist&catid[0]=45 (accessed 26 June 2022).

Slavchev, I. (2016). Practical Aspects of the Preparation and Realization of Project "New stars 2015". *Athletics&Science* 1/2016// Славчев, И. (2016). Приложни аспекти при изготвянето *и* реализирането на проект „Нови звезди *2015"*, *Лека атлетика и наука*, 1/2016.

Ustroystven pravilnik, *Ministerski savet.* (2022) / Устройствен правилник. (2022). Министерски съвет. Available at: https://www.gov.bg/bg/administratsia/funktsii-i-struktura/ustroystven-pravilnik (accessed 30 June 2022).

Winzen, G. (2008). *How are young people in Europe doing? Health status, health promotion, prevention*. In, pp. 23.

Zakon za mladezhta. (2012) /Закон за младежта. (2012). Available at: https://www.lex.bg/laws/ldoc/2135786802 (accessed 08 June 2022).

Zlatev, B., Bachev, V. (2019). Investigation on the „agility" skill at 14-to 16-year-old students by Illinois agility test, *International Scientific Congress "Applied Sports Sciences"*, *Balkan scientific congress „Physical education, sport, health", Sofia*, ISBN (Online): 978-954-718-601-9, pp. 442-443.

Corresponding author
Desislava Ilieva, Ph.D.,
National Sports Academy "Vassil Levski",
21 Acad. Stefan Mladenov, str.,
1700 Sofia, Bulgaria,
e-mail: desislava.ilieva@nsa.bg

NEW TREND IN COMPETENCE FRAMEWORK FOR SPORTS MANAGERS

Maria Grazia Pirina
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
To achieve the objectives of empowering female sports managers through an up-skill process related to marketing, communication, & visibility strategies, Germany & Italy realized comprehensive research about the current needs of sports managers in communication/ marketing skills. This study aims to determine the profiles of the sports managers in each country and their level of sport management competencies.
The descriptive-comparative research design, & descriptive statistics were used, such as mean, mode, standard deviation, & frequency count, in describing the respondents' profiles. In contrast, a t-test was used to compare the level of competencies of sports managers in each country by sex and One-Way ANOVA for age group, the number of years of experience, & their educational level. Intensive training learning was emphasized in developing the sports management competencies of female sports managers in Germany & Italy.
Based on the data for Germany, it was found that there aren't significant differences between different genders in Germany in the 25 sections making up the questionnaire. It can be noted that there was greater importance to sections on marketing, legal foundation, risk management, & conflict management. Barriers preventing bigger benefits were also identified. For Italy, there are no big differences between males & females. Females attach lesser importance to financial management, human resources, time management, & decision-making.
The study reveals intensive training through non-formal education is an effective intervention program to enhance the sports management competencies of female sports managers. Trainers delivering projects in Germany & Italy have paramount importance in developing & improving the management competencies of female sports managers. The methodology should be continuously used as a new strategy to advance the competencies of female sports managers to attract more financial resources & to improve the visibility of female teams.

Keywords: *Female sports managers, Female Teams, Germany, Italy, & Marketing Strategies*

INTRODUCTION

Sports managers, especially those who interact with national and international organizations and structures, should have different qualifications according to management concepts in different fields (Çiftç & Mirzeoglu, 2014). Considering that "Sport is an industry and needs to have a strategy, marketing, and resources," as stated by Gianmario Verona, Rector of the Bocconi University of Milan, the competencies of sports managers are very important elements in the success of the sports organization. And, sports nowadays are in line with marketing for sports while profiteering. "Marketing is a strategy, valorizes a product, realization, but for those who work in sport particularly and have to express all these values marketing become an emotion."; "Today marketing is constantly evolving, people orient the basic choices, with their experiences," as emphasized by Diego Nepi Molineris, Director of marketing and development of the Italian Olympic Committee (ItalianPost News, 2022).

Management competencies are highly valued within sports, and a capable and efficient sports manager has become essential to manage and to run sports organizations' activities effectively (Hurd, 2005). The sports manager is the leader who regulates, facilitates, promotes, or organizes any sport-related activity in school (Vosloo, 2014). Many sports managers are appointed because they possess the essential attributes required, namely enthusiasm, energy, and administrative experience; however, they sometimes find themselves ill-equipped with the actual competencies, skills, knowledge, and qualities to cope with their work (Chelladurai, 2005). To understand the role that sports managers are expected to fulfill with regard to the design, delivery, and direction of school sports programs, it is vital to understand the competencies needed for managerial and administrative effectiveness (Barcelona, 2001).

At present, the sports industry is growing and changing, adapting to the new social reality where

the web and particularly the phenomenon of social media marketing, virtual communities become very important channels for communication and instruments of marketing.

From the perspective of marketing, the sport is something very complex in the study and analysis of the context. Today, consumers and sports funders are no longer looking for a profitable and pleasant shopping opportunity but also a different experience to share in the community animated by Sports values.

The constant growth of the sport, also from an economic point of view, always pushes new players to face the world's competitive environment, raising its difficulties. This intense competition can only be answered by proportionally increasing the managerial competencies, and capacity understood to 360 degrees. Hence, this study wanted to assess the level of competencies of female sports managers in Germany and Italy in sports management to address the upskilling needs of sports managers to improve sports management. The Association between their profile variables and the level of their competencies was also tested. And as an offshoot of the study, module materials to enhance their sports management were crafted.

METHOD

In the study, the researcher used a quantitative and qualitative approach of research involving a descriptive-comparative research design using a valid questionnaire and one focus group interview guide question.

Quantitative instrument: Questionnaire

In Germany, there are a total of 40 people, of which 19 were males, and 15 were females, and 6 others (plus 1 binary, no binary, prefer not to say and not stated), ages ranging from 24 to 64. The vast majority of respondents had sports experience and/or higher education related to sports or sports management

The questionnaire was divided into two main parts. Section 1, comprises Demographic Data such as Gender, Age, Sport Organization, Current position, Job experience, and Educational level. In Section 2, the Competencies of sports managers include management thinking, effective communication, leadership, financial management, human resources management, marketing, governance, legal foundations, event management, risk management, sports facility management, time management, computer skills, information technology, decision making, philosophy & ethics, research, sports foundation, control management, results from orientation, public relations, project management strategic management social skills, and conflict management.

In the first section, the questions are open answers, while in the second part, answers will range from 1 (unnecessary) to 7 (extremely important) depending on the agreement/disagreement level.

The statistical analysis was performed with SPSS v20.0 software and analyzed using descriptive statistics and Independent sample t-tests, and One-way ANOVA. The values were expressed as mean ± SD, and the significance level was considered when $p<.05$.

Qualitative instrument: Focus Group

The focus group was carried out by collaborating agencies. The questions were: (1) What benefits can be achieved by improving your marketing, communication, and visibility strategies?; (2) What importance do you give to marketing, communication, and visibility in your entity?; (3) What strategies do you carry out?; (4) What strategies do you think can be implemented to improve?; (5) What skills or competencies do you think a sports manager should have to implement marketing, communication, and visibility strategies?; (6) What benefits or reasons to sponsor a semi-professional female sports team?; (7) What are the main requirements a sponsor looks for in an entity to be sponsored?; and (8) What barriers do you usually encounter when trying to implement marketing, communication, and visibility strategies?

RESULTS

Quantitative results: Questionnaires (Germany)

Data revealed that there were 19 (47.5%) males, 15 (37.5%) females, and 6 who opted not to say or no binary (15.0%). The youngest was 24 years of age, while the oldest was 64. Commonly, the sports managers were 31 – 51 years of age. Regarding a sports organizations, the majority were into football (6 or 15.0%), and rugby sports managers, 5 (12.5%). Sixteen, or 40%, were sports managers, although

all respondents have high posts in the sports organization. It can be understood that most of them have 6 or fewer years of job experience (32 or 82%). Further, the majority of them only finished their BS degree (35 or 87.5%), while only 2 have master's degrees (2 or 5%) and 3 (7.5%) Philosopher's Degrees.

For the Qualitative Results (Germany)

NGO NEST Berlin with four participants aged between 25 and 35 years old. All of them hold experience in the sports field as current athletes, but some of them have also experience in terms of management of sports teams. This presentation round of the focus group participants shows a diverse group of people, with various experiences, in various fields and professional positions, even if strong expertise in sports organizations management is missing from the participants. The talk has been pursued thanks to the main questions for discussion, which have been prepared and asked by the group.

Quantitative results: Questionnaires Italy

In Italy, 28 or 70% of male and 12 or 30% of female sports managers participated in the study. The youngest was 32 years old, while the oldest was 65 years old. Most of the respondents from Italy were in the Middle Ages to late ages. Most of them were into basketball sports organizations and football, with 7 or 17.5% out of 40 participants holding managers positions in the organization (15 or 37.5%). These sports managers showed that they are working 7 years and below (33 or 82%) and the majority have BS degrees (38 or 95.0%), and only 2 or 5.0% have a master's degree

For the Qualitative Results (Italy)

MVI participants underscored that big sports organizations such as federations look for spectacular ways to attract the attention of the public. At the same time, the small realities play much more on the values that the sport provides and focus on the storytelling and the emotions of the players. This is something that should be taken into consideration when planning a communication/marketing strategy for a sports organization.

Barriers were also encountered and found to be severe. These include: (1) The level of support that is received by media/press; (2) Difficulty in receiving support/sponsors from both SMEs and large companies; (3) Difficulty in finding human resources who are willing to dedicate themselves to the organization; (4) Lack of opportunities for training; and (5) Overlapping human resources roles in small organizations.

Comparative Analysis (In Germany)

Results showed that there are no significant differences between different genders in Germany in the 25 sections that make up the questionnaire. However, people of gender other tended to give a slightly lower score. We can acknowledge that generally, everyone attaches greater importance to sections such as marketing, legal foundation, risk management, and conflict management.

In the same way, results showed that there are no significant differences between different ages of sports manager and their competencies in Germany in the 25 sections that make up the questionnaire. However, people of gender other tended to give a slightly lower score. We can acknowledge that, generally, everyone attaches greater importance to sections such as marketing, governance, risk management, and conflict management.

However, it can be noted also that the competencies of the sports managers have significant differences when they are grouped according to their job experiences in management thinking, human resources, marketing, legal foundations, event management, time management, computer skills, information technology, Decision Making, Research, Sports Foundations and conflict management as indicated by their significant 2-tailed values lesser than 0.05 level of significance.

Comparative Analysis (in Italy)

Data revealed no significant differences in the competencies of the sports managers from Italy when grouped according to their gender. Although, it was a study found that some of the competencies provided higher rates from the respondents, which include marketing, governance, legal foundations, risk management, time management, sports foundations, public relations, social skills, and conflict management. However, it was assessed that there was a significant difference in the level of information technology and conflict management competencies of the sports managers by their ages and job experiences. It implied that the older the sports manager, the higher level of their competencies, and the more years of job experience, the higher their level of sports management competencies.

DISCUSSIONS

The desk research performed showed how important is the sport movement in Germany and Italy, as well as the current challenges for Sport Organizations and the reasons behind German and Italian sports organizations' financial problems. Main marketing, communication, and visibility strategies used by German and Italian sports organizations have been presented.

The quantitative research conducted through questionnaires showed the skills that the target group considered more important for a good sports manager. Among the 25 skills/competencies presented, respondents considered all of them quite important (on a scale of one to seven, the average of the answers was > 5), especially in marketing, governance, legal foundations, risk management, time management, sports foundations, public relations, social skills, and conflict management.

The qualitative research's findings resulted in some useful information for the improvement of sports managers' communication skills and general marketing strategy for sports organizations in both countries. During the focus group, indeed, the importance of marketing and communication strategy for female semi-professional teams was discussed, and participants highlighted some of the benefits of improved marketing communication and visibility strategy. These are: attracting a large number of new registrations, especially among youngsters; increasing knowledge of the discipline; promoting better the values of the sport itself, and increasing economic resources and finding sponsors

However, in addition to the lack of a comprehensive, long-term marketing strategy, several barriers prevent bigger benefits. These are; financial/economical barriers, sponsorship difficulties, lack of qualified persons or lack of competencies regarding the elaboration, preparation, and development of marketing strategy, and lack of specific training.

Some suggestions to improve the situation include the organization of specific training or courses for those who manage sports clubs/organizations, employment of a competent, expert figure for elaborating marketing, communication, and visibility strategies to contribute to the achievement of quality results, reinforcement of sports clubs/organizations presence in the schools, promotion of the involvement of volunteers with various competencies who can contribute to the visibility strategy while not using the limited financial resources. This comprehensive communication strategy goes behind the sponsors. It embraces both internal and external communication, awareness raising about the need for qualified profiles with communication/marketing skills, and support from the sports federations in putting in place a communication/marketing/visibility strategy for the sports clubs/organizations.

REFERENCES

Çiftç, S., & Mirzeoglu, N. (2014). The research of qualifications of sport manager. *Procedia - Social and Behavioral Sciences.* 152: 740 – 745

Hurd, A.R. (2005). Competency development for entry level public parks and recreation professionals. *J. Park Recreat. Adm.* 23(3):45-62.

ItalianPostNews. (2022, September 22). *Nepi Molineris: "The practice of sport must be a right for everyone and not a personal achievement"*. Italian Post. Retrieved October 1, 2022, from https://www.italianpost.news/nepi-molineris-the-practice-of-sport-must-be-a-right-for-everyone-and-not-a-personal-achievement/

Vosloo, J. J. (1970, January 1). *A Sport Management Programme for educator training in accordance with the diverse needs of South African schools*. NWU. Retrieved October 1, 2022, from https://dspace.nwu.ac.za/handle/10394/12269

Corresponding author:
Maria Grazia Pirina
Phd Candidate
National Sports Academy "Vassil Levski"
Sofia, Bulgaria
E-mail: mariagrazia.pirina@gmail.com

AUTONOMY AND RESPONSIBILITY OF MODERN SPORT: BETWEEN NATIONAL STANDARDS, THE APPLICABILITY OF EUROPEAN UNION LAW AND MARKET MECHANISMS

Vasil Dimitrov
National Sports Academy „Vassil Levski", Sofia, Bulgaria

ABSTRACT
The heterogeneous nature of sports relations, which are subject to the regulation of sports law, predetermines the different nature of regulation, which in turn provides for a different "autonomy" of sports organizations. The autonomy of individual and collective action is possible only in the existence of normative systems and cultural models that allow different degrees of conformity to their prescriptions and requirements.
The research aims to reveal some legal, sociological, and practical aspects of autonomy in sports, and features of manifestation on a national and European scale. The study's objectives are: normative documents, case law in connection with the issues discussed at the level of Bulgaria and the European Union, recommendations, reports from various committees, and others.
To solve the main tasks, achieve the goal and prove the hypothesis, a complex research methodology of normative and literature sources, content analysis, and included observation has been applied.
Conclusion: The globalization of sport is increasingly shifting the legal framework of the international sports system to international sports bodies such as the International Olympic Committee, the World Anti-Doping Agency, and international sports federations. A significant effect of this change has been the erosion of the ability of domestic legal systems to intervene, especially when the rules of international sports bodies conflict with domestic norms and values.
Changing regulatory acts that unjustifiably limit the autonomy of sport, in most cases, sports arbitrations deal with the imposed doping-related penalties. Possibilities for improving the work of the arbitration autonomy of sports organizations have been opened. There is a risk of limiting the autonomy of the sports industry, of interference, and on the other hand, there is another risk - reaching such a kind of sports autonomy which will be gradually withdrawn from national jurisdictions.

Keywords*: sports law, sports management, sociology*

INTRODUCTION

Sport and its ongoing processes from ancient times to the present continue to be the focus of public attention. When the topic of autonomy in sport is put on the agenda, they are usually analyzed through the prism of one or another theoretical and practical construction (Rawls, 2003; Backman, 2008; Stridh, 2009). In sociological terms, it can be understood from ch.t of the concept of determinism or social order as the foundation of social reality. The autonomy of individual and collective action is possible only in the existence of normative systems and cultural models that allow different degrees of conformity to their prescriptions and requirements, i.e., varying degrees of social coercion (Koleva, 1997).

With the growing social differentiation, the cooperation and integration of individuals and groups are possible not with strict and continuous control of the whole over the parts but with consensus on many and different values, norms, rules, etc. It is from here that the subjects self-determine (Durkheim, 2002). Autonomy expresses one of the main dilemmas in sociological knowledge - the relationship, incl. opposition, individual-group-society.

The research interest is related to the review of current issues related to autonomy in sports, as well as regulatory mechanisms for regulation to optimize social processes in the specific field as part of the processes taking place in our society.

Hypotheses: I assume that in the course of the research, various problems and variations will be revealed related to the autonomy and responsibility of modern sport, and its peculiarities of manifestation on a national and European scale; I assume

that the scientific development will contribute to the enrichment of theoretical and practical knowledge, legal awareness of citizens and officials.

The research aims to reveal some legal, sociological, and practical aspects of autonomy in sports, and features of manifestation on a national and European scale.

The following *main tasks* derive from the set goal:

- To reveal and analyze interpretations and variations related to autonomy in sport, with an emphasis on the applicability of European Union law and market mechanisms at a national level from a legal and sociological point of view;
- To derive conclusions and recommendations for the theory and practice of sports activities related to autonomy and regulatory mechanisms for regulation to optimize sports activities in general.

METHODOLOGY

The subject of the research are the problems related to the autonomy and responsibility of modern sport and their impact on the applicability of European Union law and market mechanisms on the main structural and organizational units.

The objectives of the study are normative documents, case law in connection with the issues discussed at the level of Bulgaria and the European Union, recommendations, reports from various committees, and others.

To solve the main tasks, achieve the goal and prove the hypothesis, a *complex research methodology* of normative and literature sources, content analysis, and included observation has been applied.

The present article examines the ontology and methodology of autonomy in sports in relation to legal systems. Analysis is in the context of modern legal developments. The concept of autonomy in sports as a legal reality is defined, and its composition and functions are outlined. Court practice from the Republic of Bulgaria and the EU was used.

The research was conducted in the period from February 2019 to May 2022.

DISCUSSION

The heterogeneous nature of sports relations, which are subject to the regulation of sports law, predetermines the different nature of regulation, which in turn provides for a different "autonomy" of sports organizations.

The sports club can be mentioned as one of the main structural and organizational units in which the training and educational process in the sports system takes place. Education, recovery, functioning, and results are subject to evaluation, analysis, criticism, and suggestions for optimization, improvement, and even sometimes abrupt and not always correct changes. In the conditions of an EU member state, market approach, and competitive environment in sports, sports clubs are beginning to become a simple element of the system, fulfilling the orders of higher levels of government (sports federations, Ministry of Youth and Sports, international federations and organizations), such as BOC and IOC, for example, in an independent management entity, which must meet a number of expectations through active action and so as to achieve the desired by all of the sports results.

When considering how many organizations can participate in the full service of sports systems, it can be visualized through the main levels of distribution and embedded in the relevant state levels of sports management, including private organizations working in this direction (Dimitrova, 2019).

The sports system consists of all societal organizations that organize, direct, and control human activity in sports situations. Based on this, such organizations are companies for the production of sports equipment, sports clubs, sports teams, government agencies in amateur and professional sports, publishing houses of sports newspapers and magazines, and others (Loy, 2005; Coakley, 1990). All of them appear as parts of the sports system and, in the broadest sense, can be considered basic social institutions in modern society (Dimitrova, 2020).

Sport is also an area where the EU's responsibilities are relatively new, acquired only with the entry into force of the Treaty of Lisbon in December 2009. The EU is responsible for developing evidence-based policies, supporting cooperation, and leading initiatives supporting physical activity and sport throughout Europe (European Parliament, 2022).

Improving the management of the development of the dispute is a current problem in the European

Union's member states, in accordance with their specifics - political, economic, and social (Trendafilov, 2020). Emphasis is placed on three key aspects: the social role of sport, its economic dimension, and the political and legal framework of the sports sector.

In the presence of many different sports in the structure of the sports system, as well as significant differences in the way of conducting competitions such as equipment, tracks, etc., including the results of the athletes that the various sports (group and individual) achieve raise issues of autonomy and responsibility, the nature, place, role, and functioning of sports organizations stand out with great force.

Rethinking the approach to the idea of the development of "sport" in general, to its characteristics, and the challenges including normative of its functioning in modern socio-economic and demographic conditions, is inevitable, and divergent views on how sport should be organized, guided, valued both intellectually (including patents in the field of sports, etc.) and staff renewed, pose many questions to sports figures in sports. Different policies, concepts, and legislative initiatives in a national, European, and international context often give rise to ambiguous and even contradictory practices.

Autonomy in sports must fit into a certain legislative framework. Otherwise, it is just a mirage.
International sports organizations have a status similar to the IOC, but with one distinction - they are responsible for one sport. Thus, vague wording in sports usually uses the term "legislation and regulatory certainty". The consequence of this is the need for clear requirements and limits on the limits of the definition of rules in the field of sport and law enforcement practices.

Any internal rule relevant to the matter covered/regulated by the PES falls within the scope of EU law. The criterion for the existence of a connection (between the internal norm and the Union law) can be only one: whether the union norm has a relation (Semov, 2022).

On 1 December 2020, the EU Council of Sport Ministers adopted the fourth EU Work Plan for Sport (2021-2024). Physical activity is an important part of the plan, with investment in sports and health-promoting physical activity, including creating sports opportunities for all generations, identified as a key priority (Lex: Europa, 2021).

Problem areas: There was a vicious practice, and for some long time, players outside the European Union were attracted to Bulgarian clubs. The football headquarters allowed new recruits who do not have European passports to receive a file even before they had officially obtained a single work and residence permit for the player. In this way, many clubs took the opportunity, and players outside the EU quickly came into play before going through all the necessary procedures. However, the practice violated some regulations of the Bulgarian legislation (dsport.bg, 2021). In sports relations, the initiatives taken in recent decades, unfortunately, cannot boast of particularly visible positive results in terms of the overall level of quality of regulations and their duration, which in our country is unfortunately short. This is directly related to the sport of excellence, the rankings of individual athletes at the Olympics, and competitions at national and international levels.

Sport is not just a social phenomenon. The economic contribution of sport to society is huge, and the trend is towards growth. Sport is an economic factor in tourism, prosperity, industry, and, increasingly, digital services. More than 7 million Europeans work in the sports and sports economy, generating nearly € 300 billion (European Parliament, 2021). The share of sport-related value is estimated at € 294 billion (2.98% of total EU added value).

With the development of competition and the different financial capabilities of sports organizations, the system of sports, and sports education, sports are facing a number of new challenges. The state and state bodies are no longer expected to simply support as stated in the Constitution Art. 52. (3) The state shall protect the health of the citizens and shall promote the development of sports and tourism (Parliament.bg, 2021). But also to provide sports, with additional fiscal and regulatory obligations, in turn, the sports product to be presented must be planned and analyzed to study the needs of potential users of its sports services, to show its effectiveness, and to be proven. Management ideas in the field of sports management, economics, and marketing are increasingly entering the sport through sports management to meet the theoretical and practical parameters, technologies, and guidelines that sport needs in this new situation. All these processes determine the need to seek new concepts for understanding the theoretical and

practical level of the sports system and ideas and its management in modern socio-economic reality. This includes taking into account the transformations that sport goes through organizationally and functionally, as well as the fundamental principles of its management such as autonomy and responsibility, which emerge as a reference to high morbidity and overweight among students due to immobility, sport is the alternative on the modern corporate social responsibility which a number of organizations apply by organizing sports events.

Due to the specifics of sports relations and their great dynamics, there is an objective difficulty in determining when "When do I have union rights, and can I count on them to be protected?". Of course, the obligation to judge - for each specific situation - has everyone who applies the law: all government agencies and all individuals in every public relationship. The most important union task of the judge is to correctly assess in each case whether there is a connection with the PES: - Deric, C-256/11, item 72 (Lex: Europa, 2021).

National courts are tasked with ensuring that EU law is enforced and enforced in a variety of ways. They are expected and required to apply EU law directly. They may refuse to apply domestic rules that are contrary to EU law. They must interpret national law in accordance with EU law. They must implement the principle of state responsibility for violating EU law. In addition, to interact with the CJEU by making preliminary inquiries.

Changing expectations of sport, including changing regulatory requirements, such as new leading sports and new technologies and regulations, pose challenges to sports governance in terms of the competitive environment in sport. The Union legislature considers that the provision of certain services closely related to sport or physical education by non-profit organizations to persons involved in sporting activities or physical education is a service of public interest that deserves to be exempted. In addition, the justification for the exemption must be seen in the context of the second subparagraph of Article 165 (1) TFEU, according to which the Union shall contribute to promoting the role of sport in European life while taking into account its specificities participation, as well as its social and educational function. The International Olympic Committee has included physical chess in activities that have been granted Olympic status (olympic.org, 2021). A mandatory physical element would lead to the exclusion of a number of activities, usually considered sports, although the physical component is more than insignificant, but whose qualification as a sport is beyond doubt. Examples in this regard are archery or archery. "Sport" within the meaning of the Directive should be understood as training in mental or physical fitness in a way that is normally beneficial to the health and well-being of citizens, as otherwise, it would not be in line with the purpose of the exemptions provided for in Title IX, Chapter 2 of the Directive. In its ruling, the court found that the double sports bridge was a card game that involved intellectual effort and skills and the physical component of which seemed insignificant. The Court clarified that it does not consider sport in principle but only in the context of this provision and concludes that what cannot be done under b. (m) it may not be excluded from the provision to become Article 132 (1) (n) - "cultural services" - if, in view of the way in which this activity is practiced, its history, and the traditions to which it belongs, it occupies in a given country such a place in the social and cultural heritage that it can be considered part of its culture (Ognyanova, 2018).

In this regard, the logic follows the case law at a national level, at the EU level, and logically we must look beyond the European Community, at least due to globalization in the world and sport. The so-called Rodchenkov Act, which aims to criminalize the use and spread of doping in international sports, law, named after the former head of Moscow's anti-doping laboratory, has become a protected witness and FBI informant, Grigory Rodchenkov. The law provides for criminal penalties for participating in a "trade scheme to influence a major international sporting event through banned substances and methods." The act applies to all international sports forums in which American athletes participate, as well as in championships whose organization is sponsored by companies with business in the United States or whose TV broadcasting rights are sold in the United States. The law provides for fines of up to $ 1 million and up to 10 years in prison, depending on the offense. The IOC has publicly criticized the Rodchenkov Act, saying it would put all athletes around the world under the US Penal Code (segabg, 2021). It does not apply to sports leagues and student sports in the United States and provoked WADA's disapproval. The law is very similar to the so-called Magnitsky Act, which gives the United

States the right to sanction foreigners involved in corruption and criminal activity. The US Global Magnitsky Act has been named after a Russian lawyer who died in prison under unclear circumstances after a serious corruption case was uncovered. The European Community reacted with a European Parliament Resolution of 8 July 2021 on the EU's global sanctions regime for human rights violations (the so-called EU Magnetic Law) (European Parliament, 2021). A review of practices leading to circumvention and undermining of sanctions is under review, as well as a review of existing reporting obligations to the Member States on the application and enforcement of sanctions. To further legislative changes and implementation guidelines.

CONCLUSION

The globalization of sport is increasingly shifting the legal framework of the international sports system to international sports bodies such as the International Olympic Committee (IOC), the World Anti-Doping Agency (WADA), and the International Sports Federations (MoF). A significant effect of this change has been the erosion of the ability of domestic legal systems to intervene, especially when the rules of international sports bodies conflict with domestic norms and values.

Change of regulatory acts that unreasonably limit the autonomy of sports as an example, in most cases, sports arbitrations deal with the imposed penalties related to doping, which is then the arbitration autonomy of sports organizations. There is a risk of limiting the autonomy of the sports industry, of interference, and on the other hand, there is another risk - reaching such a kind of sports autonomy, which will be gradually withdrawn from national courts. Challenges to the regulatory autonomy of international sports organizations are most common when the rules or decisions of international sports bodies violate fundamental legal principles. The legal basis for such challenges often involves a conflict between the rules of the Olympic regime and the laws of the nation-state.

REFERENCES

Backman J. (2008). Idrottsjuridik – enintroduktion. Andraupplagan. Malmö, available at: http://www.idrottsforum.org /(accessed 3 May 2022).

Coakley, J. (1990). *Sport and Society*. Issues and controversies, fourth edition. Times Mirror\Mosby College Publishing, St. Louis, Toronto, Boston, Los Altos.

Dimitrova, A. (2019). Volunteering in sport – a potential factor for integration, enhancing education, and sustainable development, *Journal of Strategies for Policy in Science and Education, Education for Sustainable Development*, Vol. 27, Number 2, pp. 203. // Димитрова, А. (2019). Доброволчеството в спорта – мощен фактор за интеграция, подобряване на образованието и устойчивото развитие, *Списание Стратегии на образователната и научната политика, Образование за устойчиво развитие*, брой 27, кн. 2, стр. 203.

Dimitrova, A. (2020). Sociological and marketing aspects of golf tournaments of the "Volvo world match play championship series", *Journal of Lichnost, motivatsia, sport*, tom 24, pp. 254. // Димитрова, А. (2020). Социологически и маркетингови аспекти на голф турнири от серията „VOLVO WORLD MATCH PLAY CHAMPIONSHIP", *Списание Личност, мотивация, спорт*, том 24, стр. 254.

dsport.bg (2021). News, available at: http://www.dsport.bg/ (accessed 29 August 2021).

Dyurkem, E. (2002). *Za razdelenieto na obshtestvenia trud*, SONM, Sofia. // Дюркем, Е. (2002). За разделението на обществения труд, СОНМ, София.

Entsiklopedichen rechnik po sotsiologia (1997). Avtonomia, vtoro izdanie, Entsiklopedichen rechnik po sotsiologia, M-8-M, Sofia, pp. 14-15.// Енциклопедичен речник по социология (1997). Автономия, второ издание, Енциклопедичен речник по социология, М-8-М, София, стр. 14-15.

European Parliament (2021). European Parliament, available at: http://www.europarl.europa.eu / (accessed 25 February 2021).

European Parliament (2022). Fact Sheets on the European Union, available at: https://www.europarl.europa.eu /factsheets/bg/sheet/143/ (accessed 14 May 2022).

European Parliament (2021). European document, available at: https://www.europarl.europa.eu/doceo/document/TA-9-2021-0349_BG.html (accessed 9 November 2021).

Lex: Europa (2021). Lex Europa legal-content, available at: https://eur-lex.europa.eu/legal-content/ (accessed 6 December 2021).

Lex: Europa (2021). Lex Europa legal, available at: https://eur-lex.europa.eu /legal / (accessed 22 December 2021).

Loy, Dzh. (2005). Sport i sotsialynaya sistema: napravlenia analiza, problematika i literatura, in (Ed.), *Hrestomatia po sotsiologii fizicheskoy kulyturы i sporta*, Akademia,

Moskva, Ch.1. // Лой, Дж. (2005). Спорт и социальная система: направления анализа, проблематика и литература, в *Хрестоматия по социологии физической культуры и спорта*, Академия, Москва, Ч.1.

Ognyanova, N. (2018). EU Law, Media Law, available at: https://nellyo.wordpress.com/2018/03/19/sport/ (accessed 19 March 2022).

olympic.org (2021). Recognised Federations, available at: https://www.olympic.org/recognised-federations / (accessed 13 March 2021).

Parliament.bg (2021). National Assembly of the Republic of Bulgaria, available at: https://www.parliament.bg/bg/const (accessed 7 January 2021).

Rawls, J. (2003). *Theory of Justice*, The Belk nap Press, Massachusetts, pp. 3, 171.

segabg (2021). The United States is preparing a „Magnitsky" law in sports as well, available at: https://segabg.com/node/48131/ (accessed 4 June 2021).

Semov, A. (2022). EU law between the lawyer and the judge, available at: https://news.lex.bg (accessed 18 March 2022).

Semov, A. (2022). Determining the applicability of the TEU – the first most important task of anyone applying law, available at: https://news.lex.bg1/ (accessed 23 May 2022).

Stridh, A. (2009). Idrottensjuridifiering i ett EU-rättsligt-perspektiv. Frirörlighetochkonkurrensinomidrotten: Examensarbete Umeåuniversitet; Juridiskainstitutionen. Umeå, available at: http://www.jus.umu.se/digitalAssets/52/52921_anders-stridh-ht09.pdf (accessed 12 November 2021).

Trendafilov, D. (2020). Upravlenie na pluvaneto v Bulgaria. Teoretichni, nauchno-prilozhni i prakticheski aspekti, *Journal of Sport i nauka*, broy 3/4, pp. 136. // Трендафилов, Д. (2020). Управление на плуването в България. Теоретични, научно-приложни и практически аспекти, Списание *Спорт и наука*, брой 3, 4, стр. 136.

Corresponding autor:
Vassil Dimitrov, PhD
Department of „Sports Management and History of Sport"
National Sports Academy „Vassil Levski"
21 Acad. Stefan Mladenov, str.
Sofia,1700, Bulgaria
E-mail: vasil1331@abv.bg

PARENTS AS VALUE CO-CREATORS AND DESTROYERS IN YOUTH FOOTBALL IN BULGARIA

Ivan Sandanski
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
As a result of the adoption of market mechanisms, access to sports and football services among adolescents has become a matter of individual choice and economic opportunities of their parents. Through the lens of the concept of Service-dominant logic, the paper interrogates various manifestations of the processes of value co-creation and destruction in the context of the relationships between players' parents and youth football academies. A random survey among 1,023 parents of children practicing organized forms of football within club-based youth football schools/academies throughout the country was conducted. The respondents encompassed all clubs competing in the First and Second professional leagues. Over 70% of adolescents have been practicing the game as part of a club youth football school for more than 3 years. It is worth mentioning that for nearly 20% of the parents the skills of coaches are the main factor in choosing a club. 13.5% of the parents believe that their child has the potential to become a professional player. It turns out that over 65% of children are not fans of the club in which they train, which also indicates insufficient levels of loyalty. Parents have become the biggest 'investors' in youth football in Bulgaria in the form of personal funds and volunteering. In return, they receive a service with a low perceived value. Parents' choices are driven primarily by rational consumer motives. On the other hand, in clubs with a low degree of diversification of funding sources, a number of undesirable practices are often formed. The study has practical implications for both parents and football club schools' managers who aim to find new ways of integrating resources and applying competencies. Parents are considered definitive stakeholder in the ecosystem of youth football. Therefore, the study contributes to the further understanding of the value co-creation concept by expanding it into a specific area of interactions.

Keywords: *value co-creation, process, service, stakeholder, football academy*

INTRODUCTION

Over the past 30 years, Bulgaria has undergone significant political, economic, and social transformations. The sport system and football, in particular, has also been drastically restructured. As a result of the adoption of market mechanisms, the access to organized football activities among adolescents has become a matter of individual choice and economic opportunities of their parents.

Football enjoys the status of the most popular sport in the country. The number of registered participants practicing football as a leisure activity is over 107,000. Regarding the number of people of all walks of life who play organized football currently there are 58,452 registered players of which 20,943 are youth as part of a football club academy/school and compete in official competitions (BFU, Football Development Strategy 2022-2026). Although the development of youth football in Bulgaria is accompanied by formalization and regulation that exists elsewhere in Europe, there is a paucity of systematic codified knowledge about what, how, why, and for whom works or does not in managing critical processes and relationships in the youth football domain. The lack of knowledge not only impedes research but deprives football providers from realistic insights into this crucial field. This makes any strategic planning and delivery of quality services challenging.

Today's youth football academies/schools are the main place for carrying out an organized training and competition process, creating conditions for talented adolescents to develop their skills and football pathway under the guidance of qualified coaches. In the first place, football academies are considered a key producer of highly skilled players for professional football. In addition, they offer a variety of training services and competitive opportunities thus satisfying particular needs as well as contributing to youth players' wider personal development and socialization. The development of football talents takes place within preparatory groups and subsequent selection in youth school/academy and possibly in the representative club team and/or the national teams in the

respective age group. The business model followed by most of Bulgarian youth football schools, especially those located in the larger cities, is premised on providing training services and competition opportunities in exchange for a monthly fee paid by youth players' parents. In this sense, parents can undoubtedly be characterized as a definitive stakeholder in the ecosystem of youth football possessing all three attributes and silence in relation to a youth football club – considerable bargaining power; legitimate (or not) claim on the club; and urgency of their claims (Mitchell et al., 1997). Mitchell et al.'s typology provide us with more practical ways of identifying parents as key stakeholder who really counts. However, this conjuncture also raises important ethical concerns, especially when the driving motive in their activity is commercial, and not so much related to the personal development of the child, his/her talent or for the benefit of football. In clubs with a low degree of diversification of funding sources a specific culture and a number of undesirable practices are often formed. This supposes a serious dependence of the clubs in their approach and policy of treatment and relations with parents and coaches.

The paper aims to interrogate various manifestations of the processes of value co-creation and destruction in the context of the relationships between players' parents and youth football academies. To that end, the concept of Service-dominant logic (SDL), developed by Vargo and Lusch (2004) and later on refined by Vargo et al (2008), has been employed. There are some studies which have applied the value co-creation approach in the sport context, but they have predominantly focused on the interaction between sports entities and fans, sports brands and sponsoring companies (Jalonen, 2015) as well as within a more complex sport value framework (Woratschek et al., 2014) or the network of value captures in professional football club management (Dolles & Söderman, 2012). Therefore, our study contributes to the further understanding of the value co-creation concept by expanding it into a specific area of interactions. It also has practical implications for managers of youth football clubs/academies who aim to find new ways of handling relationships with parents and other important stakeholders who really count in the process of value co-creation.

Contemporary marketing literature and practice emphasize the importance of the value and the value-creating and destructing processes and how customers integrate resources to develop or destroy value in their interaction/consumption practices (Grönroos, 2011). The consumer/participant engagement process by an organization is what Vargo and Lusch (2004) labeled a new service dominant logic supporting the customers' role as equal co-creators of value. The value co-creation approach presumes that the creation of value in any context, including *in* and *through* sports emanates from complex configurations of resources. Contrary to exchange value where value is viewed as embedded in the organization output and measured by price/exchange transaction, *service-dominant logic of value creation* suggests that value is fundamentally derived and determined in *use,* i.e., *value-in-use.* In other words, SDL refers to the process in which value is co-created in the interactions between football clubs and youth players and their parents through the integration of resources and application of competencies (Vargo et al., 2008). Football clubs can propose value through their service offerings; however, the real value arises if parents and other stakeholders accept the offering and continue to the value-creation process through use in meaningful ways. In services domains like the football industry, which is marked by intangible, heterogeneous, and inseparable offerings, customers cannot be passive recipients as they want different offerings at different times under different circumstances. Quite contrary, they are actively engaged in the value creation process. Value therefore is produced through interactions between football clubs and stakeholders/customers.

The employment of SDL in unveiling the processes of value co-creation and destruction in the dynamic relationships between players' parents and football clubs is useful as it directs attention to the specific context in which clubs make value proposals and parents integrate and apply their own resources.

METHODOLOGY

A random survey among 1,023 parents of children practicing organized forms of football within club-based youth football schools/academies throughout the country was conducted in the period of February-March 2022. The respondents encompassed over 30 cities and towns, including practically all clubs competing in the First and Second professional leagues. The respondent rate was deemed satisfactory, given the particularities of the target

group and the lack of similar research to date in the country-specific youth football landscape. The self-administering questionnaire contained a set of operationalized quality and quantity parameters. These correspond to the components of the developed theoretical model of the study. Each of the open-ended questions was structured with pre-defined options to mark, according to the real situation of the respondent. Such types of questionnaires, according to Zhelev (1995), are commonly used tools for collecting information, given that parents were expected to have limited time to get a profound familiarity with it. Part of the fieldwork on collecting data was done during a big youth tournament held in Sofia in March 2022. In order to extend the respondent pool, it was also decided to create a digital version of the questionnaire and new entrants were invited to fill it in by soliciting the involvement of club executives and youth academies' directors who further contributed to reaching out to larger cohorts of parent groups. The characteristics of the study imply a process of open interpretation of empirical data in line with the adopted theoretical framework. Gratton and Jones (2004) pointed out that the main emphasis in choosing such an approach is the stab to probe respondents' attitudes by analyzing their development in specific contextual conditions.

RESULTS AND DISCUSSION

99% of adolescents who play football are boys. Over 70% have been practicing the game as part of a club youth football school for over 3 years. Many of the clubs offering paid football trainings have a mainly social or 'entertainment' role, given the busyness of parents in bigger towns and the distinct trend to enroll their children in football because others have already done so, i.e., driven by rational consumers, health or socializing motives rather than a professional career in their football development. Building discipline and learning to work in a team are other important factors for parents when justifying their decision to enroll their child to train football (Figure 1).

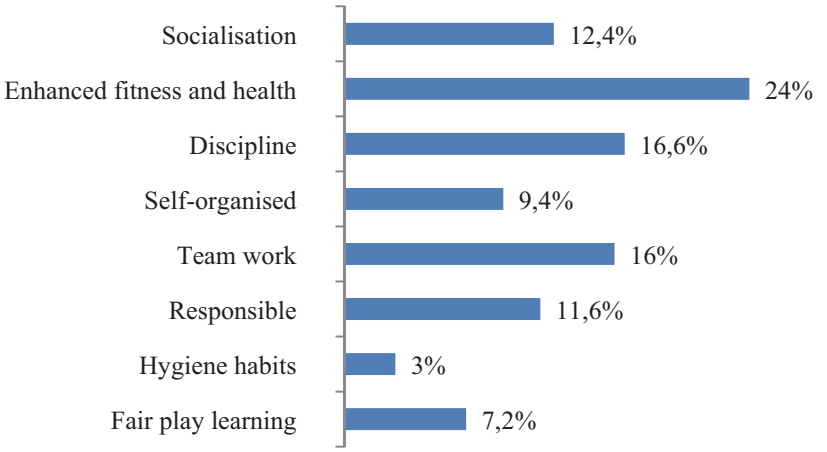


Figure 1. *Benefits of playing football*

When choosing a club, two leading motives are clearly distinguished, which have no direct link to the capacity of the club, namely preliminary impressions of the coach's work (20%) and proximity to home (11.2%). The results of the survey, presented in Figure 2, also show that parents' choices are dictated by two groups of factors in different combinations: i) user-oriented (emulation of friends/classmates already practicing football; fun, without extra expectations or aspirations; fan bias), and ii) directly related with club capacity (offered conditions, opportunity for development, organization of work, methodology, scouting). It is worth mentioning that nearly 20% of the parents believe that they have the necessary competencies to evaluate the skills of the coaches who train their child, and for them, this is the main factor in choosing a club. Nearly 10% approve the training methodology in the club, even though there are almost no clubs in the country with an established methodology imposed centrally by the club management. Parents expect their children to be cared for by qualified professionals (licensed coaches, methodologists, psychologists, and conditioning coaches) who know how to get the best out of their children. Here, the criticism is more towards club management due to the recruitment of coaches. However, parents clearly realize that most clubs possess limited resources, making it difficult for them to maintain a staff like a professional team.

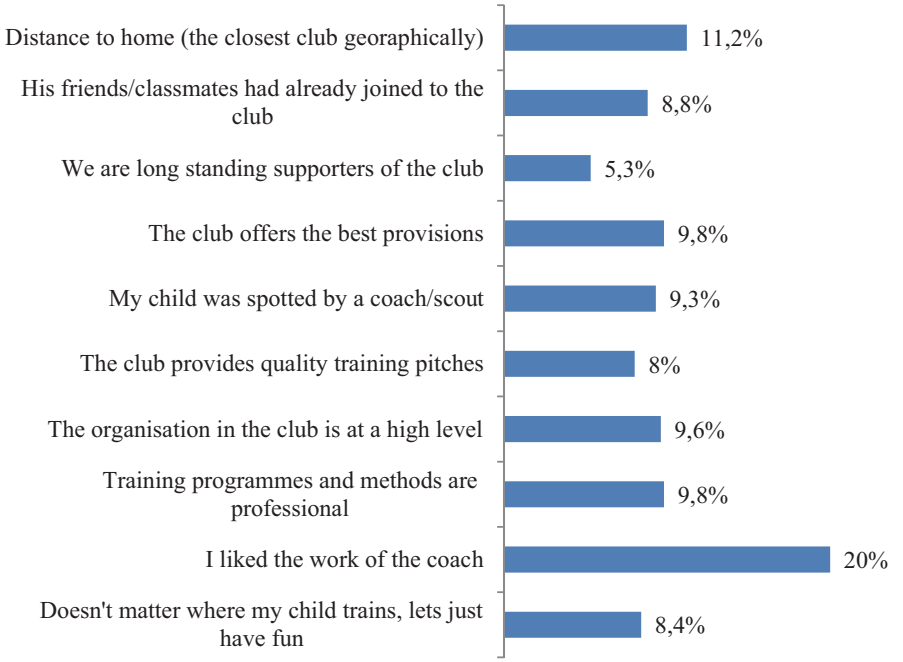


Figure 2. *Motives for choosing a club*

These data also correspond to the most frequently cited reasons for the child's withdrawal (Figure 3), which can be divided into 3 groups: *socio-psychological* (frequent injuries, bad treatment by the coach or teammates, deterioration of success at school); *economic* (financial difficulties, available free time); *career development* (lack of chances to become a professional footballer). In this regard, it is worth mentioning that the transition to professional football is not happening fast enough. Parents expect the most talented youngsters to get a chance to appear in the representative team. This is also the ultimate goal of the years spent at a club school/academy. Research questions in this regard might focus on the execution of different strategies, including a relevant combination of a young talent development strategy vs. a highly selective buying strategy of ready-made players. However, according to them, very often, the coaching staff of the men's team does not monitor the children's performances, has no relation to the academy, and does not plan to rely on its home-grown talented players. This perception of the parents is often transferred to the children's attitude and they lose motivation at the end of the youth football path.

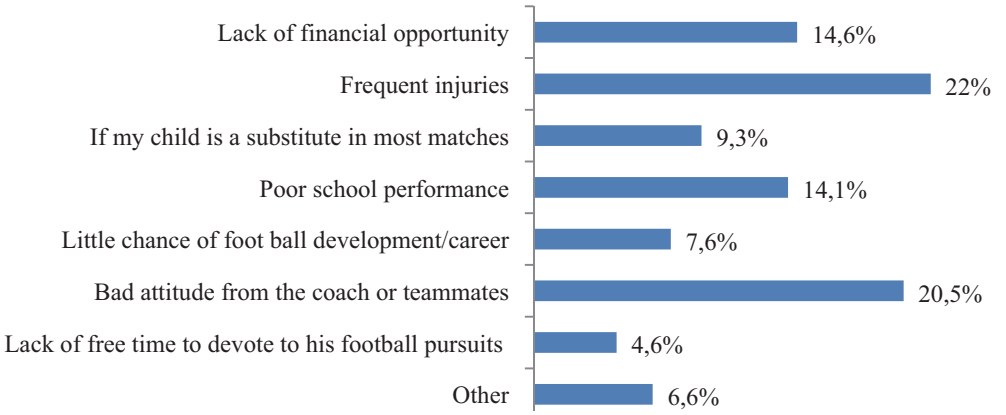


Figure 3. *Factors that would prevent parents from supporting their children's football pursuits*

Another important observation is the high degree of consumer loyalty on the part of parents and children to the chosen club and the degree of established relationship with the club (65% of the youth players have played for their first and current club, with only 6% and 2% have changed their clubs three or more times, respectively). The engagement manifests itself most often in the form of emotional attachment, experienc-

es, perceived need for sports, and individual assessment of the balance between benefits and negatives. 13.5% of the parents believe that their child has the potential to become a professional player (Figure 4).

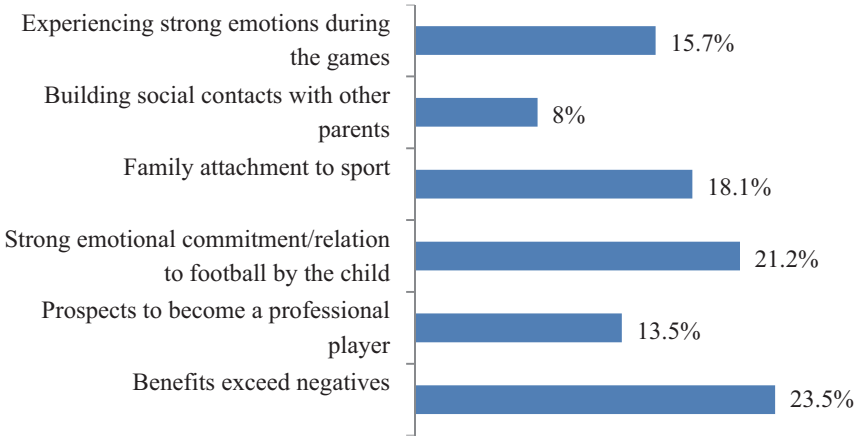


Figure 4. *Motives to invest in child's football pursuits*

As shown in Figure 5, a significant nuance stands out among the parents of children with a possible chance of development, who are much more inclined to send them to a club from another destination. At the same time, it turns out that over 65% of children are not fans of the club in which they train. Even more surprising is that nearly 80% of the parents are ready to send their child to a club based in another settlement if it is good for his further football career.

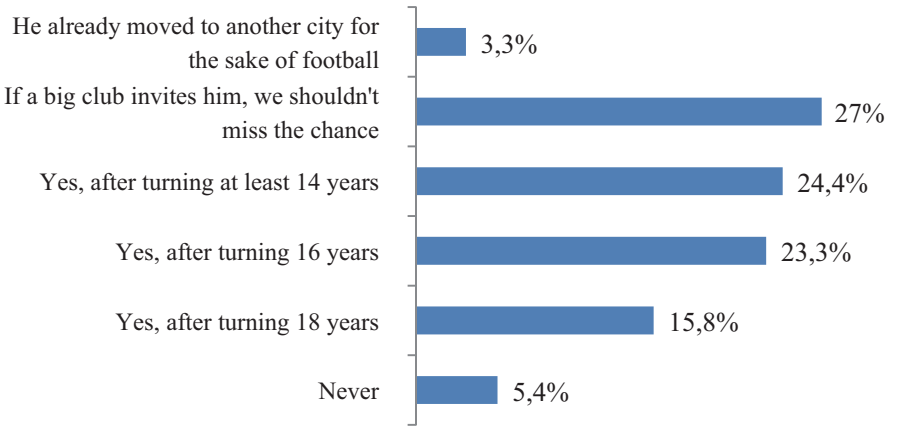


Figure 5. *Parents' attitude to let their child to change his place of residence in the name of better football development*

According to their monthly income, parents whose children train football fall into two main categories: BGN 2,000-3,000 and BGN 1,000-2,000, with an average annual cost of over BGN 3,500. However, only 14.6% would stop their child from training due to lack of financial affordability; at 85.4% this does not exist as a case at all. Also, over 30% of the respondents find difficulties in bearing the cost.

Parents have become one of Bulgaria's biggest "investors" in youth football. They expect to participate in more club life activities, even though they currently commit less than 50 hours to volunteer. At the same time, many parents invest not only personal funds but also a time in the form of volunteering to support their child's football activities. This propensity, however, is not used to the full extent – the main form of commitment is the transportation of children, followed by the performance of marketing functions for the benefit of the clubs themselves – photo/video shooting and uploading materials to social media. Club managers and coaches need to pay more attention to building a community around each youth team and the club as a whole. In this sense, clubs should consider expanding the scope of using the competencies and opportunities of parents in supporting club activities. Maintaining club Facebook page, in some cases a website, and YouTube, as well as using the Viber platform, are the most preferred marketing channels for communication with parents.

On the other hand, the business model based on practicing football in a club environment for a fee implies the clubs' high degree of dependence on managing their relations with parents and coaches. Strategically, such clubs fall into relations of dependence on parents, as a paying audience, with direct reputational damage and distortion of the very socio-pedagogical, managerial, and technological process of identification, selection, development, career, and economic realization of youth football talents. Viewed through the lens of SDL framework, such conjuncture could be a source of value destructing practices. The financial dependence on parents negatively impacts the hierarchy in the club leads to a blurring of authority and limits the access for a large number of children. The only positive thing, in this case, is that the parents realize this and do not want this "power".

Although the wins should not be the most important thing, a significant number of parents actually expect results and medals. There is no way to claim that the learning is more important than the wins as long as the parents clearly stand that they prefer another club because of the prospect of better results or simply because they feel flattered that a successful club invites their child. This urges clubs to push for results in order to meet the parents' expectations, which is often detrimental to children's development. Over 2/3 of the respondents also believe in the existence of corruption and unethical practices, which is another trigger of value destruction (Figure 6).

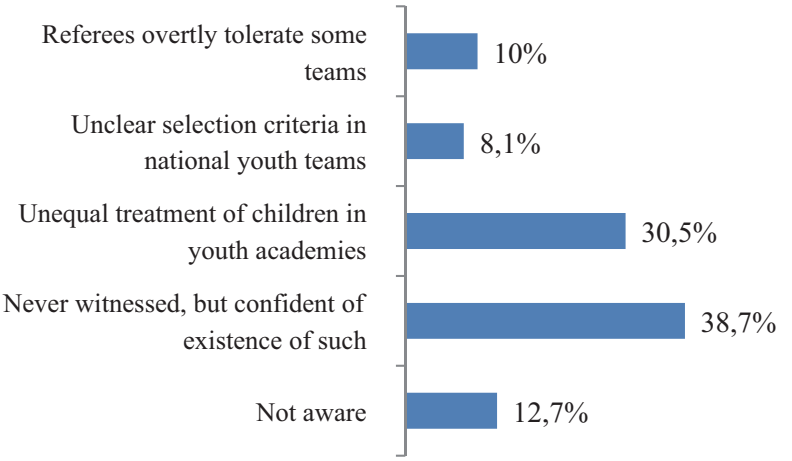


Figure 6. *Unethical practices in youth football in Bulgaria*

CONCLUSIONS

This study took the service-dominant framework to explore the processes of value co-creation and destruction in the specific milieu of interactions between youth players' parents and football clubs. The study also has a few limitations and these are outlined together with related avenues for further research. Firstly, it takes only the viewpoint and perceptions of one focal actor in the value co-creation interaction – the parents – thus limiting the explanatory power of the SDL that sees the value co-creation as a series of iterative processes embedded in the integration of various resources possessed by multiple stakeholders. Further research is needed to investigate in depth the functioning of youth football schools and academies throughout the country. They differ significantly in terms of business model, capacity, facilities, coaches, staff, methodology, partnerships, image, and level of competitiveness. Each of these relations constitutes a value capturing activity through which a football club can create value and competitive advantage. It is also important to further investigate how to measure the importance of value co-creating interactions and their growth potential. Also, what might be a value for one stakeholder might not be perceived as valuable for another customer group. This is because the parents are simultaneously claimants and influencers as they not only have very often claims on the club, legitimate or not, but also have significant power to influence the club. Although sometimes overlapping, these dimensions are different and each can exist without the other. The third dimension in Mitchell et al.'s (1997) typology – urgency – concerns the level of immediate attention demanded by the parents and refers to the combination of time sensitivity and criticality of the claim. And because parents do exhibit all three at-

tributes (or are perceived to possess) in doing their subjective evaluation club management should pay critical attention to handle the bulk of engaging relations constituting value creation asset.

Secondly, one of the most serious problems identified in our study is the poor image of youth football among parents. It is worth noting that we only surveyed parents whose children have already established a relationship with a club of varying degree. And despite this, nearly 90% of them are convinced that in one form or another there are unethical practices that exist which can be interpreted as a source of value destruction. The question that arises is how many parents have not allowed their children to play football because of the tarnished image of the game? Research shows that far more important is the social process of personality development which is premised on a long-term commitment and building relationships with skilled coaches and club staff, teammates or easy access (Coalter, 2013). Most of the well-established football clubs in the country offer training programs for multiple age groups with different level of motivation, goals and capabilities. This presupposes the shaping of different levels of trust, reciprocity, and relationship with coaches and club/academy management.

ACKNOWLEDGMENTS

This article builds on data from a survey financed, conducted, and logistically supported by the Center for Strategic Development of Sport, which is part of a larger research program.

REFERENCES

Coalter, F. (2013). *Sport for Development: What Game are we Playing?* Routledge, London.

Dolles, H., & Söderman, S. (2012). *The network of value captures in football club management: A framework to develop and analyze competitive advantage in professional team sports*. In: S. Söderman and H. Dolles (eds), Handbook of Research on Sport and Business. Cheltenham: Edward Elgar, pp.1-42.

Gratton, C., & Jones, I. (2004). *Research methods for sport studies*. Routledge, London.

Grönroos, C. (2011). Value co-creation in service logic – a critical analysis, *Marketing Theory,* 11 (3), pp. 279-301.

Jalonen, H. (2015). *A Complexity Approach to Value Co-Creation through Business and Sports Cooperation*. Proceedings of the 11th European Conference on Management Leadership and Governance, Military Academy, Lisbon, 12-13 November 2015, pp. 160-166.

Mitchell, R.K., Agle, B.R. and Wood, D.J. (1997) 'Toward a theory of stakeholder identification and salience: defining the principle of who and what really counts', *Academy of Management Review*, Vol. 22, pp. 853-887.

Senaux, B. (2008). A stakeholder approach to football club governance, *Int. J. Sport Management and Marketing*, Vol. 4, No. 1/2, pp.4-17.

Vargo, S. L. & Lusch, R. F. (2004). Evolving to a new dominant logic for marketing. *Journal of Marketing*, 68(1), pp. 1-17.

Vargo, S. L., Maglio, P. P. & Akaka, M. A. (2008). On value and value co-creation: A service systems and service logic perspective. *European Management Journal*, 26(3), pp. 149-152.

Woratschek, H., Horbel, C. & Popp, B. (2014). The sport value framework – a new fundamental logic for analyses in sport management. *European Quarterly of Sport Management*, 14(1), pp. 6-24.

Zhelev, S. (1995). *Marketingovi izsledvania* (*Marketing research*). Sofia: University Press

Corresponding author:

Corresponding author:
Ivan Sandanski, PhD
Department of Management & History of Sport
National Sports Academy "Vassil Levski"
Sofia, Bulgaria
E-mail: ivan.sandanski@nsa.bg

 DOI: 10.37393/ICASS2022/136 395 - 401

VOLUNTARY WORK IN THE MANAGEMENT OF SPORTS EVENTS

Nina Atanasova, Georgi Draganov
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
Volunteers are a valuable form of assets for many organizations, as they help reduce costs, ease the budget of full-time staff. Significant benefits from volunteering are observed in healthcare, education, sports and other areas of the economy. It contributes to the development of personal skills, helps to socialize the individual. Through it, it is possible to make contacts for possible future employment.
The organization and conducting a number of international sports events in Bulgaria, combined with the demand for volunteers, led the organizers to create strategies for recruiting and managing this human resource. In an attempt to implement this activity, it is necessary to know both the points of satisfaction for volunteers and the factors influencing their future intentions to participate in sports initiatives.
The object of study are volunteers who took part in various sports events - Rhythmic Gymnastics World Cup 2022, WIZZ AIR SOFIA MARATHON, 9th International Championship in Rhythmic Gymnastics "Cup Nuance NSA", events from the calendar of the Bulgarian Federation Sport for All, and the European Club Cup in Archery – Russe 2022. Its purpose is to explore the importance of various factors in the management of work with volunteers - motivating, their preliminary training, in terms of their satisfaction and more. In the course of the study, an online survey was conducted containing indicators for determining the satisfaction of volunteers in the listed events. The obtained data show that among the studied audience the satisfaction with the listed factors is relatively high. There are some weaknesses in the preliminary organization and distribution of volunteers in the overall organization.

Keywords: *sport, volunteering, management*

INTRODUCTION

Voluntary work creates human and social capital. It helps integration and job finding and is a key factor for improving social contacts. However, volunteering mostly sets into action the central values Europe was founded on - justice, solidarity, integration, and a feeling of civil affiliation. Volunteers contribute to the image of European society, and those who work abroad help actively build Europe and its citizens (Civil Report of EU for 2010).
Volunteering can be found in many sectors, the biggest of which is the sector of sport, followed by social care and health care.
Volunteers are precious capital in the sports industry, especially for the organizations which hold sports events of various ranges and directions (Ingerson, 2001; Baum & Lockstone, 2007).

The key to success in recruiting and keeping volunteers of a sports organization is to find out about the motives of the target group of volunteers (Chambre, 1987). There have been a lot of surveys to find out why people volunteer in a particular activity and the benefits of their helping others (Slavchev, 2009; Dimitrov, 2012; Ilieva, 2016). "Altruism" is often viewed as the central motivation because of the reward for the volunteers. No doubt, a lot of people perceive voluntary work as really enjoyable. Still, Cnaan and Goldberg-Glen (1991) showed that in addition to altruistic motives, people tended to volunteer for selfish reasons. Such people volunteer to meet essential social and psychological objectives so diverse that Mueller (1975) used three major categories to classify the obtained benefits. He cited not only altruism but also the volunteer's pleasure in "elective incentive" (e.g., prestige, social contacts, etc.); and last but not least, the advance/improvement of human capital. Another critical moment is "word-of-mouth publicity": some people volunteer for a certain work because someone they respect requires it. This personal contact is extremely important because it reduces the social risk preventing some people from becoming volunteers (Riecken, Babakus & Yavaş, 1994). Some people want to be volunteers, but volunteering contradicts their job and family commitments; they have limited resources to commit to different organizations. For some of those people, the image of volunteering is related to the fear that they would not be accepted by an established group, which is repulsive (Smith, 1999).

After recruiting volunteers, the organization should preserve their support. In a dynamic and changeable environment, where the number of volunteering organizations is growing, and the resource of volunteers is decreasing, the organizations should find out not only what motivates people but also what makes them continue being volunteers. Hobson (1996) supposed that the friendly atmosphere of volunteers makes them remain in the organization. This is enhanced by the positive relationships among the employees and volunteers (Mitchell & Taylor, 1997), the respect shown, the training provided, and entertainment. The increase in satisfaction with voluntary work leads to an increase in work experience (Omoto & Snyder, 1995).

The relations between volunteers and organizations are crucial. Because of this, marketing research in the sector is valuable. The approach called relationship marketing is used with an emphasis on keeping clients, the orientation of the product (service), compensations, contacts with clients, and commitment (Christopher, 1991; Atanasova & Ilieva, 2011).

The attitudes of the society to volunteering initiatives in Bulgaria are still different from those in countries with traditions in this field. This leads, on the one hand, to a misunderstanding of volunteering as a philosophy and on the other hand, to difficulties in achieving its goals.

Aim and tasks of the research

The aim of this research was to analyze the importance of various factors in the management of volunteers in the organization of different sports events – motivation, preliminary preparation, satisfaction, etc. The research tasks related to the aim were:

1. Survey of literary sources and documents related to volunteering in the management of sports events.
2. Inquiry with volunteers who took part in organizing different sports events.

RESEARCH METHODS

To do the research, we used some instruments which included the following scientific-research methods:

1. Content analysis – survey and theoretical analysis of specialized literary sources, supplements, and materials, incl.:
   - Scientific literature on issues related to volunteering in the management of sports events (instruments, factors for successful management of volunteers, etc.).
   - Survey of major documents related to the management of volunteers in organizing international sports events.

2. Inquiry marketing methods – an inquiry among volunteers involved in holding different sports events – Rhythmic Gymnastics World Cup 2022, WIZZ AIR SOFIA MARATHON, 9th International Championship in Rhythmic Gymnastics "Cup Nuance NSA", events from the calendar of the Bulgarian Federation Sport for All, and the European Club Cup in Archery – Russe 2022.

To fulfill the aim of the research, we created a specialized online questionnaire which included several primary research directions – motives for involvement in the events, reasons for quitting voluntary work, and overall satisfaction. The online questionnaire was uploaded to social media, shared in specialized groups and platforms, and sent as personal email communication with the volunteers.

3. Case Study – used to describe a particular management situation related to the work with volunteers at sports events.

We collected a great deal of information related to the particular case. In technical respect, we conducted a lot of structured and unstructured interviews.

4. Math-statistical methods – for the analysis of the surveys, we used some methods for quantitative evaluation of the research data, incl.:
   - relative percentage share of the obtained responses from the questionnaire
   - mean evaluation along the satisfaction factors.

The research was done among 73 volunteers who took part in organizing and holding sports events.

RESULTS

Determining the respondents' profile is a significant moment in forming strategic guidelines for the work with volunteers. The data are presented in table 1.

Most of the people (73.2%) shared that they had already participated in the organization of sports activities as volunteers. The high percentage of the re-

searched individuals who had finished high school (53.4%), compared to those who were unemployed (22.7%), showed that the events were helped by young people, some of whom were still students.

Table 1. *Researched individuals' profile*

Characteristics	Number	Percentage
Gender		
Man	25	35.2%
Woman	46	**64.8%**
Education		
High school	39	**53.4%**
Higher education – Bachelor's degree	16	21.9%
Higher education - Master's degree	14	19.2%
Ph.D.	4	5,5%
Employment		
Full-time employed	30	**42.9%**
Part-time employed	22	31.4%
Unemployed	18	25.7%
Retired	0	0
Previous experience in volunteering		
Yes	52	**73.2%**
No	19	26.8%

The initial contact among the volunteers and the organizers of sports events is among the essential components which predetermine the satisfaction and experiences of the researched target group. An object of the research was several factors influencing the organization of the preliminary preparation for the work with volunteers. The results are shown in Figure 1.

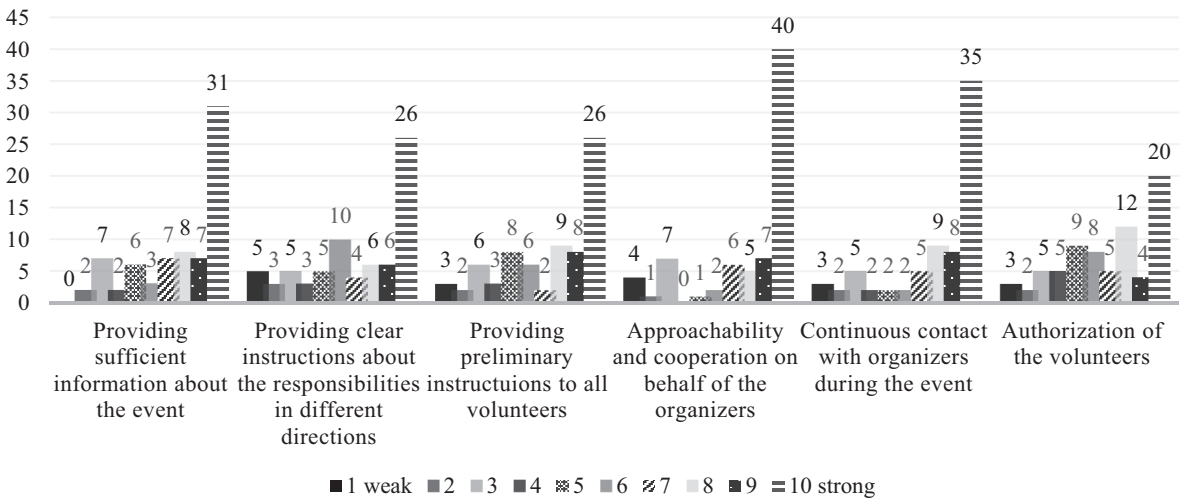


Figure 1. *Evaluation of factors influencing the organization of the preliminary preparation of the work with volunteers.*

One of the research aspects was related to establishing the factors which had the most substantial impact on the volunteers' desire to get involved in the sports event. The three leading motives were the interest in the particular event, the personal interest in the sport, and the opportunity for social contacts and communication (Figure 2).

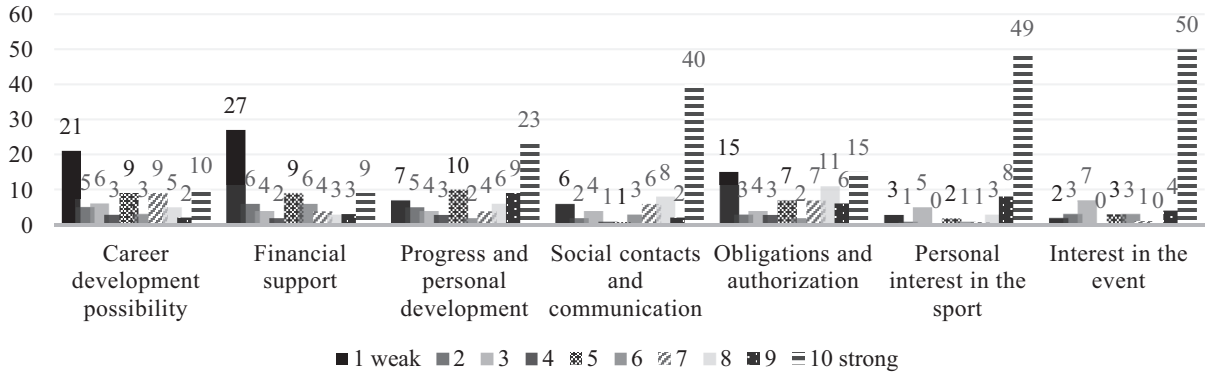


Figure 2. *Evaluation of the factors influencing the volunteers' participation in a sports event.*

One of the most significant directions in this research was establishing the volunteers' satisfaction with their participation in the particular event. We should point out that the mean values for each factor reflected the high level of the researched individuals' personal satisfaction. This high evaluation was based on the competencies and expertise of the sports organizations regarding the organization of sports events and working with volunteers.

Table 2. *Volunteers' degree of satisfaction*

Factors	Mean evaluation
My personal abilities to do the job efficiently	8.6
The opportunity to receive practical skills and experience as a volunteer	8
Interaction and teamwork with the other volunteers during the event	7.8
Value of the personal contribution	7.8
Organizers' attitude to me	7.7
Relation with other volunteers during the event	7.5
Social contacts made during the event	7.5
Organizers' assistance in problem-solving	7.5
Relations and interactions with the staff involved in the event	7.2
Challenges related to volunteering	7.1
Accurate and timely information, provided during the event	7
Convenience of voluntary work in relation to my engagements	6.8
Freedom in performing the voluntary work	6.8
Flexibility in fitting the voluntary work into my schedule	6.6
Provided educational materials and resources	5.8
Possibilities for career development in this sector	5.6

The information sources are very important in the work with volunteers, and they should be analyzed when creating strategies for their recruiting and keeping. Digitalization and media transformation suggest using communication means that reflect the target group's needs and behavior. Despite the dominance of the digital forms of information, the role of the clubs and federations that organize the events was determined as the primary information source (Figure 3).

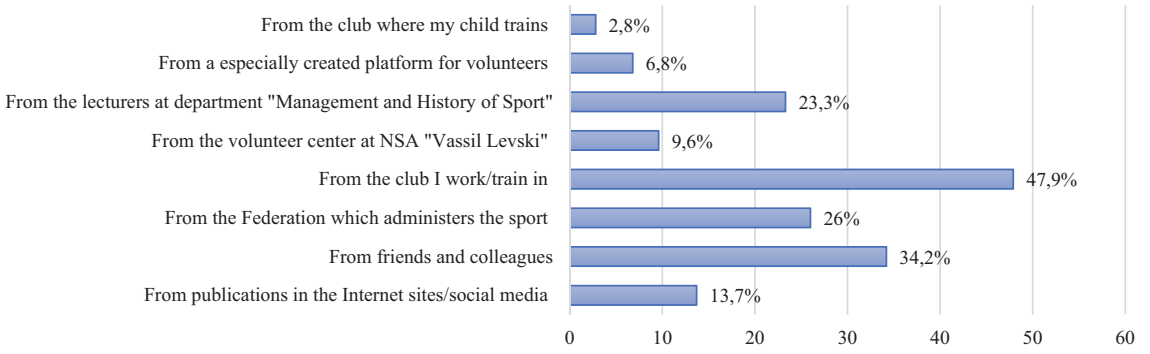


Figure 3. *How did you find about the opportunity to participate as a volunteer in the sports event? (You can mark more than one answer)*

Providing exact recommendations on behalf of the active participators is crucial for improving voluntary work. If sports organizations receive feedback, they will be able to analyze the whole organization process and, on this basis, take certain decisions for the future. The obtained results are shown in Figure 4.

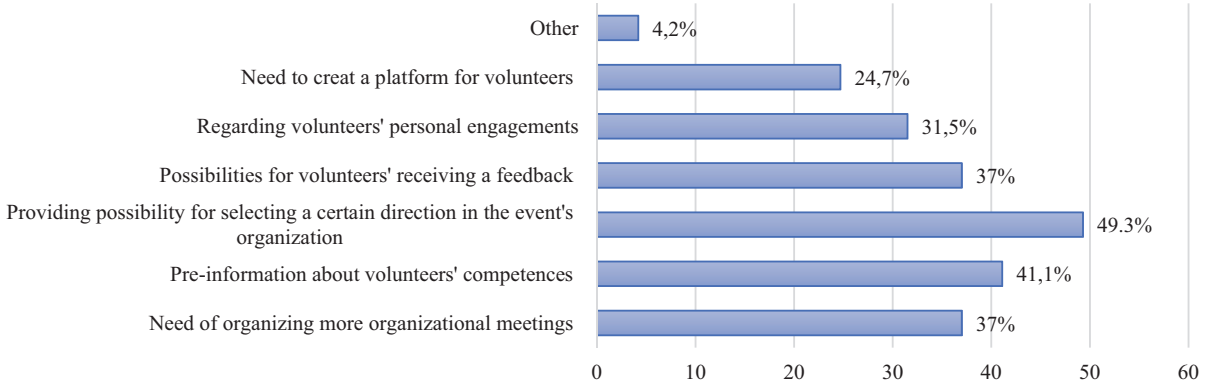


Figure 4. *What are your recommendations for improving voluntary work in future sports events?*

DISCUSSION

The results from this research present a number of areas for discussion, which would help organizers analyze the strategies used with volunteers. They reveal unique aspects in the participants' degree of satisfaction, reflected in the different directions, and the reasons why people would quit their voluntary work.

The created basic demographic profile of the volunteers and the reasons for their involvement should serve as a reference point in the detailed survey and development of new concepts for managing volunteers. The revealed trends in the participants' behavior and the communication sources used are indicative of the dominating role of sports organizations (clubs and federations) as a primary source of information for attracting volunteers.

The selection procedures and all the factors related to the preliminary organization with volunteers are multi-component and are often determined by the peculiarities and specifics of the sports events. The results from the research clearly show certain reserves in the authorization of the volunteers. The position they took and the nature of their work did not allow them to make their own decisions.

The success of a sports event is often determined by the satisfaction of the people involved in it (competitors, spectators, volunteers, sponsors, partners). As regards satisfaction, this research found a high degree of satisfaction and enjoyment of the volunteers in the researched directions. The factors which lead to the lowest degree of satisfaction are the opportunity for career development in the field of sport and providing educational materials and resources. Despite the low satisfaction regarding the components mentioned above, the frequency analysis showed that the overall satisfaction was extremely high, which positively influences one of the

strongest communication channels – the personal recommendation for volunteering. The pleased participants, in this case, volunteers, usually share with their friends and acquaintances the experiences they have had. Revealing the factors affecting satisfaction will help organizers of sports events focus their efforts and resources on the most effective methods for working with volunteers.

The recommendations for improving voluntary work are a valuable information resource in the established forms of activity management. The results emphasized an established trend. Giving freedom of choice of specific direction in the organization of the event (53,2%) is a leading recommendation, followed by gathering preliminary information about volunteers' competencies (language skills, computer literacy, etc.) (37.1%), as well as the need of more organizational meetings with the volunteers (37,1%).

The reasons for quitting voluntary work dominate the overall strategy for working with volunteers. The conclusions of this research reveal the main reasons for quitting voluntary work – some weaknesses in the organization of the sports events and the lack of evaluation for the contribution of the volunteers. Volunteers often do not realize the benefits their work has for society and the reason for that is society's unsatisfactory response to their work. Moreover, the evaluation of voluntary work is often far from its social character and is based on economic indicators, i.e., some economic benefits (dividends) are sought.

In conclusion, we can summarize that evaluating the factors for the preliminary preparation with the volunteers significantly influences the creation of policies in the work and management of voluntary work.

Providing an opportunity for evaluation and feedback on behalf of the volunteers is critical for two-way communication and building lasting relationships. The organizers of sports events should strive to achieve high satisfaction levels for all participants – users, fans, suppliers, media, volunteers, etc. The obtained data and the analysis made can be used in future surveys, which will analyze and receive new findings and dependencies regarding the evaluation of volunteers and the significance of the factors in creating a clear strategy for the work with volunteers.

REFERENCES

Atanasova, N. and Ilieva, D. (2011). Prouchvane interesa kym masovite sportni proyavi, organizirani ot Bylgarska Asociaciya "Sport za vsichki" (po primera na "Zimno predizvikatelstvo, 2011g.") – V: *Sport I nauka*, br.4. (str. 104-109) // Атанасова, Н., Д. Илиева (2011) Проучване интереса към масовите спортни прояви, организирани от Българска Асоциация „Спорт за всички" (по примера на „Зимно предизвикателство, 2011г.") – В: *Спорт и наука*, бр.4. (с. 104-109).

Volunteering in the European Union - European Economic and Social Committee. (n.d.). Retrieved April 8, 2022, from https://www.eesc.europa.eu/sites/default/files/resources/docs/ms-van-nierop_icf-ghk.pdf

Baum, T.G. Lockstone, L. (2007). Volunteers and mega sporting events: Developing a research framework. *Int. J. Event Manag. Res.*3, 29–41.

Chambre, S. (1987). *Good deeds in old age: volunteering by the new leisure class*, Lexington Books.

Christopher, M., Payne, A., and Ballantyne, D. (1991). *Relationship marketing*, Butterworth Heinemann.

Cnaan, R., and Goldberg-Glen, R. (1991). Measuring motivation to volunteer in human services, *Journal of Applied Behavioural Sciences*, 27 (3), pages 269-84.

Dimitrov, V. (2012). Globalizaciyata v sporta – factor za promyana na menidjyrskiya podhod. Sport I nauka, izvynreden broi 4. // Димитров, В. (2012) Глобализацията в спорта – фактор за промяна на мениджърския подход. Спорт и наука, извънреден брой 4.

DOKLAD ZA GRAZhDANSTVOTO NA ES ZA 2010 G. Premahvane na prechkite za ... (n.d.). Retrieved April 8, 2022, from https://op.europa.eu/en/publication-detail/-/publication/fd243935-62dc-4895-bdea-afe4d-095be42/language-bg/format-PDF// *ДОКЛАД ЗА ГРАЖДАНСТВОТО НА ЕС ЗА 2010 Г. Премахване на пречките за ...* (n.d.). Retrieved April 8, 2022, from https://op.europa.eu/en/publication-detail/-/publication/fd243935-62dc-4895-bdea-afe4d095be42/language-bg/format-PDF

Hobson, C., Rominger, A., Malec, K., Hobson, C., and Evans, K. (1996). Volunteer-friendliness of nonprofit agencies: definition, conceptual model and applications, *Journal of Nonprofit and Public Sector Marketing*, 4 (4), pages 27- 42.

Ilieva, D. (2016). Expert assessment of the status and development of the "sport for all" system in the Republic of Bulgaria. Activities in *Physical Education and Sport,* 6(2), pp. 221-227. [online]. Available at: http://fsprm.mk/wp-content/uploads/2017/01/Pages- from-APES_2_2016_AVGUST_web-17.pdf [Accessed 15 Jan. 2020].

Ingerson, L. (2001). *Comparative economic impacts of arts and sports events. In Sport in the City: The Role of Sport in Economic and Social Regeneration*; Gratton, C., Henry, I., Eds.; Routledge: London, UK, pp. 46–59.

Mitchell, M., and Taylor, S. (1997). Adapting internal marketing to a volunteer system, *Journal of Nonprofit and Public Sector Marketing*, 5 (2), pages 29-42.

Mueller, M. (1975). Economic determinants of volunteer work by women, *Journal of Women in Culture and Society*, No.1, pages 325-35.

Omoto, A., and Snyder, M. (1995). Sustained helping without obligation: motivation, longevity of service and perceived attitude change among aid volunteers, *Journal of Personality and Social Psychology*, 68 (4), pages 671-86.

Riecken, G., Babakus, E., & Yavas, U. (1994). Facing resource attraction challenges in the nonprofit sector: A behavioristic approach to fund raising and volunteer recruitment. *Services Marketing Quarterly*, *11*(1), 45–70. https://doi.org/10.1080/15332969.1994.9985141

ЕВРОПА 2020: Стратегия за интелигентен, устойчив и приобщаващ растеж. Портал за обществени консултации. (n.d.). Retrieved April 8, 2022, from https://www.strategy.bg/(F(DQ49puqZ0V23T14T-rpFDBeOX2S1kuBmnIu1Dp_vfEWl2V8kqJEUQkVtooDXh3LJ8PCt24A6bfva3skZSZ5-qoOeDv_X5nCSj0gv86VBeNKldREmWEkklmAAebVfl6ss0))/Publications/View.aspx?categoryId=&Id=124&y=2012&m=2&d=

Slavchev, I. (2009). Ekspertno prouchvane na nyakoi faktori na sponsorstvoto v lekata atletika. *Sport I nauka*, br.4. // Експертно проучване на някои фактори на спонсорството в леката атлетика. *Спорт и наука*, 4, София, 2009, с. 53 – 61.

Smith, D.J. (1999). Poor marketing or the decline of altruism? Young people and volunteering in the United Kingdom, *International Journal of Nonprofit and Voluntary Sector Marketing*, 4 (4), pages 372-77.

Corresponding author:
Nina Atanasova, Ph.D
National Sports Academy "Vassil Levski"
21, Acad. Stefan Mladenov, str.
Sofia, Bulgaria
E-mail: nina.atanasova@nsa.bg

CURRENT SOCIOLOGICAL PROBLEMS RELATED TO TENNIS IN THE SYSTEM OF BULGARIAN SCHOOL EDUCATION

Albena Dimitrova
National Sports Academy „Vassil Levski", Sofia, Bulgaria

ABSTRACT
The scientific report is dedicated to problems related to tennis at the Institute of Education, which participates in the processes of socialization to sports through sports programs.
Research interest is also related to the opportunities for adequate socialization through tennis, as a major mechanism for maintaining social order in modern society.
The aim of the empirical sociological research is to reveal some aspects related to the main forms of physical education classes for students and organized independent extracurricular activities in tennis in the system of Bulgarian school education and subsequent adequate socialization through sports. The object of this study are a total of 120 students from municipal and private schools in Sofia and Plovdiv.
To solve the main tasks, achieve the goal and prove the hypothesis, a complex methodology of research of literature sources, observation, talk, content analysis is applied. Specially developed questionnaires were used.
Based on an in-depth analysis of qualitative and quantitative data related to the issues in different schools, the attitude to the learning process is studied, different aspects of the activities are analyzed and practical measures for improving student preparation are outlined, including opportunities for additional funding for schools.
Conclusion: knowledge and creative mastery of knowledge in this field of science and their application in practice changes in a positive direction the physical development and ability to work, and as a result the health and academic performance of students.

Keywords: *sports, tennis, education, sociology, students*

INTRODUCTION

In the education system, sport is an integral part of it, having its important and significant function of strengthening the health status of students, enshrined in the law on physical education and sports in Bulgaria, which strives to respond to the current concepts and needs of students for sports in school. The changes that occur as a result of the restructuring of the sports system and the restoration of self-starting and self-management cause changes in the nature and content of organizational activity both in the sports-pedagogical and organizational-management direction (Trendafilov, 2020).

Combining and taking into account the multifaceted impact of a number of environmental and stress factors accompanying the changes in our society, the psychophysical disharmony and hypodynamia of adolescents are intensified. This reflects on the main spheres of the sociological system of society, which are formed by the main types of social needs and the activities for their satisfaction. (Mihailov, 1982).

Sport is an arena of modeled behavior, social structures, and inter-institutional relationships that offers unique opportunities to study and understand the complexities of social life. Sport is an activity that requires a degree of primary or secondary involvement unmatched by other institutionalized environments. Sport offers an opportunity to explore highly crystallized forms of social structure not found in other systems or situations (Luschen, 1990).

Physical culture and sports are a special type of social activity, the foundation of the main sphere of the sociological system of society – the reproduction of people. It interacts comprehensively, and qualitatively demarcated not only within the limits of its own main sphere but also with the main areas that are found in other main spheres of public life.

The need related to tennis, for its part, is a system-forming element of the activity, which directly forms or transforms into its goal, which acquires

an objective, social character (Entsiklopedichen rechnik po sotsiologia, 1997) and quickly finds its significant place in the Bulgarian school education system. The practice of tennis is enshrined in the program as an elective in the module class.

The listed social problems are a consequence of contradictions between needs and the means for their satisfaction, which in public life manifests itself as a contradiction between an actual and the desired state. Therefore, social problematization is not in the phase of awareness and definition of the problem situation, but in the phase of elaboration, and planning of the problem solution and its solution through organized activity (Entsiklopedichen rechnik po sotsiologia, 1997). In order to be able to fully use tennis as a means to preserve and improve the health of students, improve individual tennis skills and improve the level of motor skills, many unresolved pedagogical questions related to the training and organization of tennis lessons should be answered in Bulgarian schools in order to optimize them.

The research interest is related to the review of current issues related to tennis in the Institute of Education in Bulgaria, which participates in the processes of socialization towards sports through sports programs and the possibilities for adequate socialization through tennis, as the main mechanism for maintaining social order in modern society.

Hypotheses:

- ✓ I assume that in the process of the research, various problems and variations will be revealed, related to the main forms of classes with physical exercises of students and organized independent activities in extracurricular time in tennis in the system of Bulgarian school education;
- ✓ I assume that the scientific development will contribute to the enrichment of theoretical and practical knowledge, to the improvement of the organization, and conduct of tennis lessons in schools in the Republic of Bulgaria.

The aim of the empirical sociological research is to reveal some aspects related to the main forms of physical exercise classes for students and organized independent activities in extracurricular tennis in the Bulgarian school education system and subsequent adequate socialization through sports.

The following *main tasks* arise from this goal:

- to reveal and analyze interpretations and variations related to the main forms of classes with physical exercises of students and organized independent activities in extracurricular time in tennis in the system of Bulgarian school education;
- to draw conclusions and recommendations for the theory and practice of sports activity, with a view to increasing the mass of tennis initiatives and improving sports activity in general.

METHODOLOGY

The subject of the research are the problems related to the basic forms of tennis physical exercise classes in the Bulgarian school education system.

The object of the conducted research is a total of 120 Bulgarian students equally distributed from municipal and private schools: 4 SU "Prof. John Atanasov", "Meridian 22" EOOD in Sofia, and "Bratya Miladinovi" Secondary School, "Budeshte" in Plovdiv.

There is a large difference in the gender ratio in the sample: girls 62% and boys 38%. The age of the respondents ranged from 8 to 16 years. Therefore, the research data is presented in a summarized form.

In order to solve the main tasks, achieve the goal and prove the hypotheses, a *complex methodology* of researching literary sources, observation and content analysis was applied. Specially developed survey cards were used. The sociological sample survey is anonymous and conducted in an online environment. Students took part in it of their own free will, at a time convenient for them, and with the informed consent of their parents.

The scientific research was conducted in the period from March 2019 to April 2022.

DISCUSSION

The data were subjected to mathematical and statistical processing using the SPSS program. The obtained results were processed by variation and frequency analysis, calculation of absolute and relative frequency in one-dimensional data distribution (Goev, 1996). On the basis of an expert evaluation in the analysis of the obtained results, I focused my attention on some main aspects related to the main forms of classes with physical exercises of students and organized independent activities in extracur-

ricular time in tennis in the system of Bulgarian school education.

Physical education and sports (PES) lessons are part of the learning process. Studying and measuring the attitude of students to these lessons is an important problem in the field of sociological research, which can give us rich information about the diversity in the system of educational and sports activities and through it evaluate current solutions to educational and educational problems, as well and to predict and manage the particularities of this process.

PES lessons are more strongly influenced than other subjects by emotional and social interactions. The wishes of the students cannot be the main criterion in the orientation of the pedagogical activity, but their subjective ideas and evaluations create prerequisites that must be taken into account when making decisions about the learning process in this subject at school. When determining the quality of PES training by students, factors gain importance, which on the one hand are in the field of educational content and the organization of the lesson, and on the other - in the field of difficulties in dealing with the requirements in this type of lessons.

When analyzing the results of the student survey, it was found that the program is sufficiently flexible and allows the introduction of tennis into the Bulgarian school education system. In parallel, detailed, specific tennis training programs have been developed for different levels of application - sports clubs and children's schools. According to 60% of the respondents, the hours are not enough for their full development. Their involvement in sport is also analyzed, meaning such a sustained position which has made them inclined to accept certain roles in sport' (Frey, 1991).

Figure 1 reflects the responses related to the importance of PES classes in the students' daily school program. 60% of the surveyed persons put the subject first, 30% in the middle, and 10% after all other studied subjects.

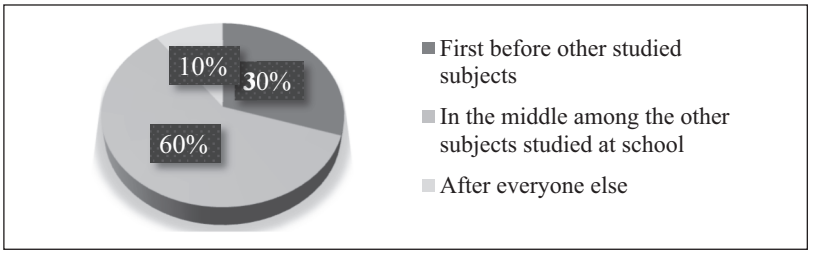


Figure 1. *In what place of importance do you place physical education and sports classes in your daily program at school?*

The question is indirectly related to the primary socialization to which they were subjected in childhood and through which they became members of society. The main psychophysical and moral qualities of the students have been determined. The results show the prevailing adequate socialization towards sport and the decisive role of the primary agents in it - family, school, physical culture, and sport. In relation to children, parents have a superior position in their socialization, and teachers/coaches reinforce them (Trendafilov, 2021). They form the basic values and regulate the current behavior of students.

In the municipal and private schools, regularly organized sports activities are held outside the compulsory hours of the PES - green schools and sports competitions.

A factor to consider when looking at opportunities in sports is social class. Obviously, a student whose family is on a limited income will have fewer opportunities to join a sports club to play tennis. This activity is only available to those who have the financial means to access the sites and the necessary equipment. People with smaller annual salaries are limited to publicly funded facilities or those requiring only limited equipment and small entry fees.

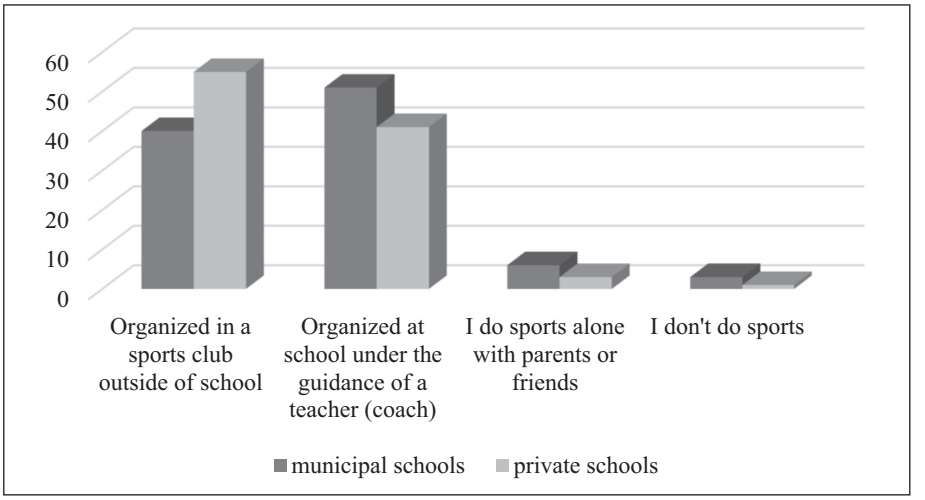


Figure 2. *Do you play sports outside of physical education and sports classes and in what way?*

Various social factors can significantly influence learners' access to sport. Factors such as gender, socioeconomic status, race, and ethnicity can enhance or hinder opportunities to participate in sports. Just as in other aspects of society, an individual's participation in sport is based on their experiences in a social context and the meaning these experiences have for each individual.

To the questions related to the number of hours outside the compulsory ones according to the PES, similar to the results presented here, the high percentage of answers of the students from the private school prevails for three times a week and more (76%), in contrast to the municipal school (32%).

Students compare themselves to others and physical competence becomes an important criterion for these comparisons. Learners who are more competent in physical skills tend to be more popular with their peers than those who are not. Their self-perception can be influenced by others' reactions to their abilities. Through the reciprocal interaction between students and other influential socializing factors, they begin to develop self-perceptions of their competence. They can join community or school teams, and when their involvement becomes visible, others also identify with their chosen sport. The participant can become a famous tennis player when his identity becomes known (Figure 3). The most established worldwide Bulgarian tennis players who serve as an example to the younger generation are: Pampulovi brothers, Lazarovi brothers, Maleevi sisters, Grigor Dimitrov and Tsvetana Pironkova.

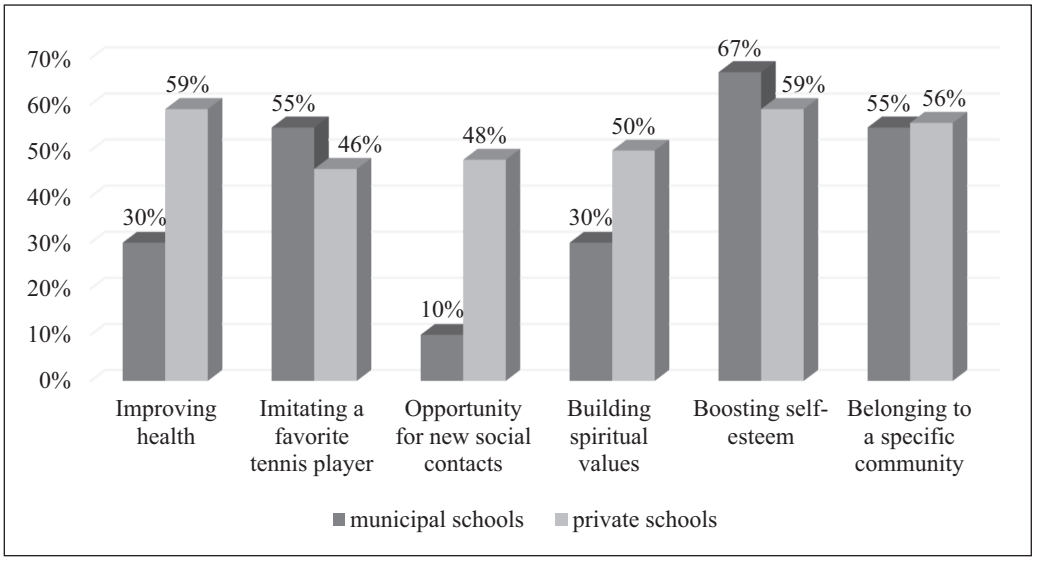


Figure 3. *Why do you play tennis?*

The widespread conclusion of sports sociologists is that when an apparent socialization effect is found, it is actually the result of a selection process that attracts and retains children and youth in the sport who already have, or are comfortable with, the values and behavioral traits required by teachers/coaches and that lead to success in sports. Without these desirable values and traits, they become disinterested in the sport or leave the sport voluntarily (i.e., drop out) or involuntarily (i.e., are removed by coaches) (Stevenson, 1975, 1985).

The practice of tennis is enshrined in the program as an elective in the module class, but problems related to the lack and number of available tennis courts were reported (Figure 4). It is necessary to optimize the available sports infrastructure in order to increase the possibilities for its effective operation, including the sports facilities managed by both the state and the municipalities for provision for use under a reduced regime, including financial ones. This also applies to students using sports complexes and tennis courts located in the newly built tennis centers. The importance of the material-technical base in secondary education is determined both by the elements it includes and also by the importance they have for the implementation of the full cycle of the educational-educational process from primary school to the last grade of secondary educational institutions.

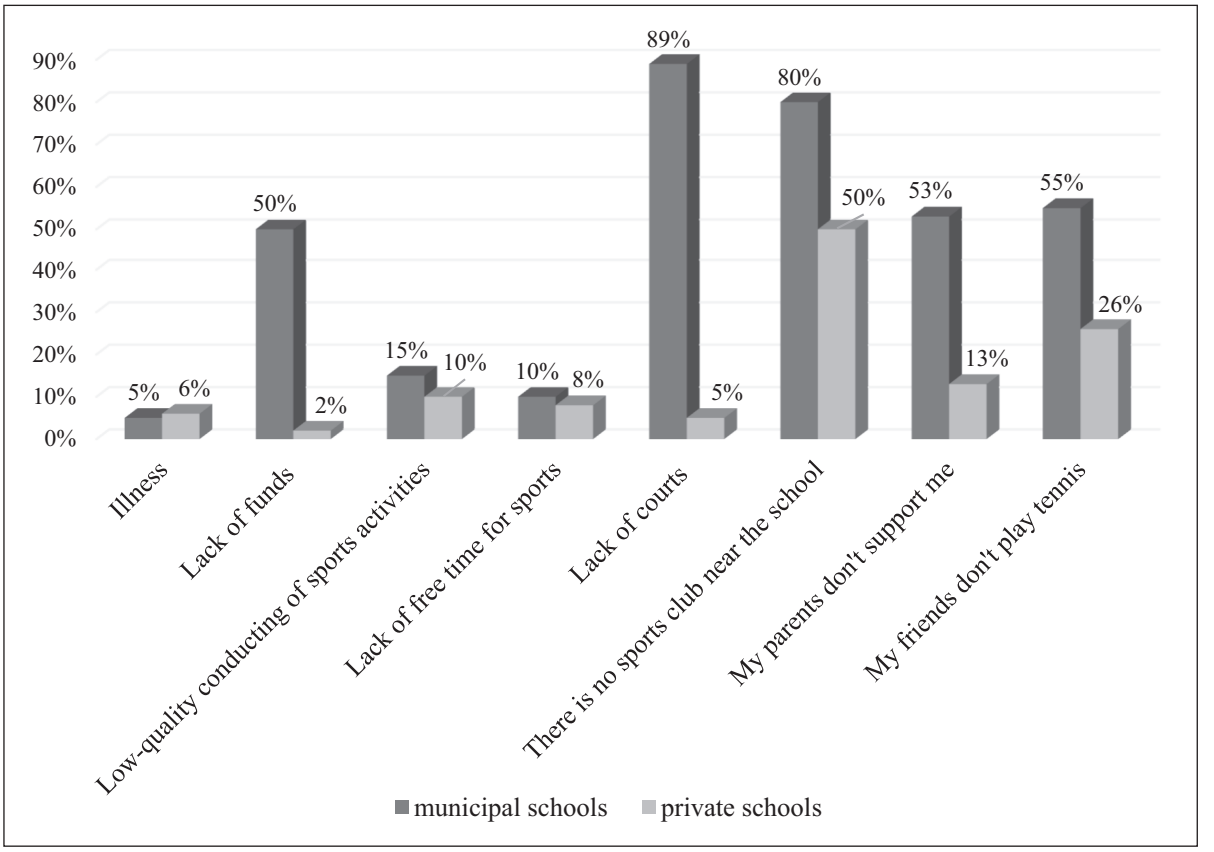


Figure 4. *What would prevent you from playing tennis?*

The modern and attractive sports base should be considered as an opportunity to prevent the increase in smoking and the use of alcohol and drugs, and as a condition for overcoming the unfavorable trends in the health of adolescents, a consequence of insufficient physical activity. The human ability to foresee a possible future and to think about all possible alternatives of emergence (Dimitrov, 2017), requires the taking of urgent measures that lead to the expansion and modernization of the sports base of schools and to the creation of conditions for the full value and use for physical upbringing.

For example, the development of a model to be offered to municipal and private schools for the creation of franchising opportunities. It is a strategic alliance between two companies. One offers a tennis training model that is provided to another, as a working successful business model for a fee under

certain conditions, and opportunities for additional funding through Ministry of Education projects.

The presence of a wide parameter of target groups willing to be trained also necessitates the creation, training, and deployment of well-prepared personnel (Petkov, 2013). In this way, the main strategy and goal enshrined in the law on physical education and sports is achieved - namely, improving the health and physical development of the nation / § 6 An integral part of the Physical Education and Sports Law is the Regulations for the Implementation of the Law on Physical Education and Sports § 14, which regulates the conditions and procedure for its application.

The reorganization of the different segments of the sports system, namely sports for all, children's and youth sports, sports in schools, sports for people with disabilities, and sports for high sportsmanship rests on thorough scientific analysis in accordance with the new European concepts of sports.

CONCLUSIONS

The obtained results generally confirm the raised hypotheses. Various problems and variations were revealed related to the main forms of physical exercise classes for students and organized individual activities in extracurricular tennis in the Bulgarian school education system. Theoretical and practical tennis lessons in educational institutions are not enough. Problems related to the lack and number of available tennis courts have been reported. It is necessary to purposefully ensure access of learners to specialized facilities and training bases, in order to ensure better conditions.

Students believe that tennis can become a more attractive and chosen sport if: additional theoretical and practical classes are introduced; increased the interest of adolescents in this type of sport by popularizing it through all media; increase the number of courts and their construction with modern surfaces accompanying the development of the modern tennis industry; the presence of many tournaments in an international aspect with the participation of a large number of competitors, both professionals of different ranks and amateurs similar to professional tennis.

Knowing and creatively mastering the knowledge in this field from science and applying it in practice changes in a positive direction the physical development and the ability to act and as a result the health condition and academic success of the students.

REFERENCES

Dimitrov, V. (2017). Planirane na choveshkite resursi v sportnite deynosti, in *Predizvikatelstva i perspektivi pred sportnata nauka 2017 proceedings of the international conference in Sofia, Bulgaria, 2017*, NSA PRESS, Sofia, pp. 12 - 18.// Димитров, В. (2017). Планиране на човешките ресурси в спортните дейности, в *Предизвикателства и перспективи пред спортната наука 2017 доклади от международна конференция в София*, България, 2017, НСА ПРЕС, София, стр. 12 - 18.

Entsiklopedichen rechnik po sotsiologia (1997). Potrebnost, vtoro izdanie, Entsiklopedichen rechnik po sotsiologia, M-8-M, Sofia, pp. 275-276.// Енциклопедичен речник по социология (1997). Потребност, второ издание, Енциклопедичен речник по социология, М-8-М, София, стр. 275-276.

Entsiklopedichen rechnik po sotsiologia (1997). Problem, sotsialen, vtoro izdanie, Entsiklopedichen rechnik po sotsiologia, M-8-M, Sofia, pp. 353. // *Енциклопедичен речник по социология* (1997). Проблем, социален, второ издание, Енциклопедичен речник по социология, М-8-М, София, стр. 353.

Frey, J. (1991). Sport and society, *Journal of Annual Review of Sociology*, Vol. 17, pp. 503-522.

Goev, K. (1996). *Statisticheska obrabotka i analiz na informatsiyata ot sotsiologicheski, marketingovi i politicheski izsledvania sas SPSS*, Stopanstvo, Sofia.// Гоев, К. (1996). Статистическа обработка и анализ на информацията от социологически, маркетингови и политически изследвания със SPSS, Стопанство, София.

Luschen, G. (1990). On theory of science for the sociology of sport: new structuralism, action, intention and practical meaning, *Journal of Sociology of Sport*, Vol. 25 (1), pp. 49-63.

Mihaylov, St. (1982). *Sotsiologicheski studii*, Nauka i izkustvo, Sofia.// Михайлов, Ст. (1982). *Социологически студии*, Наука и изкуство, София.

Petkov, Kr. (2013). *Osnovi na fehtovkata*, NSA PRESS, Sofia.// Петков, Кр. (2013). *Основи на фехтовката*, НСА ПРЕС, София.

Stevenson, C. (1975). Socialization effect of participation in sport: a critical review of the research, *Journal of Research Quarterly. American Alliance for Health, Physical Education and Recreation*, Vol. 46, pp. 287-301.

Stevenson, C. (1985). College athletics and character: the decline and fall of socialization research, in Chu, D., Segrave, J., and Becker, B. (Ed.), *Sport and Higher Education*, Human Kinetics, Champaign, Illinois, pp. 423.

Trendafilov, D. (2020). Upravlenie na nachalnoto obuchenie po pluvane pri podrastvashti. *Godishnik na Natsionalna sportna akademia „Vasil Levski"*, tom. 1, pp. 193–201.// Трендафилов, Д. (2020). Управление на началното обучение по плуване при подрастващи. Годишник на Национална спортна академия „Васил Левски", том 1, стр. 193–201.

Trendafilov, D. (2021). Otnoshenie na roditeli kam sotsialnite funktsii na nachalnoto obuchenie po pluvane pri podrastvashti*, Journal of Sport i nauka*, broy 3/4, pp. 102–104.// Трендафилов, Д. (2021). Отношение на родители към социалните функции на началното обучение по плуване при подрастващи, Списание Спорт и наука, брой 3/4, стр. 102–104.

Corresponding author:
Albena Dimitrova, PhD
Department of „Psychology, pedagogy and sociology "
National Sports Academy „Vassil Levski"
21 Acad. Stefan Mladenov, str.
Sofia,1700, Bulgaria
E-mail: albena_dimitrova.nsa@abv.bg

 DOI: 10.37393/ICASS2022/138 409 - 416

STUDY OF VIOLENCE AMONG BASKETBALL FANS IN BULGARIA

Georgi Draganov, Ivan Sandanski, Ivan Slavchev
National Sports Academy „Vassil Levski", Sofia, Bulgaria

ABSTRACT
Basketball in Bulgaria has the image of an "intellectual" sport. The lack of serious incidents of violence among fans in the National Championship is the reason for the absence of a definition of the phenomenon as an important issue on the political agenda of the institutions. However, there are some cases of violence caused by "migrating" football fans in basketball. The main objective of the empirical study was to identify the main factors and causes of aggressive and violent behavior during the national championship games.
A structured thematic survey among 704 basketball fans from nine of the top basketball teams was conducted. The main criterion for respondent selection in the survey sample is he or she has attended at least 30 percent of the home games of the team they support.
Among the leading reasons for visiting basketball games of the favorite team stand out: meeting the needs of leisure and entertainment (66%), the love of basketball (56%), building up and maintaining social relationships with friends (45%), the attractive team play (41%). As it becomes clear, visits to basketball games are dictated by social and cultural reasons (mostly value- and consumer orientated). Typical for basketball fans in Bulgaria is their interest mainly in team sports, as only 56% attend basketball games. Leading causes for the manifestation of aggressive/ violent behavior on behalf of the fans most often are sought in external factors such as referees' decisions (68%); provocations by rival fans (51%) and excessive alcohol use (45%). The identified causes fall among the group of situational, related to the specific context of the match, and not related to structural, political or cultural-determining factors.
Main participants and a reason for aggressive behavior are not always the traditional audience, but often this is due to parents of adolescent athletes, coaches, and players of certain teams. The study also provides practical guidelines for policy interventions.

Keywords: *basketball fans, violence, aggression, behavior*

INTRODUCTION

Indications of the growing importance of the problem with violence and hooliganism in Bulgarian football were the organized in 2007 round table by the Professional Football League and the BFU with participation of presidents of leading professional football clubs in the country, representatives of the largest fan clubs, of the police, of the local government and of the Ministry of Youth and Sports (MYS). Another similar initiative was the Balkan conference held in 2012 on the topic – "Media influence on combating against violence and hooliganism outside the football pitches and against match-fixing".

There is a limited number of academic publications in Bulgaria and not much reliable empirical data on fans' aggression and violence in basketball. Also, any quantitative or qualitative research is absent to explore and explain the fans' behavior. The lack of academic and institutional interest is partly explained by the absence of serious incidents of violence among basketball fans in our country and the registered more often repeated actions of violent behavior during some games are dictated mainly by various situational conditions and moments in a particular match. They are mostly expressed in offensive chants, threats, entering the field, throwing objects on the field. For such kind of fans' disciplinary acts in season 2014-2015, there were 7 cases of men and women's basketball clubs punished by NBL. The fact that acts of aggression on behalf of parents do exist during matches between adolescents (mostly provocations, insults and making threats to referees, athletes, and coaches) should not be passed by. Moreover, as it turns out, major players and a major reason for that is not always the audience, but also coaches and athletes of particular teams. In the history of Bulgarian basketball, the so-called "risky" matches, pursued by large-scale, resembling mass revolt incidents, are missing.

Basketball in Bulgaria has the image of an "intellectual" sport. The lack of serious incidents of violence among fans in the National Championship is the reason for the absence of a definition of the phenomenon as an important issue on the political agenda of the institutions, accompanied by the development of subsequent policies, mechanisms, and allocating resources to solve it.

METHODS

The characteristics of the study imply a process of open interpretation of empirical data. It is premised on the understanding that different variables cannot be controlled or manipulated, and the phenomenon under scrutiny is analyzed in its natural settings. Gratton & Jones (2004) and Yin (2003) pointed out that the main emphasis in choosing such an approach is the stab to understand and explain the actions and behavior of the participants by analyzing their development in specific contextual conditions. Due to the fact that specific events as Laumann & Knoke (1987) put it "are embedded in the context of other previous, current and future, the analysis must have a holistic orientation, rather than focusing narrowly on selected situations, which is typical of most case studies".

The survey was conducted in eight cities of the country (Sofia, Yambol, Ruse, Botevgrad, Stara Zagora, Varna, Pravets, Samokov).

The main objectives of the empirical study are as follows:

1. Composing a socio-behavioral profile of basketball fans.
2. Identifying the main factors and causes of incitement to acts of aggressive and violent behavior during the national championship games.
3. Revealing the mechanisms and forms of bad behavior from the perspective of context, time, and reasons for the manifestation of aggressive/violent behavior.

The object of the study were male teams' supporters from the NBL and the female team of "Dunav – Ruse", which is a team with the most organized fans in the women's division. The main criterion for respondent selection in the survey sample is that the respondent has to have attended at least 30 percent of the home games of the team they support. That minimum threshold has been determined after making a deductive analysis of the total number of games during the last competition season, previous to the survey.

Survey questionnaires were handed out and completed usually in the basketball halls before the start of the games. All respondents or their legal guardians were informed on the aim and the objectives of the study, as well as the ways the information will be used. The participation in the study was on their free will and after agreement. From originally distributed questionnaires to 800 persons, 704 (n = 704) or response rate of 88% were filled in and returned in a condition that allowed for processing and analysis. The developed self-administering questionnaire contains a set of operationalized quality parameters. These correspond to the components of the theoretical model of the research enabling thus the making of further comparative analysis. Each of the questions is structured with predefined options to mark, according to the real situation of the respondent. Such a type of questionnaires, according to Zhelev (1995), are commonly used tools for collecting information, given that spectators are there primarily to watch the game and will have limited time to get familiar with and fill it in. The received responses were coded and processed with the SPSS software product, and the results were presented in the form of Frequency analysis.

RESULTS

The analysis of the survey covers a total of 704 basketball fans from nine of the top basketball teams in Bulgaria (Figure 1). The majority of the respondents (93.2%) are fans of male teams from the NBL and 6.8% sympathize with the female team of "Dunav" Ruse, which is the team with the most organized fans in the women's division. The main criterion for respondent selection in the survey sample is for them to have attended at least 30% of the home games of the team they support.

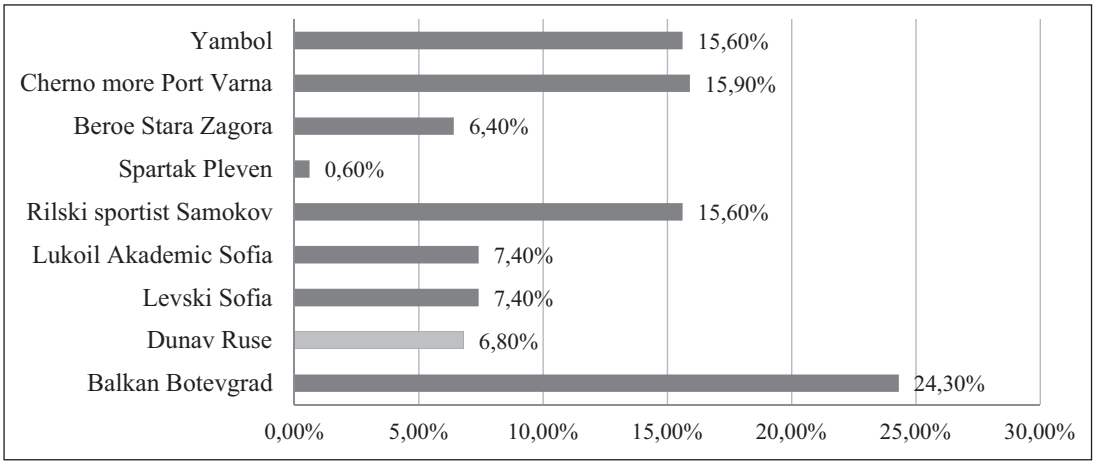


Figure 1. *Answers to "What team do you support?"*

In its significant part, these are young people aged between 16 and 39 years, with a well-defined peak of 20 to 24 years. (Figure 2).

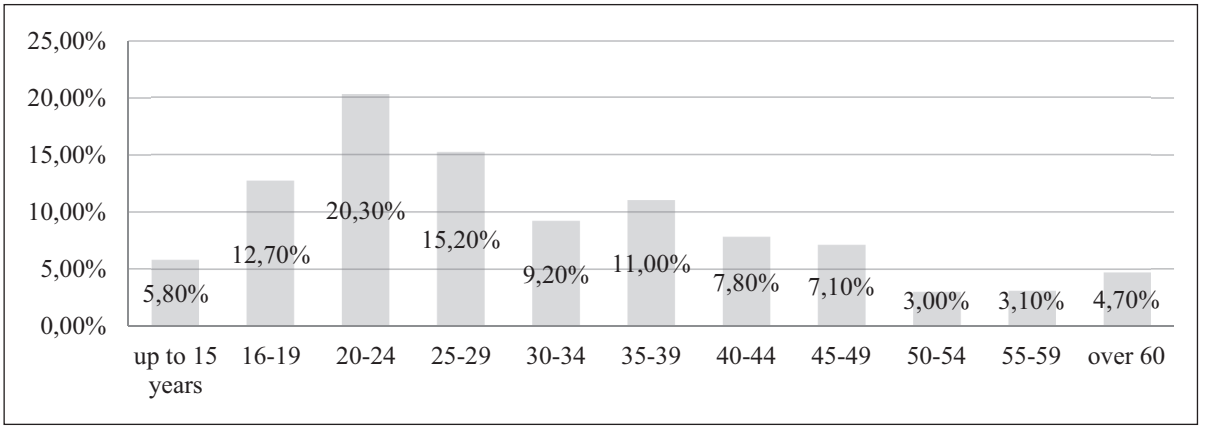


Figure 2. *Age distribution of the respondents*

The relatively large percentage of women among basketball fans (37.9%) makes an impression (is noteworthy) in comparison with the social profile of supporters in other team sports. Similar social configuration, with the presence of serious female interest, could be considered as a deterrent factor to serious incidents of violence. On the other hand, the presence of a considerable number of fans in adolescence and female audiences can be seen as a resource with serious social and marketing potential, requiring targeted policy on behalf of the basketball clubs and the management of the NBL and the Federation.

The main form of support for the favorite team is visiting the home games (Figure 3). In the maintenance of this opinion are the responses, where it becomes obvious that 63.3% do not miss games, while the other 20.4% support the team with their presence one or two times a month. Analysis of the results of this indicator should be done by stating that the survey is conducted during basketball games, among supporters of the teams, which explains the relatively high parts of the mentioned results. The second most popular form of support is through watching matches on television - 39.4% yet the weak manifestation of other established ways of demonstrating fans culture and a level of loyalty makes an impression. On the other hand, this is indicative of poor marketing policy on behalf of the basketball clubs.

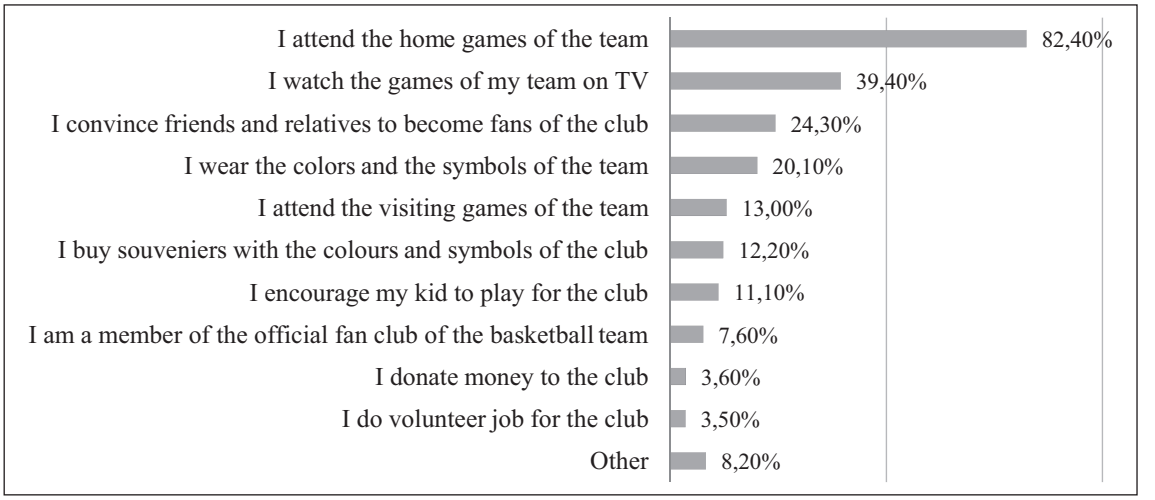


Figure 3. *Ways of supporting the club*

Another direction of the analysis aims to clarify the profile of aggressive / violent behavior on behalf of the fans. Survey data in this regard show that 14.6% of the respondents were involved in clashes with police or fans of other teams while the majority (85.4%) indicated that they weren't involved in such incidents. This is more pronounced by the fans of the home team and is mostly associated with such events before (40%) or during matches (35%). The very similar picture in terms of time and place (situational context) of a manifestation of aggressive behavior is also found in the visiting team (Figure 4).

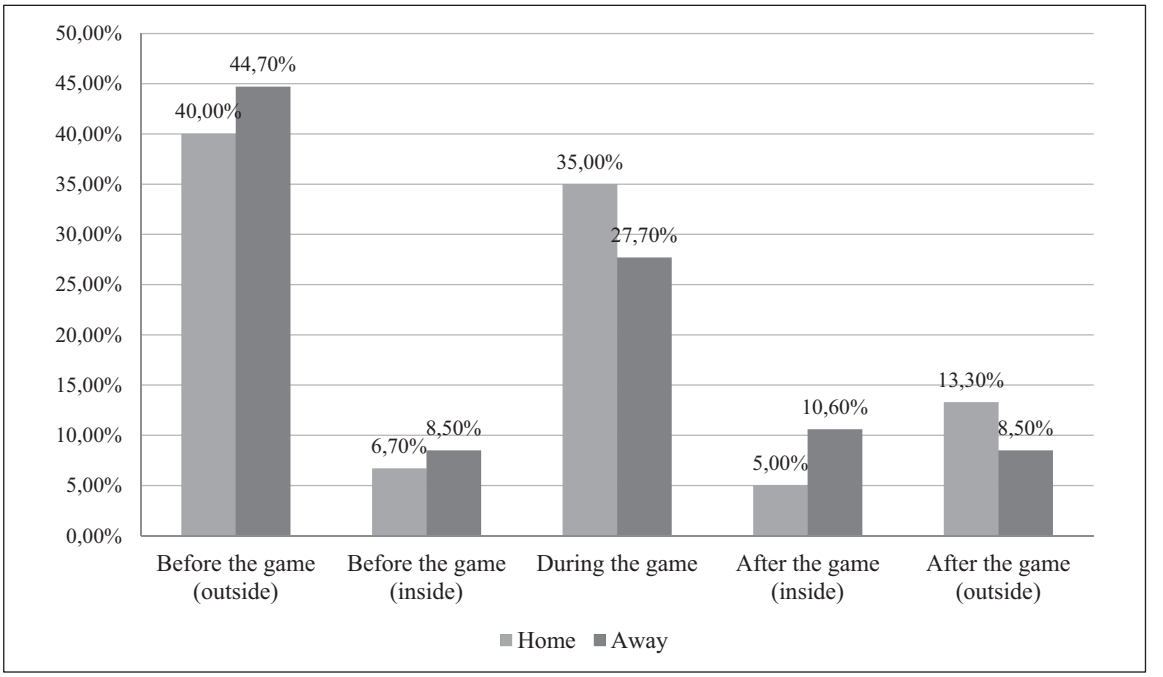


Figure 4. *Involvement in collisions with the police or opponent fans during games*

An important stage in the study was the forms of aggression and violent behavior to be identified (Figure 5). The most frequently aggressive behavior appears by making insulting chants (26.5%), while various forms of classical violent behavior, accompanied by physical collision, are relative to a much smaller share. They are most closely associated with attempts to attack referees and other technical persons (5%), participation in fights with other fans (4.3%) entering the field (3.2%), and throwing objects on the field (3.1%).

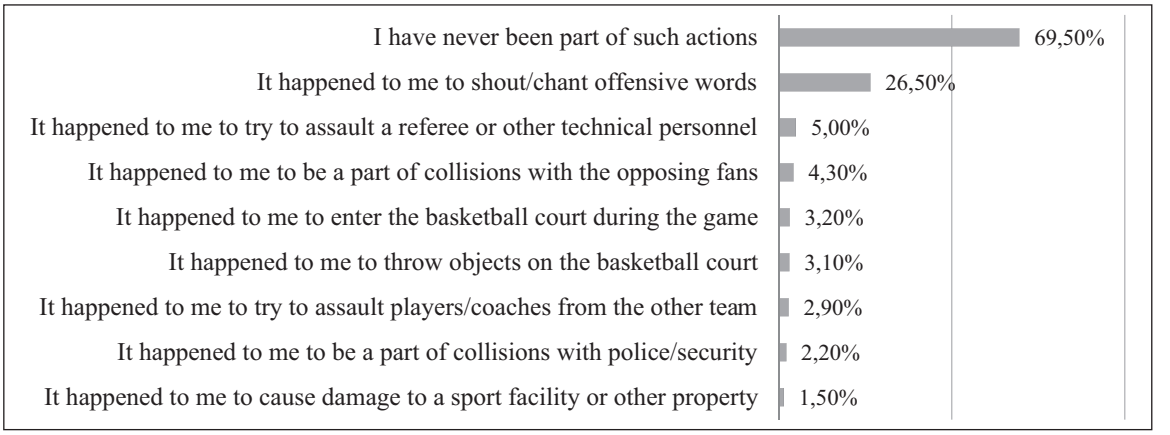


Figure 5. *Conceded forms of violent behavior*

Fans perceptions of that the federation/league tolerates certain teams, what is the opinion of 28.2%, followed by defending contrary to their favorite team ideology and values of other fans (23.4%), existence of historical enmity between fans of some teams (16.6%) and the deployment of greater financial resources than other teams, are the main reasons for the determination of other fans as opponents (Figure 6). There is also a certain percentage of fans with xenophobic conceptions (11.9%), in which the presence of foreigners in the opponent team is irritating. Large is the percentage of the respondents who answered "other" - 39% without, however, to have made concrete examples.

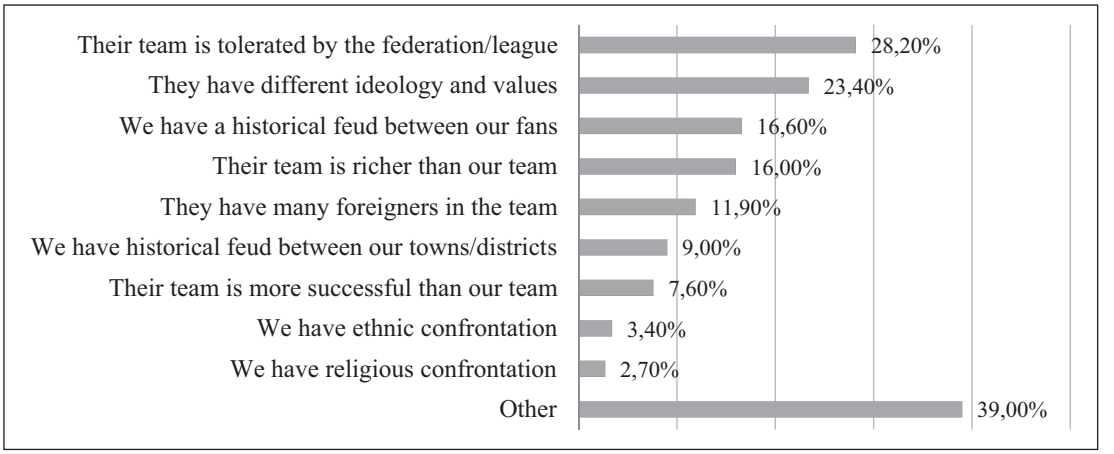


Figure 6. *Main reasons to perceive the other team as rivals*

Leading causes for the manifestation of aggressive/violent behavior on behalf of the fans most often are sought in external factors such as (Figure. 7): referees' decisions (68.2%); provocations by rival fans (51.5%) and excessive alcohol use (45%). The identified causes fall among the group of situational, related to the specific context of the match, and not related to structural, political or cultural-determining factors.

One of the key factors contributing to violence identified also in the authoritative international study of Carnibella et al. (1996), is alcohol abuse, despite the lack of clear and ambiguous conclusions about a direct link. Moreover - the authors describe several cases of "drunk, happy and friendly tuned fans," contributing significantly to the good atmosphere around the match, but they emphasise that such cases vary depending on the cultural context of the parties. Not accidentally excessive use of alcohol was identified among the three leading causes of aggression - 45%.

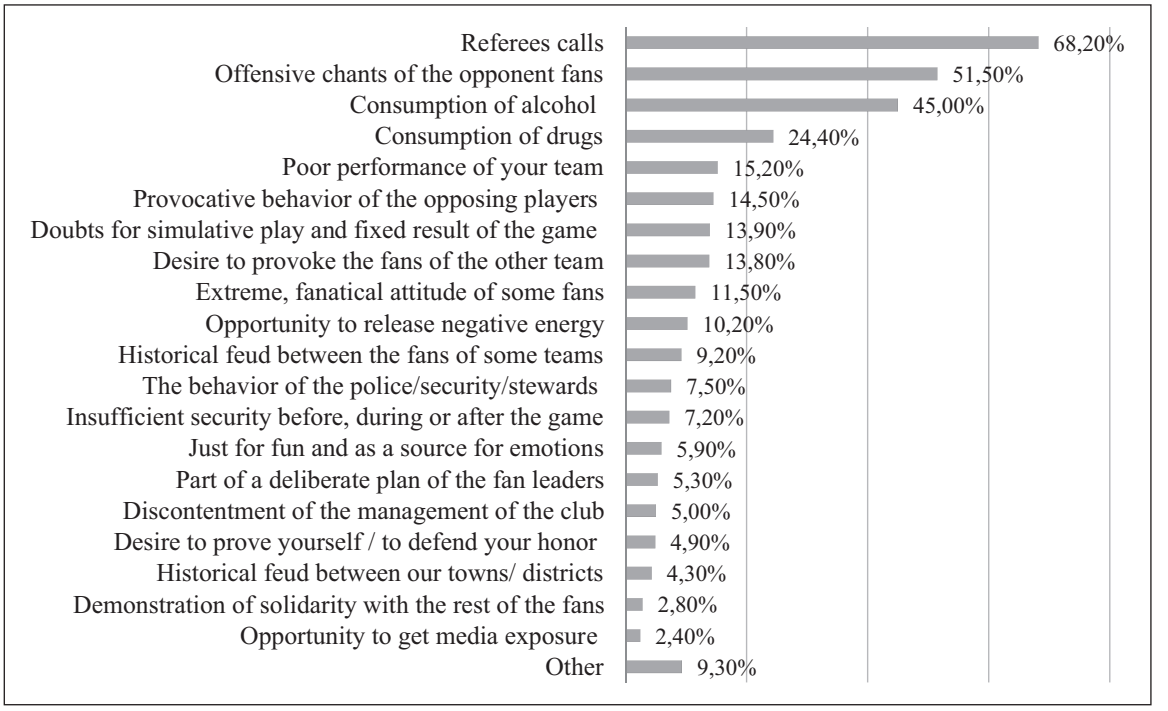


Figure 7. *Common reasons for aggressive behavior of the fans during the basketball game*

At the same time, the majority of Bulgarian fans (83.2%) exhibited a tolerant attitude towards alcohol use, as only 16.8% are strongly against its consumption (Figure 8).

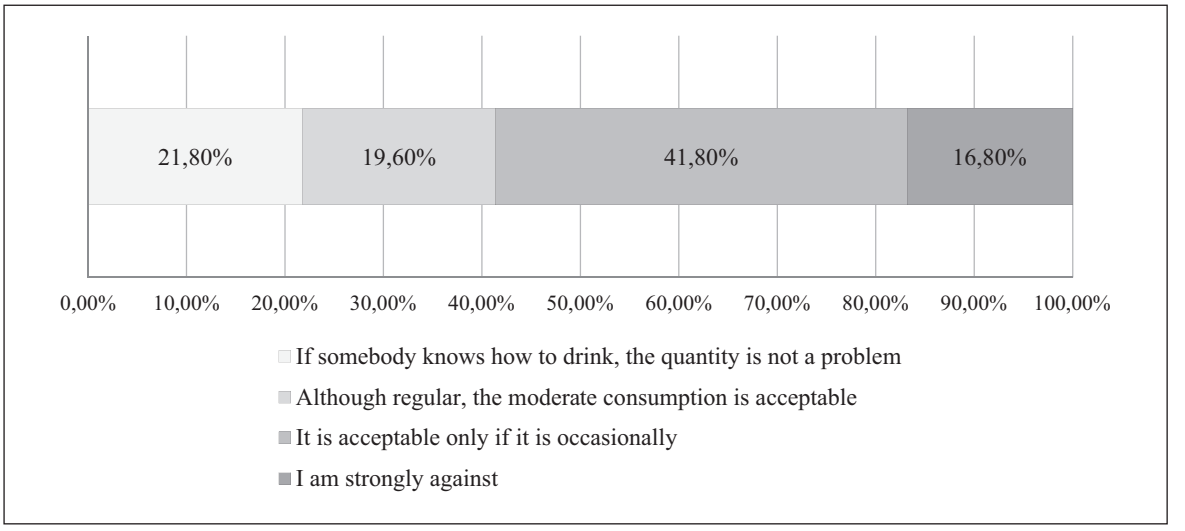


Figure 8. *Fans' attitude to alcohol use*

At the other pole is the respondents' attitude to drugs, where 87.2% are strongly against their use (Figure 9), but as it turns out from data in Figure 7, according to 24.4% of fans drug use is among the causes of aggressive behavior.

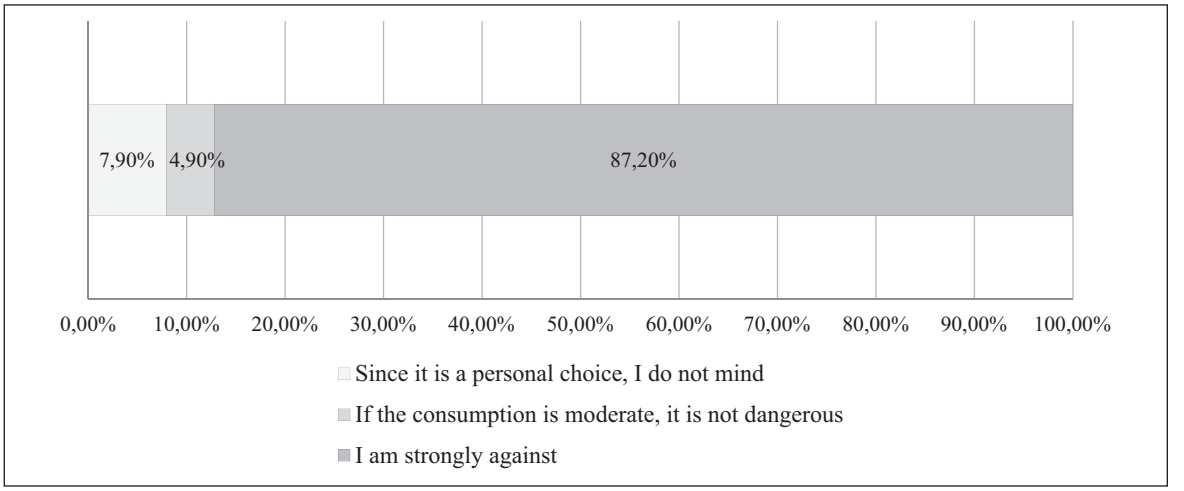


Figure 9. *Fans' attitude to drugs use*

In this sense, the conclusion in the report of Carnibella et al. (1996) is of great interest. It says that restrictions on selling alcohol sometimes may even have a negative impact as it can make some fans replace alcohol with other, more risk-related substances.

DISCUSSION

In Bulgarian basketball reality, serious incidents of violence among fans are missing, and the registered more frequently repeated acts of aggressive behavior (abusive chants, throwing non-health dangerous for the participants objects down the field) in some matches are dictated more by various situational factors of a certain game.

The profile of a Bulgarian basketball fan is a young person between 16 and 39 years. The considerable fan interest on the behalf of women should be noted, which also contributes to the lack of serious acts of violence. On the other hand, this reveals a unique potential for attracting and creating sustainable relationships with the female audience by implementing a targeted marketing approach for the basketball clubs, the league, and the federation with all the ensuing strategic, social, image-making, and economic benefits. Part of such a strategy is turning basketball into an attractive and preferred family sport by offering good basketball products, comfortable conditions, and a secure environment in basketball halls.

Main participants and a reason for aggressive behavior are not always the traditional audience, but often this is due to parents of adolescent athletes, coaches, and players of certain teams. Other more important reasons are disagreement with the referees' decisions (perceived as biased), because of fan addiction or ignorance of the competition rules details, leading to misinterpretation of controversial situations; biased media coverage; the presence of certain "migrating" from football supporters fans.

Some recommendations for control and prevention of violent behavior of fans are related to the establishment of well-coordinated policies, actions, efforts, and resources on behalf of all stakeholders, such as:

- improving security during basketball games, and in particular adolescent games;
- improving work organization in the fan clubs and stewards training during matches, with the idea of rolling out the police from basketball halls;
- improving communication and coordination of actions between the clubs and the police before and after basketball games;
- cultivating new values and attitudes to "fair play" culture in all aspects of social behavior, also in particular in the basketball game, where precisely fair play is what is the most important, not sports results;
- organizing meetings between local and visiting team fans;
- involving fans in various volunteer initiatives of the clubs and the federation/league;

REFERENCES

Carnibella, G., Fox, A., Fox, K., McCann, J., Marsh, J., Marsh, P. (1996). *Football violence in Europe: A report to the Amsterdam Group.* Social Issues Research Centre.

Gratton, C. & Jones, I. (2004). *Research methods for sports studies*. Routledge, London.

Laumann, E. O., & Knoke, D. (1987). *The organizational state: Social choice in national policy domains.* Univ of Wisconsin Press.

Yin, R.K. (2003). *Case Study Research: Design and Methods (3rd ed.).* Thousand Oaks, CA: Sage Publications.

Zhelev, S. (1995). *Marketing research.* University press "Economy", Sofia.

Corresponding author:
Georgi Draganov, PhD
Department Management and History of Sports
National Sports Academy „Vassil Levski"
21, Acad. Stefan. Mladenov, str.
Sofia, Bulgaria
E-mail: g.draganov_nsa@abv.bg

 DOI: 10.37393/ICASS2022/139 417 - 422

THE ROLE OF SET PIECES IN MODERN SOCCER

Daniel Dimov, Emil Atanasov
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
Soccer set pieces are a crucial part of the game. Research on goal effectiveness from major championships is important and can lead to change and evolutionary trends in football. The aim of this study was to analyze the goals scored through set pieces during the 2020 UEFA Euro 2020. It was analyzed 51 matches with a record 142 goals at an average of just shy of three per game. 40 goals scored of the total are from set pieces. 17 from a corner, 11 from a penalty, 8 goals following a free kick, 3 goals following a throw-in, and just one goal from a direct free kick. For data processing we used modern software products - Bandicut is the fastest and without loss of quality software for cutting and merging video and Wyscout - The professional platform for people working in the football world: videos, data, statistics, and tools. The data obtained from the present study were processed through mathematical and statistical methods. The analysis shows that set pieces can be an important means of determining victory in high-level football matches, especially between teams of the same level.

Keywords: *UEFA Euro 2020, soccer, match analysis, set pieces*

INTRODUCTION

Soccer has been researched extensively within sports performance analysis with the primary objective of improving individual or team performance through the collection of objective, valid and reliable data (Pulling, 2015). Performance analysis is now a central element of sports science support for soccer coaches and therefore research has undergone rapid expansion over recent years, with studies investigating performance indicators related to possession, tactical behavior, positional demands, and the match location (Stone et al., 2021; Zhao & Zhang, 2019; Yue, Broich & Mester, 2014). Scoring goals is the critical technical indicator of successful football team performance, although it accounts for only 1% of the ball possessions in professional competitions (Oghonyon et al., 2020). It is well documented that set pieces represent 30% to 40% of goals scored in elite football, however, most studies on set pieces have focused on the analysis of special competitions World Cup, Euro, etc. (Mitrotasios et al., 2021). The recent research has focused on set piece examination of corner kicks, free kicks, throw-ins, and penalty kicks (Strafford et al., 2021; Dujaka & Sokoli, 2019; Cerrah et al., 2014; Busca et al., 2022)

The aim of the study is to examine goal effectiveness and to obtain the most typical time patterns for those set pieces in training sessions. Proposing set pieces with a low percentage of goals scored, to help coaches in their practical work.

METHODS

The present research was conducted in the period from 06. 2021 to 05. 2022. We observed 51 matches in which 40 goals were scored from set pieces. For the needs of the research, we defined five key indicators, described below. We used modern software programs to conduct the research: Wyscout, Bandicut, and Tacticalpad. We determined the percentage value of 100 - percentage ratio using Excel.

Indicators/parameters

Set pieces – In football, a set piece is a situation where the ball is returned to open play following a stoppage. In simpler terms, a set piece occurs anytime there is a restart in play from a foul, corner, free kicks, penalty, throw-ins, or the ball going out of play.

The Corner kick – According to Law 17 (IFAB, thefa.com, 2022), a corner kick is awarded when the whole of the ball passes over the goal line, on the ground, or in the air, having last touched a player of the defending team, and a goal is not scored.

Direct free-kick – According to Law 13 (IFAB, thefa.com, 2022), a direct free-kick is awarded if a player commits any of the following offenses against an opponent in a manner considered by the referee to be careless, reckless, or using excessive force: charges. jumps at. kicks or attempts to kick.

Indirect free-kick – According to Law 13 (IFAB, thefa.com, 2022), the referee indicates an indirect free kick by raising the arm above the head; this signal is maintained until the kick has been taken and the ball touches another player, goes out of play or it is clear that a goal cannot be scored directly.

The Penalty kick – According to Law 14 (IFAB, thefa.com, 2022), a penalty kick is awarded if a player commits a direct free-kick offense inside their penalty area or off the field as part of the play as outlined in Laws 12 and 13. The ball must be stationary on the penalty mark and the goalposts, crossbar, and goal net must not be moving. The player taking the penalty kick must be clearly identified. The defending goalkeeper must remain on the goal line, facing the kicker, between the goalposts, without touching the goalposts, crossbar, or goal net, until the ball has been kicked.

The Throw-in – According to Law 15 (IFAB, thefa.com, 2022), a throw-in is awarded to the opponents of the player who last touched the ball when the whole of the ball passes over the touchline, on the ground, or in the air. A goal cannot be scored directly from a throw-in:

- if the ball enters the opponents' goal – a goal kick is awarded
- if the ball enters the thrower's goal – a corner kick is awarded

RESULTS

Figure 1 shows the type of play that goals were scored during the Euro 2020. 28% of the goals were scored from set pieces and 72% from playing positions. This gives us reasons to believe that set pieces in modern football are both underestimated and overestimated by coaches. Goals from set pieces were a precious commodity at UEFA Euro 2020, with innovative tactics employed to secure them.

Simon Kjær's deflected own goal (Figure 2) which brought England level in their semi-final with Denmark, was indicative of one of the most marked trends in terms of goalscoring: a low cross or cut-back being turned into his own goal by a defender.

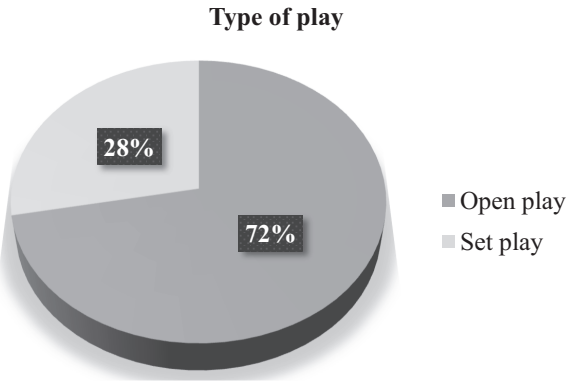


Figure 1. *Goal scored, divided by type of play*

Table 1. *Number of goals scored*

Goal type	Goals
Open play	102
Set play	40

Figure 2. *Euro 2020 goals*

Figure 3, makes an impression that the teams of Portugal and Wales scored more goals from set pieces than from playing positions. Portugal has 4 goals scored and Wales 2. Spain also has a good success rate with their 5 goals, out of a total of 13. The teams of Poland and Hungary have not scored goals from set pieces. Champions Italy had one of the lowest proportions of set-play goals: two from their total of 13.

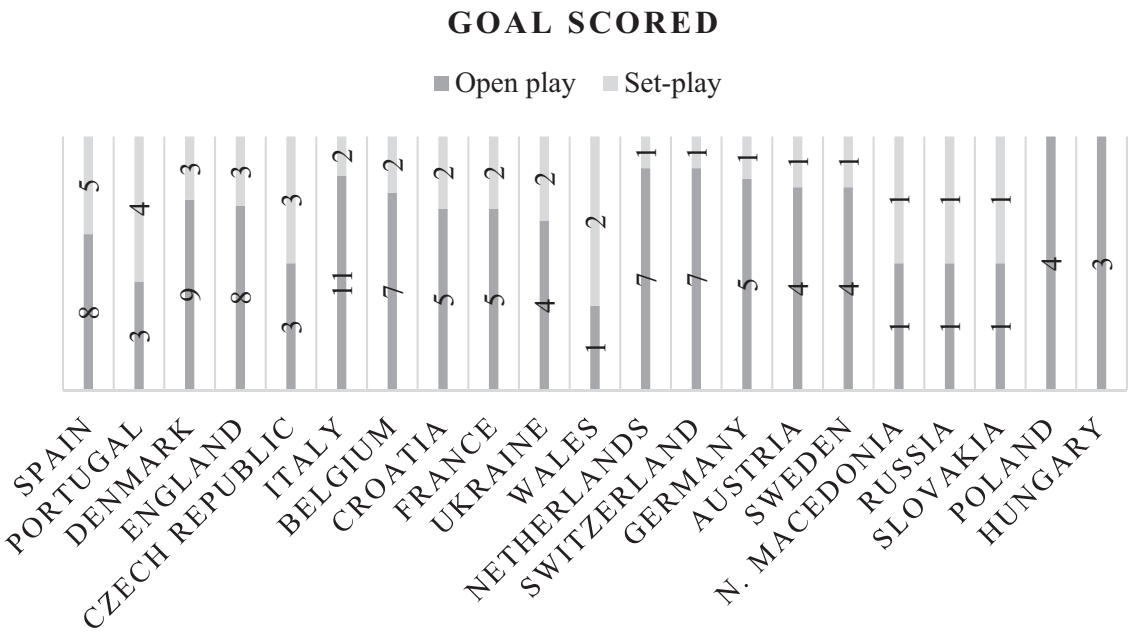


Figure 3. *Number of goals scored by all teams*

In Figure 4 of our research, it can be seen that 42% of goals from set pieces are scored from corners. The fewest goals were scored from direct free kicks only 2% and from throw-ins - 8%

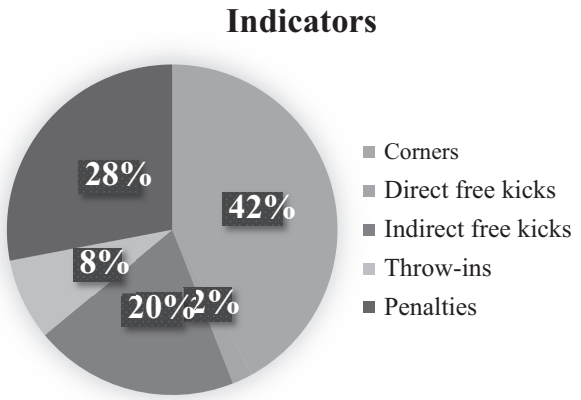


Figure 4. *Percent of goals scored*

Figure 5 shows only one goal came from a direct free-kick: Mikkel Damsgaard's in the semi-final for Denmark against England. There are too few goals scored from throw-ins. The throw-in is part of the team's group tactics and the options for executing a throw-in in different parts of the playing field and especially in the opposing third are numerous. There are teams that have assigned coaches who are committed to just this concept and develop performance patterns with a group of players in the minutes before practice sessions.

In our opinion, these are situations that could decide the final result of a game with equal teams.

With a total of 11 penalties converted, two on the rebound, UEFA Euro 2020 had its fair share of spot-kick drama even before you consider the nail-biting shoot-outs that decided four of the knockout matches, final included.

Table 2. *Goal scored, divided by set play actions*

Indicators	Group stage	Knockout stage	Total
Corners	12	5	17
Direct free kicks	0	1	1
Indirect free kicks	5	3	8
Throw-ins	2	1	3
Penalties	9	2	11
	28	12	40

Figure 5. *Goal from direct free-kick*

On table 3 we observe a trend of increasing goals scored from set pieces. At Euro 2008, only 16 goals were scored from set pieces, at Euro 2012 the number was 22, and the record is at Euro 2020 – with 40 goals scored.

Table 3. *European football tournaments and number of goals scored from set play actions*

Tournaments	Goals
Euro 2004	27
Euro 2008	16
Euro 2012	22
Euro 2016	32
Euro 2020	40

Such an increase in goal-scoring efficiency from set pieces is a consequence of the evolutionary trends that stood out at Euro 2020, namely:

Great tactical flexibility – 14 teams fielded, at some stage, three center-backs. With more coaches opting for a front line of three along with attack-minded wing-backs, many teams had enough players in advanced areas for collective high pressing. It is no secret that a significant amount of time is dedicated to practicing set plays, and dedicated coaches work with some of the teams. A variety of man-to-man, zonal, and mixed marking methods were used across the tournament, but the ability to adapt to each set-piece situation was the key to providing a strong response to the increasingly innovative attacking approaches. Set-play coaches had their work cut out trying to find those marginal gains that, in a tournament environment, so often make all the difference.

The running activity of the teams and players. In their 1-0 victory over Finland – their only win of Euro 2020 – Russia covered a huge 119.36km in Saint Petersburg. Champions Italy covered even more ground as they battled through to the quarter-finals with a 2-1 triumph over Austria, pushing themselves almost past the 150km mark. With his tournament-leading average of 12.69km per match, opportunities were plentiful for Pedri to showcase his talents (Vike, 2021). Only three players averaged more than 12km per match, including Italy midfielder Jorginho – another player who stood out in an increasingly important deep midfield role that does not always receive the appreciation it warrants.

DISCUSSION

The UEFA European Football Championships (Euro) provide an arena for the best European footballers to compete against each other. In football, goal scoring is a vital and complex skill involving multiple players to determine match outcomes (Kubayi, 2020; Wang & Qin, 2020).

Group work with the players before training sessions should be increased while the efforts should be directed to those signs on which they have the lowest percent's like throw-ins (see Figure 6). That's why we offer different examples of how to execute throw-ins in the own half and in the opponent's half with a change of places, the different parts of the playing field, visualized with modern Software "Tacticalpad" (Figure 7 and Figure 8).

Figure 6. *Group tactic throw-ins*

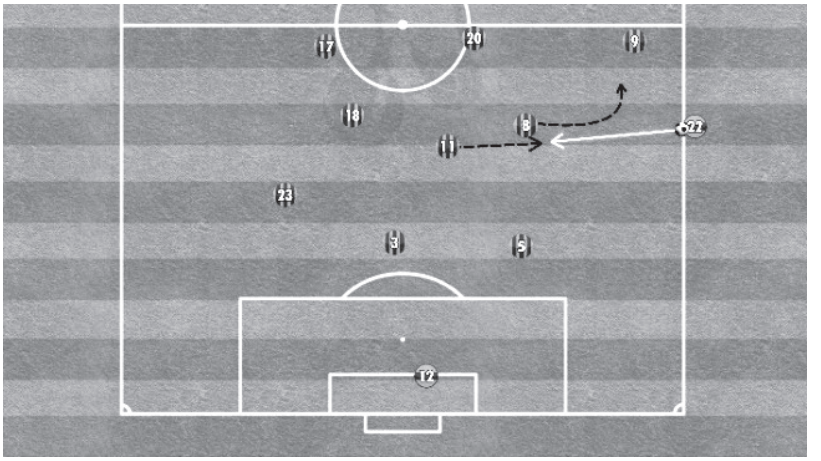


Figure 7. *Group tactic throw-in in own half*

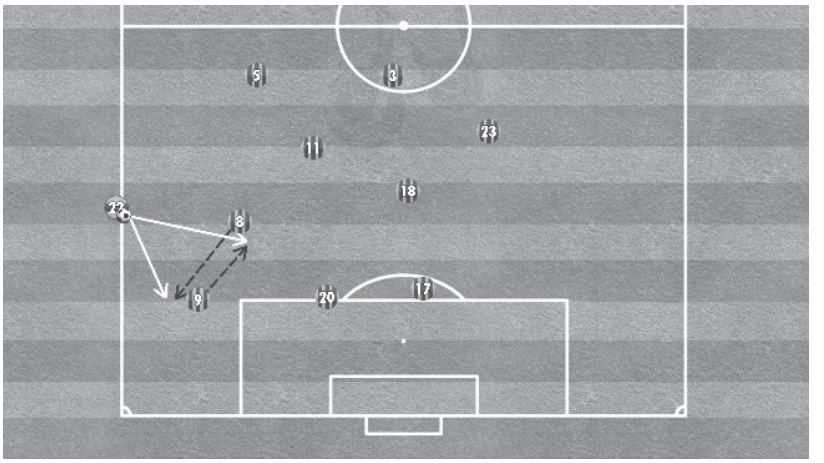


Figure 8. *Group tactic throw-in in opponent half*

The fast throw-in is the best basically, as the optimal time limit to make a throw-in is maximum of 5 seconds, to exploit the still unorganized defensive positioning and find a free-man teammate. The basic principle is a whoever is the closest to the ball if it goes outside, he moves to take the throw-in. If possible, keep possession of the ball, therefore most of the throws can be categorized as the clever throw-ins: various movements to create either a free space or a teammate. The most optimal way to go is to mix some patterns and the basic principles, to have some pre-planned ideas, whilst also offering key guidelines through principles, so the players will be able to adjust to the oppositional reaction as well. All these aspects should be taken into account when planning training sessions because having these data will allow us to transmit clear and concise information to the players. Likewise, it will allow coaches to design training exercises similar to the actual competition and adapt the game style with regard to match status. This is important notes to consider from a practical point of view.

REFERENCES

Busca, B., Hileno, R., Nadal, B., & Sena, J. (2022). Prediction of the penalty kick direction in men's soccer. *International Journal of Performance Analysis in Sport*, https://doi.org/10.1080/24748668.2022.2097834

Cerrah, A., Simsek, D., & Ertan, H. (2014). The Evaluation of Ground Reaction Forces During Two Different Soccer Throw-In Techniques. *A Preliminary Study Pamukkale Journal of Sport Sciences,* Vol. 5 No. 1, pp. 106-112.

Dujaka, A., & Sokoli, B. (2019). The Free Kick Kinematics of Elite Football Players. *International Journal of Sports Science and Physical Education,* Vol. 4 No. 2, pp. 18-27.

Kubayi, A. (2020). Analysis of Goal Scoring Patterns in the 2018 FIFA World Cup. *Journal of Human Kinetics,* 71 (1), pp. 205–210.

Mitrotasios, M., Casal, C., Armatas, V., Losada, J., & Maneiro, R. (2021). Analysis of Corner Kick Success in Laliga Santander 2019/2020. *European Journal Of Human Movement,* Vol. 47 No. 2, pp. 8-22.

Oghonyon, J., Okagbue, H., Amanie, E., & Atayero, A.

(2020). Statistical analysis of leading goal scoring pattern of Europe's top five football leagues. *International Journal of Innovative Technology and Exploring Engineering,* 9 (4), pp. 517-521.

Pulling, C. (2015). Long corner kicks in the English premier league: deliveries into the goal area and critical area. *Kinesiology*, 47 (2), pp. 193-201.

De Baranda, P. S., & Lopez-Riquelme, D. (2012). Analysis of corner kicks in relation to match status in the 2006 World Cup. *European Journal of Sport Science,* 12 (2), pp. 121-129.

Strafford, B., Smith, A., North, J., & Stone, J. (2019). Comparative analysis of the top six and bottom six teams' corner kick strategies in the 2015/2016 English Premier League. *International Journal of Performance Analysis in Sport,* 19 (6), pp. 904-918

Stone, J., Smith, A., & Barry, A. (2021). The undervalued set piece: Analysis of soccer throw-ins during the English Premier League 2018–2019. *International Journal of Sports Science & Coaching,* 16 (3), pp. 830–839.

Vike, P. (2021). *futaa.com.* Retrieved from EURO 2020 stats: Fastest players, distance covered, attacking runs and best dribblers: https://futaa.com/article/224784/euro-2020-stats-fastest-players-distance-covered-attacking-runs-and-best-dribblers

Wang, S., & Qin, Y. (2020). Analysis of shooting and goal scoring patterns in the 2019 France Women's. *Journal of Physical Education and Sport*, 20 (6), pp. 3080-3089.

Yue, Z., Broich, H., & Mester, J. (2014). Statistical analysis for the soccer matches of the first Bundesliga. *International Journal of Sports Science & Coaching* , Vol. 9 No. 3, pp. 553-560.

Zhao, Y., & Zhang, H. (2019). Analysis of goals in the English Premier League. *International Journal of Performance Analysis in Sport*, Vol. 19 No. 5, pp. 820-831.

IFAB. (2022). *thefa.com*. Retrieved from Laws of the game & FA rules: https://www.thefa.com/football-rules-governance/lawsandrules/laws/football-11-11/law-13---free-kicks

IFAB. (2022). *thefa.com*. Retrieved from Laws of the game & FA rules: https://www.thefa.com/football-rules-governance/lawsandrules/laws/football-11-11/law-14---the-penalty-kick

IFAB. (2022). *thefa.com*. Retrieved from Laws of the game & FA rules: https://www.thefa.com/football-rules-governance/lawsandrules/laws/football-11-11/law-15---the-throw-in

IFAB. (2022). *thefa.com*. Retrieved from Laws of the game & FA rules: https://www.thefa.com/football-rules-governance/lawsandrules/laws/football-11-11/law-17---the-corner-kick

Corresponding author:
Daniel Dimov
Football and Tennis Department
National Sports Academy "Vassil Levski"
Sofia, Bulgaria
E-mail: ddimov.nsa.football@abv.bg

 DOI: 10.37393/ICASS2022/140 423 - 428

DIDACTIC TEST FOR ASSESSMENT OF THEORETICAL KNOWLEDGE IN TAEKWON-DO

Silvia Ilieva-Sinigerova
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
Successful performance and high sports achievements in martial arts depend on the various aspects of sports training - physical, technical, tactical, and psychological training. On the other hand, the increase in technical degree is related to a physical and theoretical exam. The aim of the present study is to assess the knowledge of athletes related to the history and creation of taekwon-do. Methodology: The study was carried out in April – May 2020. The research was aimed to explores the knowledge of the athletes, related to the history and creation of taekwon-do. The study involved 232 taekwon-do athletes (15.53 ± 4.30 years) with different sports experience and degree from 15 local taekwon-do clubs in Bulgaria. The online form test contains a total of 17 questions (4 personal and 13 specialized questions). Results: The largest accumulation of values (most athletes) received a result in the range of 11-16 points (68.53% of all tested). Most tasks have very good discrimination (0.40 ≤ DP ≤ 0.70). The calculated difficulty P of the questions used is in the range of 63-97%. Conclusion: Empirical data show that the test has good statistical characteristics and can be used to assess the theoretical knowledge of athletes during a promotion exam. The data obtained from the pedagogical experiment give grounds to claim that the level of knowledge and skills of taekwon-do athletes are at different levels.

Keywords: *sports education, taekwon-do, evaluation*

INTRODUCTION

Didactic tests are increasingly present in educational practice (Ilieva, Terzieva, 2002). Didactic tests are informative in terms of acquired knowledge and skills and can be used both for self-study and for control by teachers (Tishinov, Gikova, 2013). Didactics pose with sharpness the question of the effectiveness of school learning, which is measured not by the quantity, but by the quality of acquired knowledge, skills, and competences (Teneva, 2016).

Dimitrova (2008) offers a characterization of test systems - true or false statement tests, multiple choice; more than several possible answers, or selecting one answer as an area of a figure. According to Pavlova (2000), the answer in true and false statement tests is specific single knowledge and contains a considerable percentage of a lottery. These questions have a motivational value (easier) and provide a gradual progression of difficulty. Damyanova et al. (2006) applied a test battery to check the knowledge of sports dance specialists, containing closed questions, differentiated into three separate types of scales depending on the number and/or combination of correct answers indicated: 2 distractors (1 correct answer); 4 distractors (1 correct answer); 6 distractors (a combination of 3 correct answers).

With the emergence of online learning environments, online methods for checking knowledge and corresponding software tools also arise (Marchev, Kirkova, 2012). Nowadays, web systems and applications are available to teachers and training organizations, such as Google Forms. This system provides the convenience of organizing e-testing and evaluating and analyzing test results (Kostadinova, Aleksiev, 2018).

Google Forms is an application for creating survey forms, quizzes, and tests and collecting responses. For checkbox questions, the application reports a correct answer only if all correct answers were indicated. If the student indicated only some of the correct answers or also gave a wrong one, Google Forms counted 0 points for the corresponding question. At the teacher's discretion, they may manually assign a portion of the credit to this question (Kojuharova, 2019).

PURPOSE

The present study aims to assess athletes' knowledge related to the history and creation of taekwon-do.

METHODS

The research was conducted in the period April-May 2020. The study aimed to explore the knowledge of the athletes related to the history and cre-

ation of taekwon-do and involved 232 taekwon-do athletes (15.53 ± 7.30 years) with different sports experience and degrees from 15 local taekwon-do clubs in Bulgaria.

After the start of the Covid-19 pandemic, the training process was suspended for an indefinite period. The measures that the Bulgarian Taekwon-do ITF Federation took at that time were: sharing training videos (on YouTube), sending materials with theory, and regularly conducting tests on theory material. For their part, sports clubs conducted online training through various platforms, shared training videos, materials, and prepared programs.

Taekwon-do was a martial art and apart from the sports and competition part, great attention was paid to the theory as well. This was also included in the degree promotion exam syllabus. Participation in the tests was voluntary and there was no limit to the number of attempts. At the beginning of each test, the specific requirements for completing it were indicated, as well as a minimum number of points for successfully passing the test. All participants or their parents (in the case of participants under 18 years of age) provided written informed consent.

The test for athletes was created using the Google forms software. The test contained a total of 17 questions (4 personal and 13 specialized questions - closed questions with one or more than one correct answer). The variants of the questions used were pictures and marking the correct answer. There was no time limit for filling and no feedback on each question, whether the answer was right or wrong.

Mathematical and statistical methods: descriptive statistics, quantitative and qualitative analysis were applied. Data were statistically analyzed with SPSS and MS Excel.

RESULTS

The study included athletes representing all age groups and gender in ITF taekwon-do. The data presented in (Table 1) showed the average values for age and obtained test results of the athletes.

Table 1. *Average values for athletes*

Indicator	N	R	Min	Max	X	SD	V	As	Ex
Age	232	20	10	30	15.53	4.30	27.68	1.664	3.518
Result	232	32	2	34	19.59	6.44	32.87	0.185	0.175

SD – standard deviation, V- coefficient of variance

232 athletes completed the test. The tested contestants' age was 20 years, and the results reported the greatest interest and completion of tests in the age group of 10-20 years (86%).

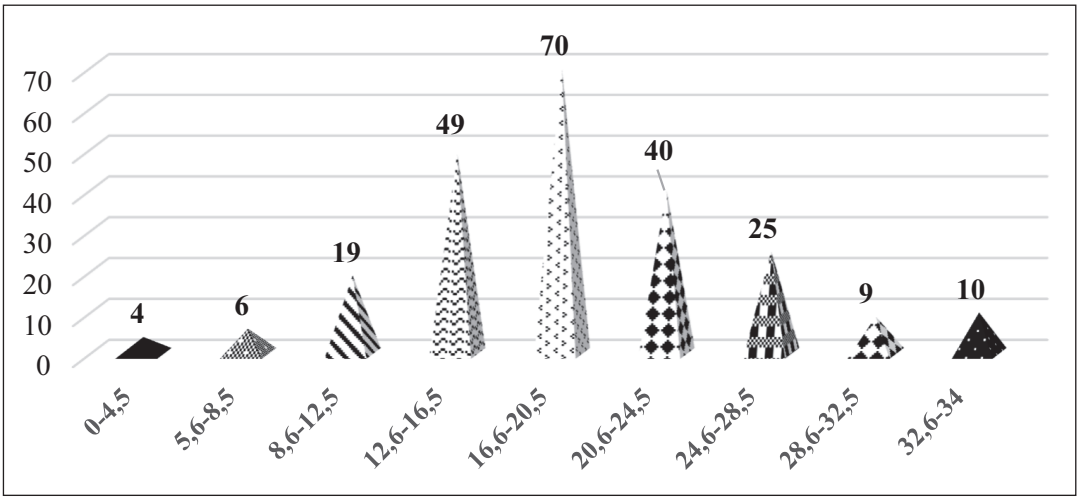


Figure 1. *Frequency distribution of test scores*

The lowest reported score was 2 points, and the strongest was 34 points (which was also the maximum possible score). After reviewing the individual results, it was determined that ten athletes achieved the maximum number of points on the test. It was estimated that 68.3% of final test scores were in the 14–24-point range (Figure 1).

A posteriori analysis was applied to determine the difficulty index of the individual questions in the test. The test for athletes included a variety of questions with a different number of distractors.

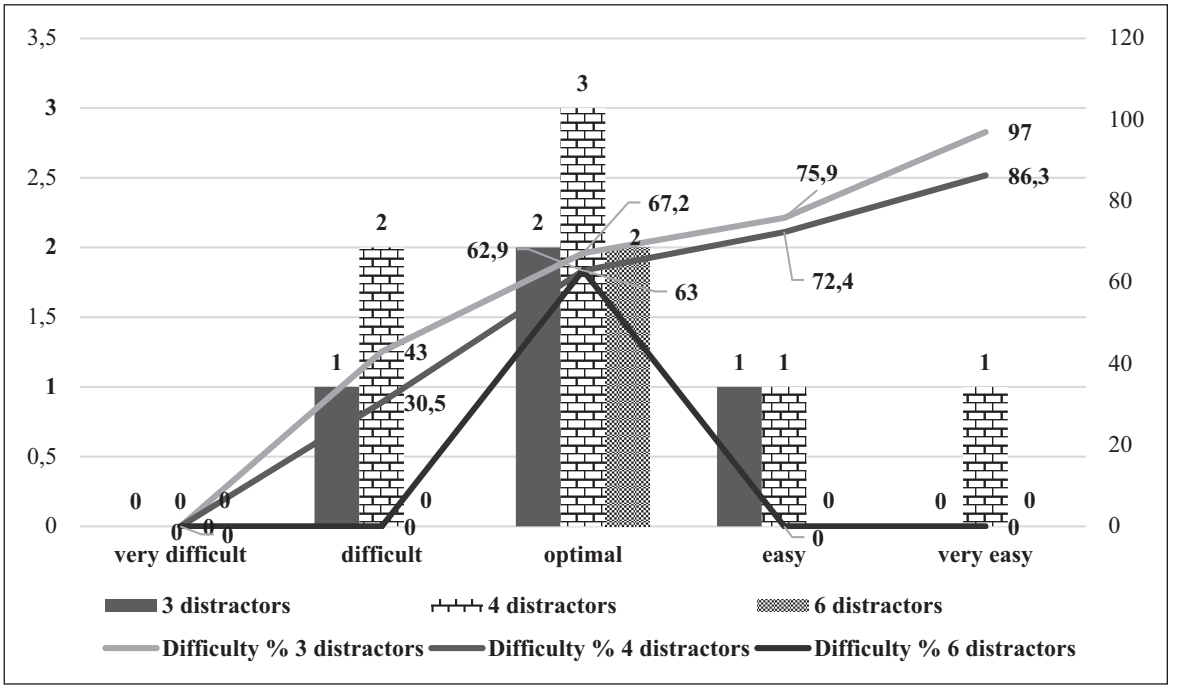


Figure 2. *Coefficient of difficulty of questions*

After the analysis, it was found that for the questions with three distractors, two of the included ones were of optimal difficulty, and one was "difficult". For the questions with four distractors (which variant was found to be the most reliable according to the researchers), three of the questions were of optimal difficulty and two with difficulty. Two questions with an easy level of difficulty and one question with a very easy level of difficulty were identified. The test includes two questions that have more than one correct answer. As the number of distractors increased, two questions of optimal difficulty were calculated. The calculated difficulty P of the questions used is in the range of 63-97%.

Upon further analysis, it was found that questions with more than one correct answer (6 distractors) were most frequently answered incorrectly. The questions were related to the martial arts mission (34 correct answers) as well as significant events that happened in 1959 (41 correct answers).

On the other hand, however, we draw attention to the fact that the Google Forms application used is constructed in such a way that it is necessary to indicate all the correct answers to recognize the answer as correct and to give the points for a correct answer. A partially correct answer will not be counted. This fact further complicates the athletes and reduces their overall results. In our opinion, this specificity of the software used increases the difficulty of the questions and allows them to be reused.

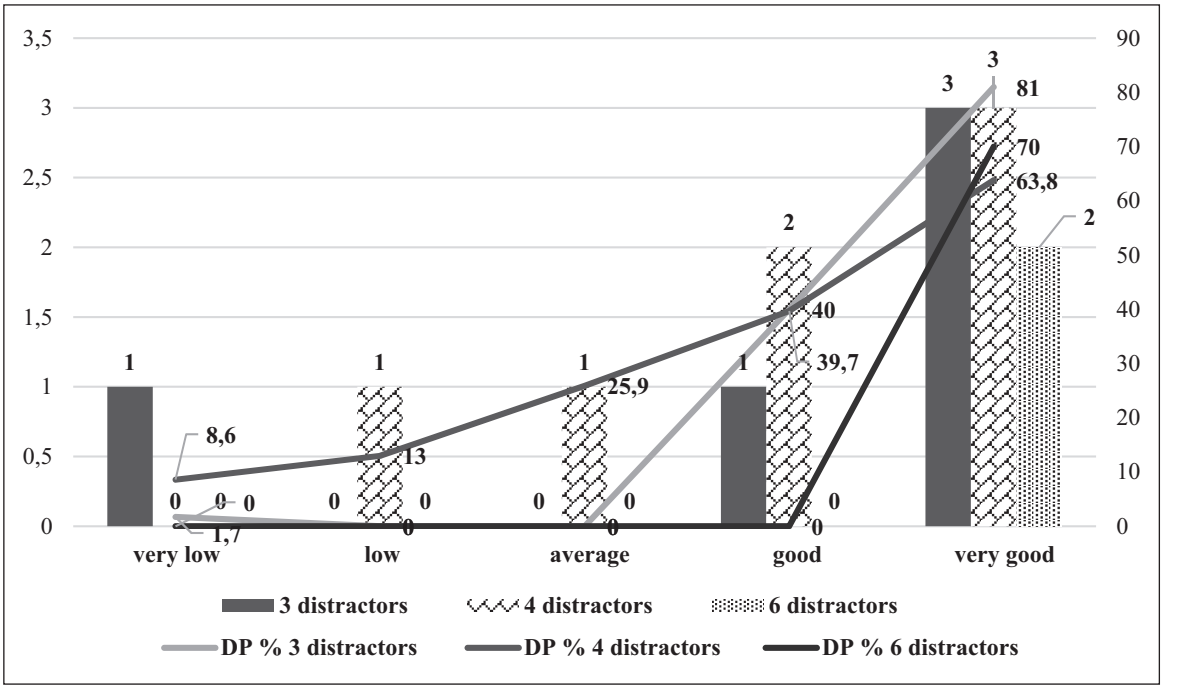


Figure 3. *Discriminative power of questions*

Two of the questions were found to have low levels of discriminatory power (below 20%). According to didactic test theories and researchers' recommendations, it is advisable to drop these questions from the test because they do not have good discriminating qualities and should not be used. One of the questions had a medium discriminative power, for which it is recommended to be revised and improved.

Most tasks have very good discrimination ($0.40 \leq DP \leq 0.70$). This gives us reason to conclude that the test used is an excellent discriminator with a very good rating.

DISCUSSION

According to Konchev (2019), the introduction of mobile technologies into education marked the beginning of the so-called "mobile learning" - the intersection of mobile computing and e-learning. Young people prefer to use modern information technologies (Kostadinova, Alexiev, 2018).

From pedagogical practice, it was found that the grades of oral exams are almost always higher than those of written ones, which means that the influence of subjective factors is much greater. The written form can be conducted through the presentation of one or several questions or through didactic tests. Through the application of tests, objective, reliable and quantitatively comparable data are obtained to establish the level of knowledge (Kutincheva et al., 2005). In systems that are used to assess knowledge, the results go directly to the teacher and sometimes no feedback to the student is provided (Dimitrova, 2008). The questions that have a low difficulty index and, respectively, made most of the tested difficult, it is desirable to modify, simplify or the questions themselves to be decomposed and reformulated to achieve even better characteristics of the entire test battery (Damyanova, 2004).

The wide range of questions in a similar test gives information about the candidate's knowledge of the material in the entire section, and not only on individual questions that would occur to him randomly. The possibility of the questions appearing in front of the candidates in a jumbled manner eliminates to a large extent the possibility of copying and prompting (Petkova, 2013). There were some negative features of this type of test for example with regular use of the system, conditions are created for striving to memorize the correct answers, regardless of the random order of presentation of the questions by the computer and lack of possibility to avoid some psychological problems related to the unusual form of exam. Practice shows that individual students perceive the situation of being tested by a computer differently (Yordanov, Marin-

ov, 1898). According to Tsvetkov (2017), to achieve effective management of sports training in elite athletes and teams, the scientific approach must re-enter practice.

CONCLUSIONS

Empirical data show that the test has good statistical characteristics and can be used to assess the theoretical knowledge of athletes during a promotion exam. The data obtained from the pedagogical experiment give grounds to claim that the level of knowledge and skills of taekwon-do athletes are at different levels.

ACKNOWLEDGEMENTS

To all Bulgarian taekwondo ITF teams that took part in this investigation.

FUNDING

The present study was conducted within the framework of the project "Increasing the theoretical knowledge of Taekwon-Do ITF competitors during the Covid-19 pandemic", implemented in 2020 by the Bulgarian Taekwon-Do Federation ITF.

REFERENCES

Damyanova, R., Stoimenova, E., Kostov, Zl. (2006). Klasicheski analiz na psihometrichnite svoistva na testovata bateriya za ocenka na teoretichnite znaniya po sportni tanci. *Sport I nauka*, special vol. 2, pp. 82-89. ISSN 1310-3393. // Дамянова, Р., Стоименова, Е., Костов, Зл. (2006). Класически анализ на психометричните свойства на тестовата батерия за оценка на теоретичните знания по спортни танци. Спорт и наука, изв. бр. 2, стр. 82-89. ISSN 1310-3393.

Damyanova, R. (2004). Kontrol I ocenka na teoretichnite znaniya po praviloznanie – golf. *Sbornik nauchni dokladi ot I-va mejdunarodna konferenciya na katedra "Futbol I tenis"*, Avangard prima, pp. 123-130. // Дамянова, Р. (2004). Контрол и оценка на теоретичните знания по правилознание – голф. Сборник научни доклади от I-ва международна конференция на катедра „Футбол и тенис", Авангард прима, стр. 123-130.

Dimitrova, S. (2008). Predimstva na sistemniya podhod pri razrabotvaneto na testove za proverka na znaniya. *Ubileyna nauchna konferenciya s mejdunarodno uchastie VSU'2008,* Sofia, Bulgaria, vol. 2, No 8, pp. 13-16. ISBN: 978-954-331-020-3. // Димитрова, С. (2008). Предимства на системния подход при разработването на тестове за проверка на знания. *Юбилейна научна конференция с международно участие ВСУ'2008*, София, България, том 2, бр. 8, стр. 13 -16. ISBN: 978-954-331-020-3

Ilieva, M., Terzieva, S. (2002). Pismeni formi na proveryavane na znaniyata v tehnicheskite visshi uchilishta. Mejdunarodna nauchna konferenciya "Problemi na malkiya I sredniya biznes", *spisanie "Upravlenie I ustoichivo razvitie"*, vol. 1-2, pp. 170-175. // Илиева, М., Терзиева, С. (2002). Писмени форми на проверяване на знанията в техническите висши училища. Международна научна конференция „Проблеми на малкия и средния бизнес", списание *„Управление и устойчиво* развитие", бр. 1-2, стр. 170-175.

Kojuharova, D. (2019). Suzdavane na testove s Google forms. E-spisanie 'Pedagogicheski forum', vol. 1, pp. 63-70. ISSN: 1314-7986. // Кожухарова, Д. (2019). Създаване на тестове с Google forms. Е-списание „Педагогически форум", бр. 1, стр. 63-70. ISSN: 1314-7986.

Konchev, M. (2019). Ocenka na razvitieto na distancionnoto obuchenie v Evropa. Sport I nauka, vol. 1-2, pp. 195-202. ISSN 1310-3393. // Кончев, М. (2019). Оценка на развитието на дистанционното обучение в Европа. Спорт и наука, бр. 1-2, стр. 195-202. ISSN 1310-3393.

Kostadinova, I., Aleksiev, K. (2018). Optimizaciya na WEB – testovi stranici v sistemata za e-testove. XV Nacionalna nauchna konferenciya 'Obshtestvoto na znanieto I humanizmat na XXI vek', sbornik 'Suvremenni strategii I inovacii v upravlenie na znanieto', vol, 4, pp. 140-147. // Костадинова, И., Алексиев, К. (2018). Оптимизация на WEB - тестови страници в системата за е-тестове. XV Национална научна конференция „Обществото на знанието и хуманизмът на XXI век", сборник *„Съвременни стратегии и иновации в управление на знанието"*, бр. 4, стр. 140-147.

Kutincheva, P., Tishinov, O., Alsahary, O. (2005). Usuvurshenstvane metodikata za ocenyavane na teoretichnata podgotovka na studentite po pluvane. *Sport I nauka*, vol. 4, pp. 90-95. ISSN 1310-3393. // Кутинчева, П., Тишинов, О., Алхасаири, О. (2005). Усъвършенстване методиката за оценяване на теоретическата подготовка на студентите по плуване. Спорт и наука, бр. 4, стр. 90-95. ISSN 1310-3393.

Marchev, Y., Kirkova, A. (2012). Online ocenyavane I e-testove po informatika v Medicinski kolej Plovdiv. Ubileina nauchna sesiya za prepodavateli I student '70 godini medicinski kolej Plovdiv – tradicii I budeshte' 9-10.05.2012, *Sbornik nauchni dokladi*, pp. 264-268. ISBN 978-954-9549-68-3 // Марчев, Й., А. Киркова. (2012). Онлайн оценяване и е-тестове по информатика в Медицински колеж Пловдив. Юбилейна научна

сесия за преподаватели и студенти „70 години Медицински колеж Пловдив – традиции и бъдеще“ 9-10.05.2012, Сборник научни доклади, стр. 264-268. ISBN 978-954-9549-68-3

Pavlova, E. (2000). Hipotetichen model na testova Sistema (adaptirana za aprobirane v izpita po Fiziologiya). Godishna nauchna konferenciya *"Sport. Obshtestvo. Obrazovanie*" 22-23 May 1997, vol. 3, pp. 191-200. // Павлова, Е. (2000). Хипотетичен модел на тестова система (адаптирана за апробиране в изпита по Физиология). Год. Научн. Конф. „*Спорт. Общество. Образование*“ 22-23 май 1997, том 3, стр. 191-200.

Petkova, D. (2013). Elektronni testove za ocenyavane na znaniyata na specialist po ski. *Sports I nauka*, vol. 1, pp. 119-122. ISSN 1310-3393. // Петкова, Д. (2013). Електронни тестове за оценяване знанията на специалисти по ски. Спорт и наука, бр. 1, стр. 119-122. ISSN 1310-3393.

Teneva, M. (2016). Didacticheska efektivnost – factori I predpostavki za neinoto realizirane. Godishnik na Trakiiskiya universitet, Pedagogicheski facultet, vol. 13, pp. 5-46. ISSN 1312-286X // Тенева, М. (2016). Дидактическа ефективност – фактори и предпоставки за нейното реализиране. Годишник на Тракийския университет, Педагогически факултет, бр. 13, стр. 5-46. ISSN 1312-286X

Tishinov, O., Gikova, M. (2013). Programirano interaktivno obuchenie I prilojenieto na testove v uchebniya kurs po biomechanika za OKS "bakalavar". *Sport I nauka*, vol. 1, pp. 99-105. ISSN 1310-3393. // Тишинов, О., Гикова, М. (2013). Програмирано интерактивно обучение и приложението на тестове в учебния курс по биомеханика за ОКС „бакалавър“. Спорт и наука, бр. 1, стр. 99-105. ISSN 1310-3393.

Tzvetkov, Al. (2017). Naukata I sportnite postijeniya. Sport I nauka, special issue 1, pp. 47-54. ISSN 1310-3393. // Цветков, Ал. (2017). Науката и спортните постижения. Спорт и наука, изв. бр. 1, стр. 47-54. ISSN 1310-3393.

Yordanov, N., Marinov, M. (1898). Sistemen podhod za testova proverka na praviloznanieto po basketbol, voleibol I handbal. *Nauchni trudove na VIF*, vol. 29, No. 5, pp. 83-85. // Йорданов, Н., Маринов, М. (1898). Системен подход за тестова проверка на правилознанието по баскетбол, волейбол и хандбал. Научни трудове на ВИФ, т.29, кн.5, стр. 83-85.

Corresponding author:
Silvia Ilieva-Sinigerova, PhD
Department "Theory of sport"
National Sports Academy "Vassil Levski"
Sofia, Bulgaria
E-mail: nsastatics@gmail.com

 DOI: 10.37393/ICASS2022/141 429 - 435

EXPERIMENTAL METHODOLOGY FOR EVALUATION OF THE PRELIMINARY TRAINING OF MOUNTAIN GUIDES

Alexander Shopov, Todor Todorov
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
Introduction. As the industry experts like to say: "The mountain guide is the guide at the "Museum of Nature". But what distinguishes these people who "do not stay anywhere longer than their enthusiasm"? The training of mountain guides is carried out in the Professional Education Center part of the National Agency for Vocational Education and Training. The training begins with an entrance exam, which assesses the preparation of candidates, and subsequently, the results are used to rank for the upcoming training. The purpose of our research is the development of an experimental methodology for evaluating the preliminary training of candidates for mountain guides. Methods. The research was held in 2022 at the Professional Education Center "Mountains and people". Our methods included several criteria: moving on a mountain route with a topographic map crossing terrain, a theoretical test, and an intervthese criteria formed an overall score with a maximum score of 20 points. We applied our method to 29 participants. Results: Our participants showed an average time of 4 h 38 min for moving on a mountain route with a topographic map and crossing terrain. These times corresponded with an average of 8.8 points in our evaluation method. The average score for the theoretical test was 3.3 points, and the average score for the interview was 3.8 points. The average overall score was 14.8 points, which we define as very informative for the selection of candidates for mountain guides. Conclusion. We recommend this assessment methodology to National Agency for Vocational Education and Training. It is likely to be implemented in the examination requirements of all Professional Education Centers in the country.

Keywords: *mountain guide, topographic map, difficult terrain*

INTRODUCTION

A mountain guide is a specialist who loves and knows mountains, can move and reside in them, and who is in charge of taking a person or a group to the mountain against some payment to show them the best of its nature and his knowledge (Popyordanov et al., 2008).

A mountain guide is a person registered in the National Tourist Register (NTR) according to article 166, paragraph 1 of The Law of Tourism (WT) for practicing the occupation of "Mountain guide", who takes and guides tourists on the mountain and among nature, and along the chosen route takes care of the tourists' safety and provides them with information about the natural-geographic peculiarities of the route and its sights (ORDINANCE N3 of 7 March 2016).

The job of a "Mountain guide" can be done by a person who meets the requirements of article 12, paragraph 1, or paragraph 2. The level enables a mountain guide to take tourists and groups to the mountains in the country on foot or in snow conditions - with traction devices along different routes without using alpine equipment.

The qualification along article 1 can be acquired by every able Bulgarian or EU citizen, or a citizen of a country involved in the European Economic Area Agreement (EEA), or the Confederation of Switzerland who has successfully undertaken the respective training (ORDINANCE N3 from 7 March 2016).

The acquired professional qualification is attested with a certificate for a professional qualification issued according to ORDINANCE N4 from 2003 for the documents in the national education system (announced in DV, issue 41 of 2003) by the schools according to article 9, paragraph 1, point 3 of Professional Training and Education Law, or by the licensed professional training centers registered in the Register of the professional training centers at the National Professional Training and Education Agency (NPTEA).

The training of the mountain guides is mainly provided by the Center of Professional Training (CPT) and starts with an entrance exam which evaluates the candidates' preparation. The results then serve as a classification for future education.

The aim of this research was to create an experimental methodology for evaluation of the candidates for mountain guides' preparation in a point form along a maximum of 20 degrees scale.

METHODOLOGY

The subject of the research was the possibilities and the process of integral diagnostics of competence and degree of readiness of candidates applying for training for the occupation "Mountain guide".

The object of the research was the quantitative and quality indicators characterizing physical condition, technical preparation, and knowledge about Bulgaria, as well as the gained experience and competencies of the candidates for mountain guides.

Research Methods

To evaluate the level of the candidates' preliminary preparation, we used complex methods including the following indicators: trekking a mountain route with a tourist topographic map, taking a test for conditioning and technical skills "Hard terrains", a test "Knowledge about Bulgaria", and an interview with the candidates.

1. Control and evaluation of the physical preparation and test "Hard terrains"

Trekking a mountain route with a topographic map – there are mid-stations along the route where the candidate's time is recorded. They get one point if they are within the allotted time or a maximum of three points from the control stations. If they finish the route within five hours, another three points are added to their score. If they finish past time, some points are deduced - 1 point for every ten minutes of overtime. From the test "Hard terrains", the candidates get from 0 to 4 points, or the total is a maximum of 10 points.

2. Control and evaluation of general and specific knowledge – test "Knowledge about Bulgaria": it is a written test for two hours. It consists of 88 multiple-choice questions, each with three answers. There is only one correct answer, which should be marked with „V" or „X". The questions are divided in the following way:

A. General knowledge – 15 questions

E.g., Which of the following sorts of grapes does not originate in Bulgaria?

- Broad leaved Melnik
- Gumza
- Otel.

B. Specific questions about Bulgaria's history – 14 questions

C. 30 questions about Bulgaria's geography; religion, Christianity – 15 questions; Bulgarian culture – 14 questions. On the basis of the correct answers, the candidates for mountain guides get from 1 to 6 points (Table 1). The results are announced in written form no later than three days after taking the exam.

Table 1. *Criteria for evaluation of the test "Knowledge about Bulgaria" according to the number of the correct answers*

6 points	5 points	4 points	3 points	2 points	1 point
80–88	70–79	60–69	50–59	40–49	30–39

The physical preparation test includes trekking a mountain route outlined on a topographic map (about 15 km, total ascend more than 1000m) for an allotted control time. The candidate's backpack should be 15% of his weight. *During the trekking, at a suitable spot with good visibility, the candidates do the test "Hard terrains".* It includes an outlined rocky-scree route (about 20m, up to 50m denivelation). During the trekking, the evaluators watch out for the candidates' staggering, supporting, sitting, and fallings. Two evaluators observe the allotted time (5 min), but the total control time remains unchanged.

The organization and diagnostics of the evaluation of the physical preparation and the test 'Hard terrains" are the following:

- ✓ When taking the test, the candidates should bring the necessary trekking equipment.
- ✓ The candidates are weighed (with scales), and the weight of their backpacks is determined.
- ✓ The backpack's content is reduced to the weight needed.
- ✓ An oral technical description of the route is made. Its physical parameters are explained –

linear distance, overall ascend, and control time for passing the whole route.

- ✓ Five minutes before the start, the candidates receive maps with an outlined route (Figure 1).

The experiment was held in April 2021, in Vitosha mountain, with a start-final at the parking lot of Dragalevski Monastery. The route was outlined on a tourist map with a scale of 1:25000 and horizontals every 10 m. The map was made especially for the case by "Iskar tour". The route length was 16,688 км with an overall ascend of 1210 m. there were three control stations – at Boyana lake, Kikish shelter, and at the first crossing of the route, where evaluators recorded the middle times (Figure 1). The middle control times were 1, 2:30, and 3:30 hours. The idea was that the candidates moved at a moderate pace and that the serious mistakes could not be compensated. The start was after a draw every 5 minutes, and the candidates were wearing numbers attached to their backpacks to be recognizable. Only the use of a compass was allowed (without GPS) and telescopic poles, if required.

3. An interview with the candidates for mountain guides

The aim is to determine the candidate's mountaineering experience and motivation. The candidates provide the committee with their CVs, including their mountain experience in the past three years, and they should expand on them during the interview. The maximum number of points they can get is 4.

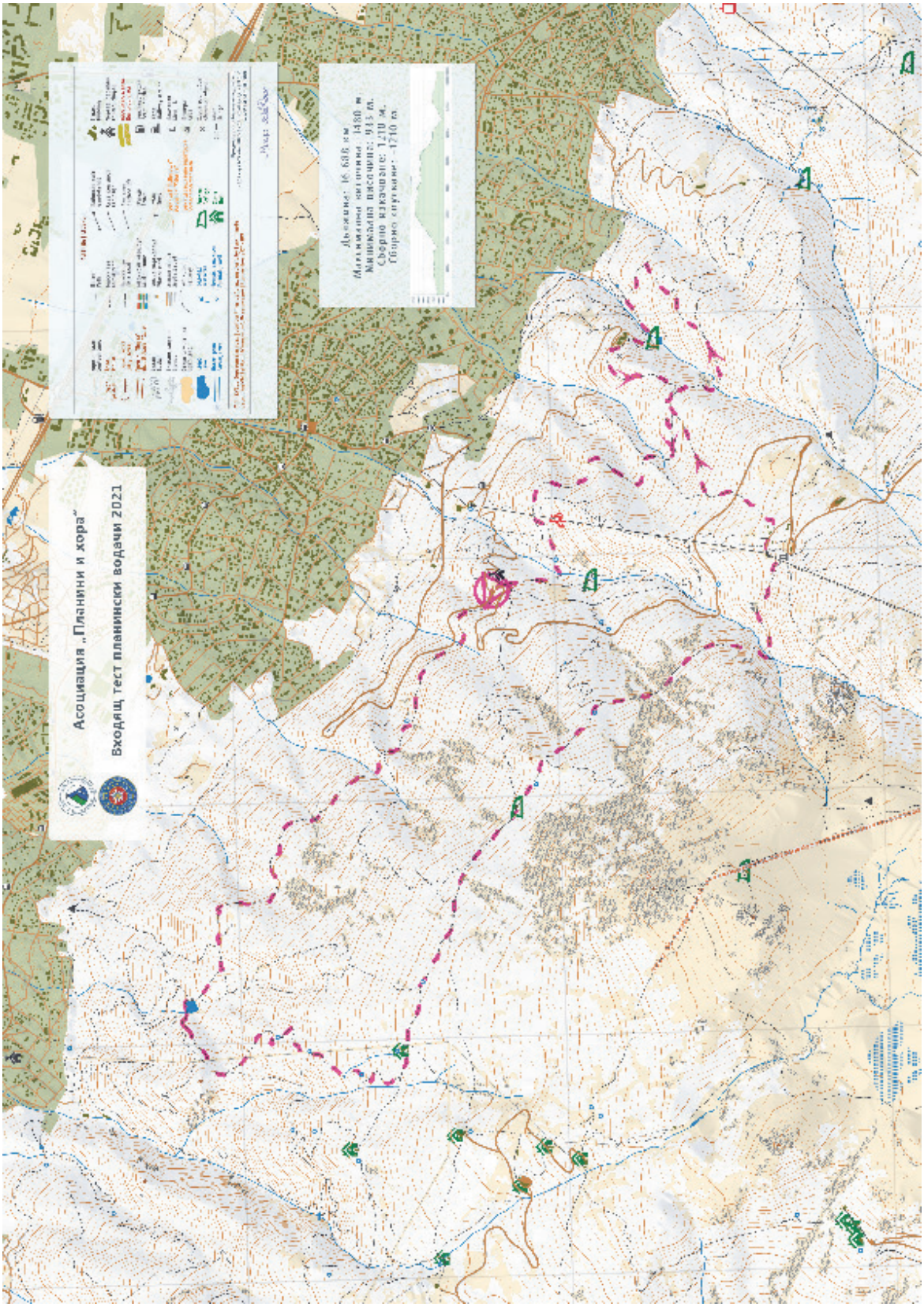


Figure 1. *Tourist map of Vitosha mountain with the route for control of the preparation*

Table 2. *Results from the tests for control of the preparation of the candidates for mountain guides*

	Participant		Control times (hour)					Trekking time to the stations				Responses	Number of points along the different criteria for evaluation								Result
№	Start N	Name	Start	st.1	st.2	st.3	Final	st.1	st.2	st.3	Total time	Test	st.1	st.2	st.3	Hard terrains	Final	Total	test	Interviews and CV	Number of points
1	234	M.N.	8:00	8:51	10:08	11:22	12:47	0:51	2:08	3:22	4:47	50	1	1	1	2	3	8	3	2	**13**
2	235	A.Z.	8:03	8:51	10:08	11:22	12:42	0:48	2:05	3:19	4:39	63	1	1	1	3	3	9	4	3	**16**
3	236	Z.D.	8:06	8:51	10:08	11:22	12:36	0:45	2:02	3:16	4:30	55	1	1	1	4	3	10	3	4	**17**
4	237	Z.P.	8:09	8:45	9:47	11:00	12:39	0:36	1:38	2:51	4:30	58	1	1	1	4	3	10	3	4	**17**
5	238	I.K.	8:12	8:53	10:07	11:22	12:43	0:41	1:55	3:10	4:31	64	1	1	1	3	3	9	4	3	**16**
6	239	V.K.	8:15	8:53	10:07	11:22	12:36	0:38	1:52	3:07	4:21	63	1	1	1	4	3	10	4	4	**18**
7	240	D.B.	8:18	9:02	10:16	11:22	12:47	0:44	1:58	3:04	4:29	61	1	1	1	2	3	8	4	3	**15**
8	241	D.D.	8:21	9:05	10:34	11:51	13:22	0:44	2:13	3:30	5:01	57	1	1	1	3	2	8	3	2	**13**
9	242	K.D.	8:24	9:02	10:08	11:22	12:39	0:38	1:44	2:58	4:15	45	1	1	1	3	3	9	2	2	**13**
10	243	I.P.	8:27	9:24	10:08	12:17	14:05	0:57	1:41	3:50	5:38	54	1	1		1		3	3	1	**7**
11	244	A.D.	8:30	9:19	10:46	11:54	13:32	0:49	2:16	3:24	5:02	64	1	1	1	3	2	8	4	3	**15**
12	245	I.M.	8:33	9:24	10:47	11:58	13:27	0:51	2:14	3:25	4:54	45	1	1	1	2	3	8	2	3	**13**
13	246	V.K.	8:36	9:24	10:47	11:58	13:22	0:48	2:11	3:22	4:46	49	1	1	1	4	3	10	2	3	**15**
14	247	E.N.	8:39	9:30	10:47	11:53	13:27	0:51	2:08	3:14	4:48	58	1	1	1	3	3	9	3	3	**15**
15	248	R.S.	8:42	9:29	10:46	11:53	13:37	0:47	2:04	3:11	4:55	68	1	1	1	4	3	10	4	2	**16**
16	249	D.G.	8:45	9:31	10:47	11:53	13:27	0:46	2:02	3:08	4:42	55	1	1	1	3	3	9	3	3	**15**
17	250	V.S.	8:48	9:33	10:39	11:58	13:21	0:45	1:51	3:10	4:33	50	1	1	1	4	3	10	3	4	**17**
18	251	A.D.	8:51	9:35	10:46	11:58	13:21	0:44	1:55	3:07	4:30	59	1	1	1	4	3	10	3	4	**17**
19	252	O.Sh.	8:54	9:37	11:02	12:17	13:46	0:43	2:08	3:23	4:52	73	1	1	1	4	3	10	5	3	**18**
20	253	I.P.	8:57	9:35	10:38	11:27	12:34	0:38	1:41	2:30	3:37	50	1	1	1	3	3	9	3	2	**14**
21	254	B.S.	9:00	9:47	11:00	12:01	13:26	0:47	2:00	3:01	4:26	62	1	1	1	1	3	7	4	3	**14**
22	255	Ts.P.	9:03	9:48	11:02	12:17	13:47	0:45	1:59	3:14	4:44	48	1	1	1	3	3	9	2	2	**14**
23	256	B.K.	9:06	9:58	11:02	12:17	13:47	0:52	1:56	3:11	4:41	58	1	1	1	2	3	8	3	3	**14**
24	257	R.H.	9:09	9:58	11:18	12:27	13:52	0:49	2:09	3:18	4:43	58	1	1	1	2	3	8	3	1	**12**
25	258	Y.N.	9:12	9:58	11:19	12:27	13:51	0:46	2:07	3:15	4:39	41	1	1	1	4	3	10	2	3	**14**
26	259	P.A.	9:15	9:58	11:08	12:17	13:47	0:43	1:53	3:02	4:32	61	1	1	1	3	3	9	4	2	**13**
27	260	I.A.	9:18	10:01	11:23	12:27	13:52	0:43	2:05	3:09	4:34	59	1	1	1	2	3	8	3	2	**13**
28	50	M.G.	9:21	10:01	11:23	12:27	13:46	0:40	2:02	3:06	4:25	63	1	1	1	3	3	9	4	3	**16**
29	51	V.G.	9:24	10:20	11:30	12:27	13:46	0:56	2:06	3:03	4:22	59	1	1	1	4	3	10	3	3	**16**

Table 3. *Distribution of the candidates for mountain guides according to the points on the entrance test*

18 points	17 points	16 points	15 points	14 points	13 points	12 points	7 points
2	4	5	5	5	6	1	1

4. Math-statistical methods

To make the results objective and mainly to create a table for complex evaluation of the candidates for training, we processed the individual achievements (registered in points) with a variation analysis and the method of sigma digressions of Martin in a seven-degree scale.

Table 4. *Distribution of the percentage values and the theoretical evaluation margins*

MARK	P (%)	MARGINS	
VERY LOW	2,27	BELOW Av–2 S	
LOW	13,59	FROM Av–2 S	TO Av–1 S
BELOW AVERAGE	14,99	FROM Av–1 S	TO Av–0,5 S
AVERAGE	38,29	FROM Av–0,5 S	TO Av+0,5 S
ABOVE AVERAGE	14,99	FROM Av+0,5 S	TO Av+1 S
HIGH	13,59	FROM Av+1 S	TO Av+2 S
VERY HIGH	2,27	ABOVE Av+2 S	

RESULTS AND DISCUSSION

The obtained statistical values characterizing the variable *result – number of points* (the last column in Table 2) are the following:

Table 5. *Table of variances for statistical values characterizing the variable (number of points)*

STATISTICAL VALUES
n = 29
Av = 14,69
S = 2,22
1s = 2,22
2s =2,22.2 = 4,44
0,5s =2,22/2 = 1,11
V = 15,1%

Operating with the mean value of the evaluated indicator (Av) and the standard deviation (S), we created the table to evaluate the integral preparation of the candidates and the respective margins.

Table 6. *Evaluation of the integral preparation of the candidates and the respective margins*

MARK	P (%)	MARGINS	
VERY LOW	2,27	BELOW 10,25 points	
LOW	13,59	FROM 10,25	TO 12,47 points
BELOW AVERAGE	14,99	FROM 12,48	TO 13,58 points
AVERAGE	38,29	FROM 13,59	TO 15,8 points
ABOVE AVERAGE	14,99	FROM 15,81	TO 16,91 points
HIGH	13,59	FROM 16,92	TO 19,13 points
VERY HIGH	2,27	ABOVE 19,13 points	

DISCUSSION

Table 5 shows how the number of points varies in the different zones. Having particular results, the committee should start ranging the candidates for mountain guides from the ones who fall in the zone of "very high mark" to the next ones in the standing. Provided a training course quota exists, the committee can freely and objectively announce the classification. If there are other conditions, the committee should carefully select the candidates who fall under the "average mark".

Another conclusion we can formulate in this case is that the group of candidates was relatively homogeneous – the variety coefficient was 15,1% (leaning to low). This is very important for the future training process at Professional Training Centers, where there is a group organization.

CONCLUSION

We recommend that NPTEA and all professional education centers use this methodology to evaluate the preliminary preparation and admittance of the candidates for mountain guides.

Analyzing the route outlined on the topographic map, we recommend that it be with the same start and final. Most rationally, its shape should be with crossing (eight) because this will enable the change of direction of the movement (Figure 1).

The tourist map on which the route for the entrance test is outlined is recommended not to include names of huts, shelters, and other captions.

REFERENCES

Brogli, Ya. (1979). *Sportna statistika.* M i F.S. // Брогли, Я. (1979). Спортна статистика. М и Ф.С.

NAREDBA № 3 ot 7 mart 2016 g. za obrazovanieto, prakticheskata podgotovka i profesionalnata kvalifikatsia, neobhodimi za pridobivane na pravosposobnost za uprazhnyavane na profesiyata „Planinski vodach".

Popyordanov, L. et al. (2008). *Planinite otblizo*. Odiseya-IN OOD, S.

Turisticheska karta na Vitosha M1:25000 "Iskartour". S. (2020).

Corresponding author:
Alexander Shopov
Tourism, Alpinism, Orienteering Department
National Sports Academy "Vassil Levski"
Sofia, Bulgaria
E-mail: sasho_sh@abv.bg

THE OLYMPIC FLAME THROUGH BULGARIA – 1936

Emiliya Vitanova
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
The topic of this report is related to introducing information about the Olympic flame's passing through Bulgaria in 1936. Our country takes a significant place in the development of the international Olympic movement. Since it participated in the first modern Olympic Games, our country has persisted in establishing the Olympic values in society through the gymnastics movement, the Bulgarian Olympic Committee activities, and other prominent sports people's activities. An important feature related to Bulgarian sport's involvement in the Olympic idea and the Olympic movement was our active participation in organizing the first carrying of the Olympic flame.
This study aims to reveal new information on the topic. The research encompasses several major areas for collecting information – foreign literary sources research (13 sources); a survey of all publications by Bulgarian researchers-historians in the field of sport and the Olympic movement in Bulgaria (11 sources); a review of all preserved Bulgarian periodicals since 1936 (74 articles found), review of the „Olympia Zeitung"since 1936 (8 articles found) and review of Greek newspapers since 1936 (4 articles found). Methodologically, all the information found in scientific or popular publications was systematized by using content analysis, comparative analysis, and critical analysis. The keywords used to search for information on the topic were: Olympic Flame, Olympic Flame Torch, Olympic Games 1936, and Olympic symbols. For the aim of the research we used data retrieved from Journal of Olympic History, Journal of the History of Sport, International Olympic Academy, Olympic Review, www.academia.edu, as well as books and publications preserved in the historical archive of National Sports Academy "Vassil Levski", the Central National Archive, the Regional archives, and the regional history museums in the towns where the Olympic flame went through.
In the unfavorable material and economic conditions in the 1930s our country created an excellent organization and turned this event into one of the most important social-cultural phenomena, which influenced the new perception about the role and significance of the Olympic Games and amateur sport.

Keywords: *Bulgarian Olympic Committee, Stefan Chaprashikov, Carl Diem*

INTRODUCTION

Summary of the research problem

Bulgaria was one of the few countries which sent a delegation for participation in the first modern Olympic Games in Athens in 1896. In the following decades, the Olympic idea was developed through the spirit of the gymnastics movement, which established relations with the International Olympic Committee through the union "Yunak" and, as of 1912, made efforts to establish the Bulgarian Olympic Committee. Thus, the development of the sports movement in Bulgaria at the beginning of the 20th century was immunized against different forms of exploitation – commercially and politically, which was the case in Europe in the first half of the 20th century. An important feature of Bulgaria's involvement in the Olympic idea and the Olympic movement was its active participation in organizing the first carrying of the Olympic flame.

The research of the Olympic flame's passing through Bulgaria in 1936 is related to collecting information from specialized German editions covering the organization and holding of the Olympic Games in Berlin. Some of the sources are Karl Diem (Diem, 1982), Richter (Richter 1936), Stöckel (Stöckel 2015), as well as the official report about holding the XI Olympic Games in Berlin (Organisationskommitee (Hg.) 1937, XI olympiade Berlin 1936). Some foreign authors who partially dwelled on the topic were: Chapman (Chapman 2012), Kornado Durantez (Durantez 1988), Philip Barker (Barker P. (2012), and Walter Borgers (Borgers 2005), including the research of The Olympic Studies Centre (2017).

The topic of the organization and holding of the torch relay in 1936 is also presented in Bulgarian issues. Still, it is based on limited historical sources, which does not provide a clear idea about the contents, organization, and significance of this event for the Bulgarian sport. There is some information in publications related to the history of the Bulgarian Olympic Committee and the Olympic movement in the country. The first publication was of the Bulgarian Olympic Committee. BOC published information about the participation of Bulgaria in the Olympic Games in 1936 in the collection "Telesno vazpitanie v Bulgaria" (1936). Partial studies and publications on this topic were made by: Nikolay Georgiev (Georgiev, 1971), prof. Vassil Conkov (Conkov, 1981), prof. Nataliya Petrova

(Petrova, 1985), prof. Raina Bardareva (Bardareva, 2008), prof. Lozan Mitev (Mitev, 2014, 2016), Yavor Todorov (Todorov, 2017), Tihomir Medjidiev (Medjidiev, 2000). We found some information in several articles published on the Internet: the article "Olimpiadata v Berlin, 1936" (2009) and Diana Hristova's research (Hristova, 2012).

That information allowed us to conduct specialized research for the additional gathering of data preserved in the country's national archives. The analysis of the information and its presentation allows us to find new information which can enrich the history of the Olympic movement in Bulgaria, both on national and local levels.

Aims and objectives of the research

The aim of this study was to find new information about the organization and passing of the Olympic flame through Bulgaria in 1936.

The main tasks of the research were connected with:

1) Researching the information and publications related to the organization and carrying the Olympic flame in 1936 in periodicals by foreign and Bulgarian authors.
2) Presenting some information related to the organization of carrying the flame (organizing committee, route, torch relay participants, celebrations).
3) Presenting new information justifying the historical knowledge about carrying the Olympic flame in the country's different regions.

METHODS

The research encompasses several major areas for collecting information – foreign literary sources research (13 sources); a survey of all publications by Bulgarian researchers-historians in the field of sport and the Olympic movement in Bulgaria (11 sources); a review of all preserved Bulgarian periodicals since 1936 (74 articles found), review of the „Olympia Zeitung"since 1936 (8 articles found). A review of Greek newspapers from 1936 found 4 articles in the „Η Καθημερινη", „Νεα Αληθεια"

The keywords used to search for information on the topic were: Olympic Flame, Olympic Flame Torch, Olympic Games 1936, and Olympic symbols. For the aim of the research, we used data retrieved from Journal of Olympic History, Journal of the History of Sport, International Olympic Academy, Olympic Review, www.academia.edu, as well as books and publications preserved in the historical archive of National Sports Academy "Vassil Levski", the Central National Archive, the regional archives, regional libraries and the regional history museums in the towns of Blagoevgrad, Dupnitsa, Kyustendil, Pernik, and Sofia.

Methodologically, all the information found in scientific or popular publications was systematized by using content analysis, comparative analysis, and critical analysis.

After researching and systematizing all the literary sources found, we outlined two aspects of the research activity. The first aspect of research was finding information about the organization and preparation; the second was introducing some information about holding the Olympic torch relay and celebrations in the bigger towns.

RESULTS

The most important information about the passing of the Olympic flame through Bulgaria was found, systematized, and processed from the 52 articles published in the periodicals "Sport", "Zora", and others. The articles mention several important organizing decisions which benefitted the Olympic torch relay through all the towns. We found some information about the cooperation of the German Organizing Committee led by prof. Karl Diem with the Bulgarian Organizing Committee, BOC, and the Bulgarian member in IOC – Stefan Chaprashikov. Other periodicals where we found some information on the topic are: "Svetlina" (iss. 26-27 from 19.07.1936), "Svetoven Papagal" (1936), "Shturec" (17 July 1936), Chronicle of more important events (1936), "Sredec" (1 November 1936), "Praznichen Dnevnik" (26 July 1936), and "Olympia Zeitung" (1936).

We also researched the regional state archives in the towns of Pernik, Kustendil, and Blagoevgrad where, we found no information. We found some information on the topic in BOC's Central National Archive archives. All the information in the periodicals mentioned above and archives enabled us to make a reenactment of the whole process of preparation and holding the Olympic torch relay through Bulgaria.

After the survey we made, we could point out some important tasks determining the Olympic torch relay. Firstly, the Bulgarian Olympic Committee's

desire to spread the Olympic ideas among the Bulgarian society and to include it in all initiatives the committee was carrying out. Secondly, sports organizations' (including BOC) desire to help the development of the sports movement in the country and their desire for dignified participation in the Summer and Winter Olympic Games in 1936. Thirdly, a desire to reinforce the contacts with IOC and the possibilities for raising Bulgaria's image in the international sports movement.

The International Organizing Committee made the preparation of carrying the Olympic flame of the Games in Berlin 1936. In 1934 it sent a preliminary organization plan to all countries. The participation on our behalf was made by the BOC, government representatives, the Ministry of National Enlightenment, local authorities, and media in towns, sports organizations, and clubs. The organizing committee took several measures to ensure the whole organization.

BOC established Olympic committees in the towns of Petrich, St. Vrach, G. Djumaya, Dupnica, Radomir, Sofia, and Godech (Sport, 1936c, Za olimpiyskata shtafeta – zapisvane na begachite …). The Olympic committees had the following tasks: to take all measures needed for the correct and proper carrying of the flame along the route in their region, to select the torch relay carriers, to make the measurements and marking of the roads, to place road signs, to provide the runners with some transportation to the place of the relay, to organize celebrations for welcoming and sending off the flame *(*TsDA,F.177,op2, arh.ed.579*).* According to some publications in "Sport" (Sport, 1934, Olimpiyskia ogan", 5 noemvri), the organizing committee had a committee related to examining the route of the Olympic flame. The committee members were Todor Zabov, Ivan Kovachev, and a correspondent of the newspaper "Sport". The primary task of the committee was to cooperate with the actions of the Greek Olympic Committee and to decide on some details related to handing the flame from Greek to Bulgarian territory (Sport,1934, BOK shte prouchi …), and to coordinate all local organizations for the successful holding of the event (TsDA, F.177, op2, arh.ed.579).

In 1935, on the occasion of the Olympic torch relay, the Berlin organizing committee's representatives arrived in Bulgaria: Fon Chamer, prof. Karl Diem, Braytmayner, and Dr. Tsap (attaché in the Ministry of Foreign Affairs). Their welcoming was related both to organizational issues and to some discussions about the development of the German sports movement and the Olympic Games in Berlin (Sport, 1935b, Fon Chamer Osten, d-r K. Diem …).

At the end of September 1935, the representatives of the Olympic organizing committee explored the whole route of the Olympic flame – from Olympia to Berlin. The German organizers Karstensen and Klinberg took note of the good organization on our behalf and the fact that Bulgaria had a great experience in organizing such kinds of events (Sport, 1935a, Za Olimpiyskata shtafeta). Proof for this was carrying the Sacred Flame from the town of Preslav to Sofia on the occasion of the 1000 anniversary of Tsar Simeon the Great – 1929.

The organizing committee issued an order for the program of the celebrations on the occasion of welcoming the Olympic flame in the towns. The program envisioned welcoming the torch relay carriers, a welcoming speech by the mayor of each town and some official guests, playing the Olympic and Bulgarian anthems, a prayer service, a performance of some exercises, games, and competitions for children, adolescents, and adults, folklore dances and songs, and bell chime. There was a sacrificial altar which was lit with the flame of the torch relay runner.

An important moment in organizing the Olympic torch relay was the preliminary selection of the participants, which would guarantee the trouble-free passing of the flame through our country. That is why there were trial races (without torches) in all the towns where the flame would go through which were meant to select the most dignified runners.

Information on this topic was found in the BOC's letters (TsDA, F. 262 K, op. 1, a.e. 82) and in the publications in some periodicals *(*Sport, 1936, Za olimpiyskata shtafeta – zapisvane …; Zora 1936c, Prenasyane na olimpiyskia ogan – Plan za rabota,).

The Olympic flame passed on 25 and 26 July 1936 through the following route: Kulata – 25 July at 2 a.m., Marino Pole, Levunovo, delchevo, Kriva Vada, Pirin railway station, Kresna, Izvorite, Gorna Djumaya (the town of Blagoevgrad today), Barakovo, Kocherinovo, Usoika, Dupnica, Drugan, Cher-

vena Mogila, Radomir, Biala Voda, Pernik, tsurkva, Vladaia, Kniajevo, Sofia, Bojurishte, Slivnica, Dragoman, Kalotina – border – 26 July at 1 a.m. (Sport, 1936d, Razpisanie na fakelnoto …; Sport, 1936f, Okonchatelno i ofitsialno …).

Figure 1. *Olympic Flame route through Bulgaria, 1936*

Carrying the Olympic flame through Bulgaria included some obligatory elements to which all regional organizing committees had to abide – organization of the running, celebrations in the big towns, and receiving and handing the Olympic flame on the Greek-Bulgarian and Bulgarian-Yugoslavian borders.

On the spot, long before handing the flame from Greek to Bulgarian land, many people from the adjacent towns and villages gathered, and fanfares and signals at night announced the flame's arrival. The main organizer of carrying the flame through Bulgarian territory, Tenyu Georgiev, welcomed the Greek athlete. In his short speech, he emphasized the great significance of the Olympic deed. The moment the torch was given to the first Bulgarian runner, first lieutenant Rumenov, he ran the first kilometer accompanied by the loud "Hurray" (Zora, 1936b, Tazi sutrin nashite …).

Detailed information about the passing through the whole route was published on the pages of the newspapers "Zora" and "Sport". They mentioned the hour of the arrival of the flame in the Bulgarian towns, the stay of the flame, the duration of the celebrations, the kilometers to be run, etc. The most detailed information can be found in the articles „Timetable of the Olympic torch relay through our territory", "Along the tracks of the sacred Olympic flame – the

Olympic flame set in Olympia approaches Bulgaria", "Final and official timetable of the passing of the sacred Olympic flame through Bulgaria".

The celebrations in the towns included a program: the arrival of the runner, lighting the flame, national anthem, mayor's speech, exercises – children, adolescents, adults, sports games and competitions, the Olympic anthem, a speech about the Olympic Games, preparation of the setting off, prayers, leaving of the runner, bell chime. A sacrificial altar was burning during the celebration, which was lit by the flame brought by the runner. Because of the short stay, the celebrations started before the runner's arrival, continued during his visit and after his leaving. An important element in the program of the celebrations was the prayer by a clergyman. Similar to the religious character of the ancient Olympic Games, the passing of the flame through all our towns emphasized the sacred ritual of its consecration. This, on the one hand, showed symbolism of the past and the unity between clergypersons and secular authority in holding this significant for Bulgaria event.

The media paid particular attention to welcoming the flame in Sofia. Most information can be found in periodicals such as "Zora" (Zora, 1936d, Olimpiyskiyat ogan v Sofia). There is detailed information about the excitement during welcoming ceremonies. The whole Aleksander Nevski square was full of people impatient to see the Olympic flame and to feel its power and message. When the torch relay runner approached Oborishte Str., the people exclaimed, "The runner is coming!" and at that moment, the whole crowd started cheering the runner with a powerful "Hurray".

The last hours of the passing of the Olympic flame through Bulgarian land were also related to celebrations and greetings. In Dragoman, the torch relay runner handed the burning torch to the head of the border department, major Zlatkov, and he, in return, handed it to the mayor, Mr Dimitar Manolov. The mayor raised the torch, lit the flame on the sacrificial altar, and delivered a welcoming speech expressing his gratitude to the German Organizing Committee, which, together with the Bulgarian one, managed to organize that great event (Zora, 1936c, Noshtes Olimp. ogan …).

DISCUSSION

The development of the sports movement in Bulgaria through the creation of many civil and sports organizations was helped by people without a sound economic status and specialized educational background. Despite the ordeals, however, the Bulgarian athletes managed to build aristocratic ideals about humanity in sport. Evidence of that was Bulgaria's participation in the Olympic Games in Paris in 1924 and Amsterdam in 1928, when our athletes impressed with noble acts of masculinity and humanity. Namely, in the unfavorable economic conditions of the 1930s, our country made an excellent organization of such a large-scale event and continued to establish its authority in the international Olympic movement.

The passing of the Olympic flame through Bulgaria became one of the most important social-cultural events influencing the new understanding of the role and significance of the Olympic Games. Thanks to the spread of the Olympic principles, a new perception of the necessity of the development of the sports movement and its social mission for the education of the youth was formed in society. The spirit of adventure was established in the community, and in the following decades, our sport was immunized against the powerful influence of commercial sport seen in big European countries at the time.

REFERENCES

Bardareva, R. (2008). Istoria na olimpiyskoto dvizhenie, Natsionalna sportna akademia, Sofia, Бърдарева Р. (2008). История на олимпийското движение, НСА, София

Barker ,P. (2012). The Story of the Olympic Torch, Amberley Publishing - https://digital.la84.org/digital/collection/p17103coll10/id/14766/rec/1

BOK shte prouchi patya za Olimpiyskia ogan, 1934, 2 noemvri, *Sport*

Borgers, W. (2005), From myth to torch relay, Journal of Olympic history, May/June 2005 - https://digital.la84.org/digital/collection/p17103coll10/id/3533/rec/1

Cahill, J. (1998) The Olympic flame: running towards Sydney 2000. paper to the 4th International Scientific Symposium for Olympic Research, London, Ontario: International, Centre for Olympic Studies, University of Western Ontario, October. - https://digital.la84.org/digital/collection/p17103coll10/id/13498/rec/1

Chapman, A. (2012). The Olympic Flame - A Christian Perspective, Oxford, available at: https://www.academia.edu/5028650/THE_OLYMPIC_FLAME_A_Christian_Perspective

Christodoulos, F., Albanidis, E. (2014). Sports in education from antiquity to modern times, Proceedings of the

18th International Congress of the European Committee for Sports History (CESH), Greece 16-18 October 2014

Diem, C. (1982). Carl Diem – Ausgewählte Schriften 2, Beiträge zur Entwiklung und Organosation des Sport, Richarz, Berlin

Durantez, C. (1988). Le Flambeau Olympique: Le Grand Symbole Olympique, Comite International Olympique, Lausanne, str. 49

Fon Chamer Osten, d-r K. Diym, Braytmayer i d-r Tsap shte badat gosti na Sofia na 26 t.m., g. St. Chaprashikov pristiga v ponedelnik, 1935b, 14 oktomvri, *Sport*

Georgiadis K., Syrigos, A. (2009). Olympic truce - sport as a platform for peace, Athens, available at: https://www.academia.edu/4966986/OLYMPIC_TRUCE_SPORT_AS_A_PLATFORM_FOR_PEACE_Konstantinos_Georgiadis_-Angelos_Syrigos

Georgiev, N. (1971). Olimpiyski sbornik. Balgarski olimpiyski komitet, Sofia

Hristova, D. (2012). Bulgaria li dava ideyata za olimpiyskata shtafeta? Sega // Cera, iss. 4457(177),02.08.2012. available at http://old.segabg.com/article.php?sid=2012080200040001201 (in Bulgarian)

Medzhidiev, T., (2000). Dupnitsa: Ikonomika i bit v minaloto 1878-1944, Dunitsa

Mitev, L. (2016). Osnovi na Olimpiyskoto dvizhenie, NSA, Sofia

Noshtes Olimp. ogan be predaden na Yugoslavia 1936c, 26 yuli, *Zora*

Okonchatelno i ofitsialno razpisanie za minavaneto na sveshte-nia Olimpiyski ogan prez Bulgaria, 1936f, 22 yuli, *Sport*

Olimpiadata v Berlin, 1936 g., (2009), blog „Stara Sofia“ na 10.07.2009 g. http://stara-sofia.blogspot.com/2009/07/1936.html

Olimpiyskiyat ogan v Sofia, 1936d, 26 yuli, *Zora*

Olympia-Zeitung: offizielles Organ der 11. Olympischen Spiele 1936 in Berlin available at https://digi.ub.uni-heidelberg.de/diglit/olympia_zeitung1936 (accessed 10 November 2021)

Origanisationskommitee (Hg.) (1937). XI olympiade Berlin 1936 – amtlicher bericht, band 1, vom organisationskomitee für die XI olympiade Berlin 1936, Limpert, Berlin

Petrova, N. (1985) Istoria na fizicheskata kultura, Sofia

Prenasyane na olimpiyskia ogan – Plan za rabota, 1936a, 14 yuli, *Zora*

Richter, W. (1936). Die Olympischen spiele 1936 in Berlin und Garmisch-partenkirchen, Cigaretten Bilderdienst Altona-Bahrenfeld, Hamburg

Stöckel, K. (2015), Berlin im olympischen Rausch - Die Organisation der Olympischen Spiele 1936, available at: https://www.buecher.de/shop/allgemeines--lexika/berlin-im-olympischen-rausch-ebook-pdf/stoeckel-karin/products_products/detail/prod_id/37127206/ (accessed 10 july 2021).

Tazi sutrin nashite begachi poeha olimpiyskia ogan - tarzhestvoto pri kulata, proiznesenite rechi, entusiazmat sred naselenieto, 1936b, 23 yuli, *Zora*

Telesno vazpitanie v Bulgaria. (1936). BOK

The Olympic Studies Centre (2017). Torches and Torch Relays of the Olympic Summer Games from Berlin 1936 to Rio 2016, available at: https://stillmed.olympic.org/media/Document%20Library/OlympicOrg/Fact-sheets-Reference-Documents/Games/Torches/Reference-document-Torches-and-Torch-Relays-of-the-OG-from-Berlin-1936-to-Rio-2016.pdf

Todorov, Ya. (2017), Makedonski yunak, Yavor Todorov, Dupnitsa

TsDA, F. 262 K, op. 1, a.e. 82 - Pismo ot Tsentralnia organizatsionen komitet za pre-nasyane na olimpiyskia ogan prez Bulgaria do Sayuza na balgarskite gimnasticheski druzhestva „Yunak“ s naredba za fakelnoto poshtovo byagane „Olimpia - Berlin 1936“.

TsDA, F. 262 K, op. 1, a.e. 82 Pismo ot Balgarskia olimpiyski komitet do Sayuza na balgarskite gimnasticheski druzhestva „Yunak“ za tarzhestvata po chestvuvaneto na Vladislav Varnenchik vav Varnenska oblast. Sofia, 26 yuli 1935 g.;

TsDA, F.177, op2, arh.ed.579, Pismo do oblasten uchilishten inspektor ot 7.07.1936 g.

TsDA,F.177, op2, arh.ed.579 Naredba za fakelno pishtovo byagane „Olimpia-Berlin 1936 g.“

Tsonkov, V. (1981), Bulgaria v Olimpiyskoto dvizhenie do 9.IX.1944 g., Sofia

Za olimpiyskata shtafeta – zapisvane na begachite za olimpiys-koto byagane, 1936c, 15 yuli, *Sport*

Za Olimpiyskata shtafeta, 1935a, 22 septemvri, *Sport*

Corresponding author:
Emilia Vitanova, PhD
Department „History and Management of sport”
National Sports Academy „Vassil Levski”
21, Acad. Stefan Mladenov Str.
Sofia 1700, Bulgaria
E-mail: emilia_vitanova.nsa@abv.bg

PHYSIOTHERAPY

 DOI: 10.37393/ICASS2022/143 445 - 449

ASSESSMENT OF THE EFFECTIVENESS OF LUMBAR SPINAL MANIPULATION IN PATIENTS WITH MECHANICAL LOW BACK PAIN

Nikolay Popov
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
The article aims to evaluate the functional impact of manipulation/mobilization of the lumbar region in patients with mechanical low back pain (MLBP).
The survey was conducted with 23 patients (12 male and 11 female) with subacute MLBP, mean age 42,8 (32-50 y.o.). They respond to the criterion for application of spinal mobilization techniques and have not been treated with any other kind of treatment by that time.
The patients were assessed at the beginning of every treatment session with the Shober test and Oswestry Disability Index (ODI) with a six-week follow-up. Every patient has four visits in the first two weeks and one final visit after six weeks.
Methods. Techniques for high-velocity, low-amplitude spinal manipulation of the lumbar region were used to treat the patients. First rotations, then posterior-anterior glidings were assessed on every level and applied in the region of hypo mobility.
Results. There has been significant improvement in the symptoms of MBP in 21 (91.30%). In the rest of them, there was no benefit from the lumbar manipulation, and they were treated with lower thoracic spine mobilization techniques. Maximum benefit has been recorded after the first and second treatment sessions. Most often, rotational mobility has been affected, and rotational mobilization has been of more benefit.
Conclusion. The hypo mobility of the lumbar region is the main source for MBP in patients that meet the criterion for application of spinal manipulation. That is why we strongly recommend functional assessment and treatment of the lumbar segmental mobility in every case of MBP with impact onto posterior-anterior thrust techniques.

Keywords: *manual therapy, lumbar spine, low back pain*

INTRODUCTION

Mechanical low back pain is maybe the most common problem in muscle-skeletal physical therapy. It is considered a major public health problem in many European countries and all over the world (Airaksinen et al., 2006). Mechanical, non-specific low back pain is a highly prevalent condition for men and women of working age, with most people experiencing back pain between the ages of 20 – 55. On the other hand, it is one of the most difficult for assessment and management spine disorders. This is evident in its resistance to treatment and the frustration it induces in physical therapists which must deal with this problem.

Low back pain refers to the pain and discomfort on the posterior belt line with occasional dissemination of pain to buttock or/and posterior tight, altered by movement or posture, usually with intermittent nature (Magee, 2007). Other synonymous terms referring to LBP are used randomly, such as backache, lower back pain, low back injury, low back syndrome, low back disorders, back pain trouble, etc. Suffering from chronic low back pain can influence many aspects of the patient's life. It is associated with many negative physical, social, and psychological effects on a patient's life.

Based on the duration of symptoms, LBP is classified into three stages:

- Acute low back pain, when the episode of pain lasts less than six weeks.
- Sub-acute low back pain, with the pain persisting between 6 to 12 weeks
- Chronic low back pain, as the pain continues for more than 12 weeks (Airaksinen et al., 2006).

Billis and colleagues identified at least 39 diagnostic and treatment-based classification systems, most of which were based on the biomedical patient characteristics and seldom on psychosocial or biopsychosocial features. The most notable classifications were those of Dellito and colleagues (Billis et al.,2007). It is based on the patient's history, clinical presentation, and physical examination. It identifies and places then th e patients into one of the four treatment-based categories: direction-specific exercise, manipulation, stabilization, and traction (Delitto et al., 1995).

Nowadays, there is a wide variety of treatment possibilities for low back pain starting with medications, back education, exercises, manual therapy, behavioral therapy, and others. According to European guidelines for CLBP management, a key factor to be considered when choosing the best possible treatment is the duration of LBP (Airaksinen et al. 2006).

Spinal mobilization/manipulation is widely accepted as one of the most effective treatment strategies for spinal back pain. As a rule, the first method of choice is to assess and treat the region of the pain symptoms. However, the symptoms often arise from a different area of the spine. In the lower back, practitioners usually use two kinds of techniques – anterior-posterior gliding and rotational mobilization\manipulation. If the technique is appropriate and effectively applied, the result is immediate analgesic effects in patients. The challenge came from the decision of which of those use two kinds of techniques should be used. If the choice is inappropriate, it will not be of benefit. Even more – it could worsen the symptoms. The necessity for the choice between the two kinds of techniques could be explained by the kinesiology of the lumbar spine.

Usually, the facets of the intervertebral joints are sagittally orientated. But in the segment of L5-S1, those facets very often are orientated, more or less, in the frontal plane. Also, in the superior parts of the lumbar spine - T12-L1 and L1-L2 those kinds of tendencies could be fined. That's why we could consider that if the patient has a problem in sagittally orientated facets, we must apply anterior-posterior gliding. But if his\her facets are with frontal orientation, we could expect a benefit from rotational mobilization\manipulation. According to this thesis, we think that the investigation of the therapeutic effect of the different kind of mobilization/manipulation of the lower back will be of great importance to clear out the most appropriate treatment approach.

Aim and objectives of the study

The purpose of the study is to evaluate the functional impact of manipulation/mobilization of the lower back area in patients with mechanical low back pain (MLBP). It is of great importance for the clinical practice to find out if manipulation of the lumbar spine is of benefit in patients with mechanical back pain and, if so, which kind of technique should be used.

A prospective cohort clinical study was conducted. The survey was conducted with 23 patients (12 male and 11 female) with subacute mechanical pain in the lower back, mean age of 42,8 (32-50 y.o.). They have not been treated with any other kind of treatment by that time.

Prior to proceeding with data collection, an information sheet, detailing the research, was provided to the participants. Informed written consent was obtained from all the participants, for participation and publication of anonymous data, before starting the data collection. Trials were conducted in accordance with guidelines of the Consolidated Standards of Reporting Trials (CONSORT).

Inclusion criteria of the study (4 of 5):

- Duration of the symptoms less than 16 days
- No symptoms under the knee
- Fear avoidance index less than 19
- At least one hypomobile spinal segment
- At least one hip joint with more than 35°

Exclusion criteria of the study:

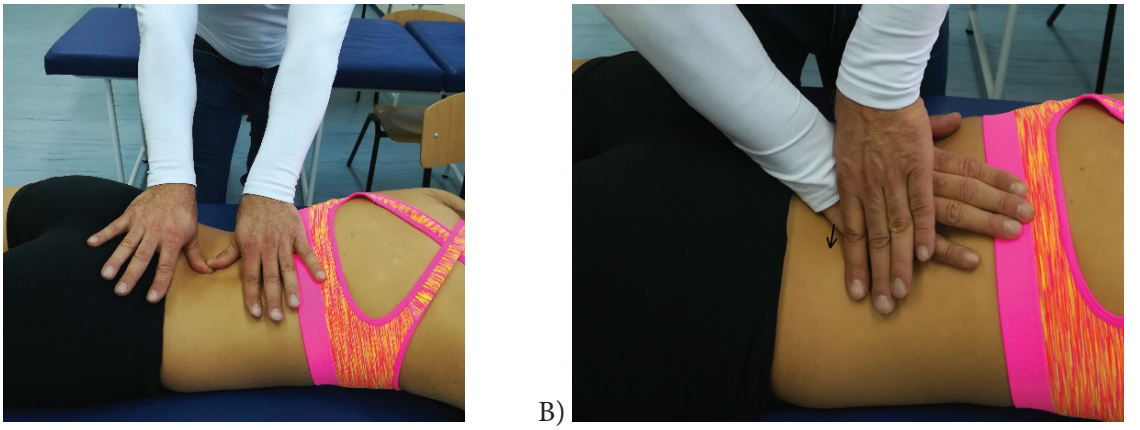
a) Spinal pathologies (e.g., tumors, fractures, inflammatory diseases)
b) Nerve root compression, presence of two or more of the following signs: weakness of a lower extremity, reflex change, sensory loss associated with the same spinal nerve.
c) Spinal surgery
d) Pregnancy
e) Illiteracy
f) Cardiorespiratory disease
g) Fibromyalgia or any musculoskeletal disease that may interfere with the movements during the exercise protocol.

Criteria for dropping out of the study:

a) Deterioration of back pain
b) Severe physical/physiological damage
c) Patient refusal
d)Drastic compliance reduction.

METHODS

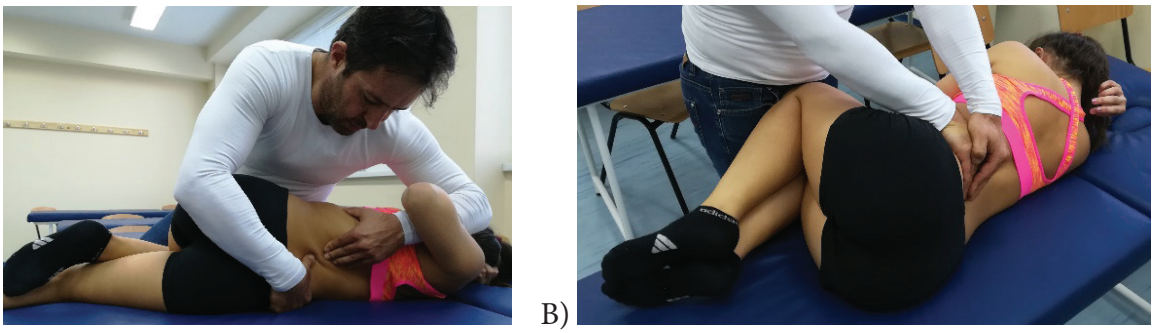
The current study represents the manipulation techniques which were used for the treatment of the mechanical back pain. First rotational mobilization\manipulation, then posterior-anterior gliding direction, was assessed on every level (Figure 1).



A) B)

Figure 1. *Assessment of lumbar spine rotation (A) and antero-posterior translation (B).*

Then techniques for high-velocity, low-amplitude spinal manipulation of the region of the lumbar region were used to treat the patients (Figure 2). The techniques were applied in the region of hypo mobility, as found out during the assessment.



A) B)

Figure 2. *Techniques for manipulating the lumbar motion segments - rotation (A) and anterior-posterior translation (B).*

An assessment of the immediate effect of every technique has been provided. The patients also were re-assessed at the beginning of every treatment session with the Schober test and Oswestry Disability Index (ODI) with a follow-up of six weeks. Every patient has five visits – 4 in the first two weeks and one final visit after six weeks.

If there was no benefit from the first two sessions, mobilization/manipulation of the Sacroiliac joints and thoracic spine has been done.

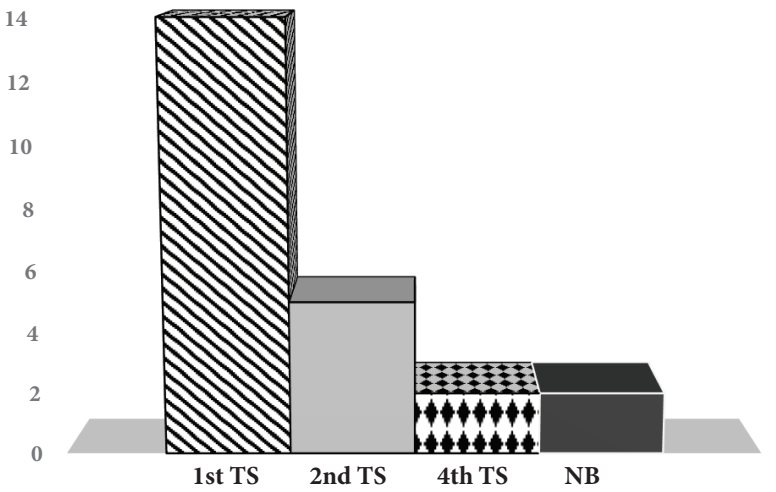
RESULTS

The initial assessment of the lumbar spine mobility shows that 20 (86.95%) patients have a limitation in the lower thoracic or lumbar spine region (table 1). Four of them have limited accessory mobility in the upper lumbar region (20%), 10 in the lower lumbar region (50%), and 6 of them (30%) have restricted mobility in the lower thoracic spine (T4-T12).

Table 1. *Initial assessment of the mobility of the lumbar and lower thoracic region.*

Region	***Restricted mobility/ % (n=20)***
Upper lumbar region (L1-L4)	*4 (20%)*
Lower lumbar region (L4-S1)	*10 (50%)*
Lower thoracic spine (T4-T12)	*6 (30%)*

The analysis of the immediate treatment effect shows significant improvement in 14 patients after the first treatment session and in another 5 (five) patients after the second treatment session (Figure 3).



Legend: TS – treatment session
NB – no benefit

Figure 3. *Presentation of the immediate pain relief effect on the patients.*

There were four patients without or with slight improvement after the first two sessions. They were treated with mobilization/manipulation of the neighbor region according to the localization of the restriction. In one of them, there was a fast improvement after the 3rd session, and in another one after the 4th session. Only two patients left without significant improvement after the fourth session. Finally, there has been significant improvement in the symptoms of MBP in 21 (91.30%).

The assessment of the mobility shows restriction of the rotation in the direction of the painful sight in all the patients before the first treatment session. The examinations at the beginning of every following session show normalization of the symmetry of the rotation in all the patients that reported pain relief.

The assessment with the Oswestry Disability Index (ODI) shows moderate impairment in all the patients (mean score 19.2±3.5). All the patients with reported pain relief shows improvement to mild or no impairment on the next treatment session.

After the six-week follow-up, normal mobility in 20 patients has been found. There was only one patient (among those with treatment benefits after the first four sessions) with a new episode of mechanical back pain. There was also a significant improvement in the results from the Oswestry Disability Index (ODI). The mean score of the patients with treatment benefits is 3±1. That means that there was no impairment in the lumbar spine.

CONCLUSION

The mobilization\manipulation of the spine is one of the most popular conservative treatments for CLBP patients, but data from different studies supporting their effectiveness are controversial. The results of this thesis suggested that the mobilization of the spine demonstrated a significant reduction of pain, disability, and amelioration in the quality of life of non-specific low back pain patients.

The results of this thesis indicated a significant reduction in pain intensity after the first treatment session in most of the patients. These findings are supported by the results of a study from Zapata and colleagues that demonstrated a significant reduction on pain levels even after 6-months following an eight weeks stabilization exercise program on adolescents with LBP in idiopathic scoliosis (Zapata, Wang-Price, & Sucato, 2017).

The mobilization techniques should be accepted as a method of choice for the patients with subacute mechanical low back pain. The benefit of these techniques depends on the precise interpretation of the data received during the assessment of the accessory motion. The lower thoracic spine restrictions should not be neglected because this region is a common source of pain and restriction of the lumbar movements. The most effective technique for the lower thoracic and the lower lumbar region

is the rotational mobilization\manipulation. For the upper lumbar region, the anterior-posterior mobilization\manipulation is of most benefit. If rotational mobilization is of no benefit, anteroposterior translation should be applied. These techniques are especially effective and appropriate if there is end-range pain in the lumbar region that restricts the range of motion.

REFERENCES

Airaksinen, O. et al. (2006). COST B13 Working Group on Guidelines for Chronic Low Back Pain. Chapter 4. European guidelines for the management of chronic nonspecific low back pain. *Eur Spine J*. 15 (2), 192-300.

Billis, E.V., McArthy, C.J., Oldham, J.A. (2007). Subclassification of low back pain: a cross contry comparison. *Eur Spine J,* 16: 865-879.

Bove GM, Zaheen A, Bajwa ZH, (2005). Subjective nature of lower limb radicular pain, *J Manip Physiol Ther 28,12-14*

Delitto, A., Erhard, R.E., Bowling, R.W., et al. (1993). A treatment-based classificationapproach to low back syndrome: identifying and staging patients for conservative treatment. *Phys Ther* 1993; 75: 470-85

Fritz, J.M., Whitman, J.M., Flynn, T.W., et al. (2004). Factors related to the inability of individuals with low back pain to improve with a spinal manipulation, *Phys Ther 84, 173-190*

Magee, DJ. (2007). *Low back pain* IN: Orthopedic Physical Assessment, Saunders; 467-558.

McGill. (2002). *Low back disorders: evidence-based prevention and rehabilitation*. The book. WB Saunders, Philadelphia.

Roland, M., Fairbank, J. (2000). The Roland-Morris Disability Questionnaire and the Oswestry Disability Questionnaire. *Spine* 25(24), 3115-3124

Williams, M. and Lissner, H. (2000). *Biomechanics of Human Motion*, ed 1. WB Saunders, Philadelphia.

Corresponding author:
Prof. Nikolay E. Popov, PhD, DSc
Dept. of Theory and methods of physical therapy,
National Sports Academy "Vassil Levski"
1, Gurgulyat str.
Sofia, Bulgaria

PREDISPOSING FACTORS AND PREVENTION FOR OVERUSE INJURIES IN ANKLE AND FOOT COMPLEX IN RHYTHMIC GYMNASTS

Tanya Grueva-Pancheva
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
The ankle and foot complex is a body segment that undergoes a high load in rhythmic gymnasts. Constant standing on toes and repetitive movements like relevé, pirouettes, and jumps, apply acute stress on soft tissues in the area. Due to poor proprioception, incorrect performance techniques of these rigorous activities repeated many times daily by a gymnast can lead to overuse injuries. Additional factors related to these conditions are weak Posterior Tibial muscle; tight Achilles tendon or short Triceps Surae; inadequate or forced turnout, provoking increased pronation of the foot; a muscle imbalance between invertors and evertors muscles. These contributing factors could be corrected by changes in technique or the way of training.
The purpose of the present report is to follow the effect of proprioceptive training on postural balance and limb functioning in elite gymnasts.
Methodology. Eighteen elite gymnasts from RG club "NUANCE NSA" have been investigated. The rhythmic gymnast aged between 10-17 (mean 13.3 years) underwent two (2) months of proprioceptive program, which included specific preventive and balance exercises performed before each practice. Star Excursion Balance Test and One Leg Hop for a time were used to measure the dynamic postural balance before starting the exercise program and two (2) months after.
Results. Star Excursion Balance Test showed the shortest tap distance in the anterolateral direction for both dominant and non-dominant legs. The anterior and lateral direction were as follow. The performance improved after the two (2) months of proprioceptive program, but these directions still show the shortest tap distance. One Leg Hop test did not show any significant improvement in the performance.
Conclusion: The 8-week proprioceptive training positively affects postural balance in elite rhythmic gymnasts. However, the tested period is short to make deep conclusions. A further prolonged investigation is needed to summarize the preventive effect of proprioceptive training.

Keywords: *micro-traumatism, overuse, repetitive traumas*

INTRODUCTION

The ankle and foot complex is a body segment that undergoes a high load in rhythmic gymnasts. Constant standing on toes and repetitive movements like relevé, pirouettes, and jumps, apply acute stress on soft tissues in the area. The exaggerated turn out of the feet and the extreme flexibility of the peripheral joints and spine all lead to unusual movements and therefore to unusual injuries (Quirk, 1994). Due to poor proprioception, incorrect performance techniques of these rigorous activities repeated many times daily by a gymnast can lead to overuse injuries (Denton, 1997). Conservative treatment often helps to improve the condition, but the intensity of the sport often forces the gymnasts to continue to play with pain and that exacerbates the problem. Additional factors related to these conditions are weak Posterior Tibial muscle; tight Achilles tendon or short Triceps Surae; inadequate or forced turnout, provoking increased pronation of the foot; a muscle imbalance between invertors and evertors muscles (Schon, 1993). These contributing factors could be corrected by changes in technique or the way of training. That is why the whole team of doctors, physiotherapists, coaches, and ballet pedagogues, must have a basic knowledge of proper sports performance as well as ballet technique. Also, an understanding of the mental approach of gymnasts is needed to accurately work with them, accurately diagnose eventual disorders, and effectively treat their injuries (Broun & Micheli, 2004; Quirk, 1994). Due to the specific of the sport and the big demand placed on the foot and ankle area, if an acute or overuse injury occurs, all these factors must be considered when designing an appropriate treatment plan for a rhythmic gymnast. Another important thing is applying an appropriate assessment when complaining of a gymnast comes from a foot and ankle complex. A researcher claims that when evaluating a dancer, in addition to routine physical examination, static and dynamic biomechanical evaluation is of great importance to make a proper analysis of the condition and build a proper treatment of leg, foot, and ankle disorders (Schon, 1993).

Looking at the present literature on the topic, we figured out that there is not enough research concerning preventing and treating overuse injuries of the lower limbs in rhythmic gymnasts, especially in the foot, forefoot, and shin areas. That is why we focused our attention on enlightening the factors that exacerbate and lead to incorrect performance and, from there lead to overuse injuries in the foot and ankle complex. We consider that with some prevention, we can diminish the percentage of overuse traumas in gymnasts and help them to train without pain and fear.

The present report aims to follow the effect of proprioceptive training on postural balance and limb functioning in elite gymnasts.

METHODOLOGY

Eighteen elite gymnasts between 10 and 17 years of age (mean 13.3) competing for RG club "NUANCE NSA" have been investigated. All the anthropometric data of the gymnasts are presented in Table 1. Limb dominance was determined by pointing out which leg is more convenient for being in support.

Table 1. *Anthropometric characteristics of all investigated subjects*

Parameter	Subjects (n=18)
Age (years)	13.3±5.1
Height (cm)	147.5±3.3
Weight (kg)	39.2±2.3
Right dominant leg (n)	12
Left dominant leg (n)	6

The participants were informed for the purpose of the investigation, and they gave their consent to participate in the study in accordance with the ethical standards of the local Ethics Committee and the Helsinki declaration. They were free to withdraw from the study at any time.

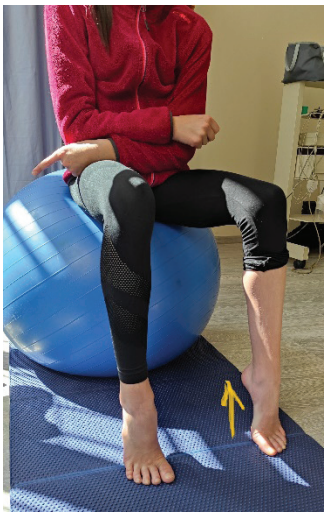


Figure 1. *Balance training*

Figure 2. *Foot neutral position*

Figure 3. *Strength training*

Figure 4. *Discofit*

All tested gymnasts underwent two (2) months of proprioceptive training. The proprioceptive program included several specific preventive exercises: proprioceptive exercises for movement sense (kinesthesia) in loaded position (Figures 1-2); strength exercises with theraband for Tibialis Posterior muscle (Figure 3); balance exercises on a discofit (Figure 4); and specific stretches for Triceps Surae muscle, to improve its elasticity. The rhythmic gymnasts practice six days a week, and the proprioceptive program was performed before each practice, which takes about 15 minutes.

The gymnasts were assessed with two tests. Star Excursion Balance Test (SEBT) and One Leg Hop for a time were used to measure the dynamic postural balance before starting the exercise program and two (2) months after. For SEBT, we followed the procedure described by MAT (mat assessment technologies, 2022). The sequence of measurements was as follows: Anterior (A), Anterolateral (AL), Lateral (L), Posterolateral (PL), Posterior (P), Posteromedial (PM), Medial (M), and Anterolateral (AM). The right leg was measured first, followed by the left one. The supporting leg was the one being measured for dynamic balance abilities. For anterior directions, the foot was placed with the second toe on the line at 0 cm. For the posterior directions, the foot was placed with the heel on the line at 0 cm. And for mediolateral directions, the mid-part of the foot was placed at 0 cm. The free limb was then asked to reach as far as possible in the given direction and tap on the measurement line without putting weight on that foot. The hands had to be placed on the waist. The heel of the supporting leg had not been lifted off the floor, otherwise, the test was not reliable. For the functional test Single Leg Hop for a time the procedure of evaluation was taken by McGee (McGee, 2006). Every gymnast was assessed for the time taken to hop 6 meters on one leg, where the right was tested first. Statistical analysis was done, where mean values and standard deviation were calculated for each parameter of every test. A paired sampled t-test was used to determine if there were differences between data obtained before proprioceptive training and after two (2) months of practicing the program for each leg.

RESULTS

The statistical data for all parameters of SEBT are presented in Table 2. Before performing the specific exercises the shortest tap distance was seen in the AL direction for both right (51.16± 5.62cm) and left (49.56±5.88) legs. The A (55.11±6.74) and L (62.28±9.74) directions were as follow for the right leg (Figure 1) and A (55.61±6.88) and AM (62.89±9.51) for the left leg (Figure 2). The performance improved after the 2 months proprioceptive program, and the sequence of shortest tap distance for both limbs become AL, A, AM (Figure 5, 6). On the opposite end, the longest touch distance before the proprioceptive program was in the M direction, followed by PM and P, and that was for both legs. But after the specific practice for the right leg become M (77.50±8.23), PM (76.00±8.79), and PL (75.22±9.06) and for the left M (77.72±7.14), PL (73.05±8.77), P (73.05±8.77) (Figure 5, 6).

Table 2. *Statistical results of SEBT*

		start		2nd month		d	d%	d_{es}	t	P (t)
		X_1	S1	X_2	S2					
Right leg	A	55.111	6.738	58.000	6.020	2.889	5.242	1.083	3.198	99.472
	AL	51.611	5.617	55.278	7.234	3.667	7.104	0.871	2.539	97.883
	L	62.278	9.743	68.944	8.299	6.667	10.705	1.382	4.068	99.920
	PL	66.333	9.331	75.222	9.059	8.889	13.400	1.939	5.812	99.998
	P	68.222	10.866	73.444	8.417	5.222	7.655	1.070	3.047	99.271
	PM	68.389	7.293	76.000	8.785	7.611	11.129	1.644	4.829	99.984
	M	71.889	8.080	77.500	8.234	5.611	7.805	1.306	3.916	99.889
	AM	60.667	8.296	64.389	8.991	3.722	6.136	0.886	2.641	98.286
Left leg	A	55.611	6.887	59.000	6.088	3.389	6.094	1.090	3.223	99.501
	AL	49.556	5.883	53.556	6.099	4.000	8.072	1.103	3.306	99.582
	L	56.722	7.387	68.056	6.717	11.333	19.980	3.044	9.068	100.000
	PL	66.778	8.742	73.056	8.775	6.278	9.401	1.505	4.515	99.969
	P	67.389	10.993	72.167	7.294	4.778	7.090	0.823	2.291	96.497
	PM	67.889	8.457	71.944	8.314	4.056	5.974	1.145	3.433	99.683
	M	74.000	7.746	77.722	7.144	3.722	5.030	1.099	3.274	99.552
	AM	62.889	9.511	65.611	7.147	2.722	4.329	0.578	1.649	**88.256**

X– mean values in cm, S– standard deviation, d – mean differences (degrees of freedom), t – t-criteria of Student

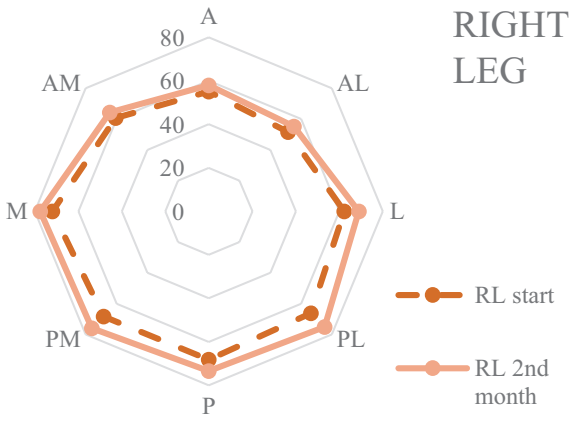


Figure 5. *SEBT Righ Leg (RL)*

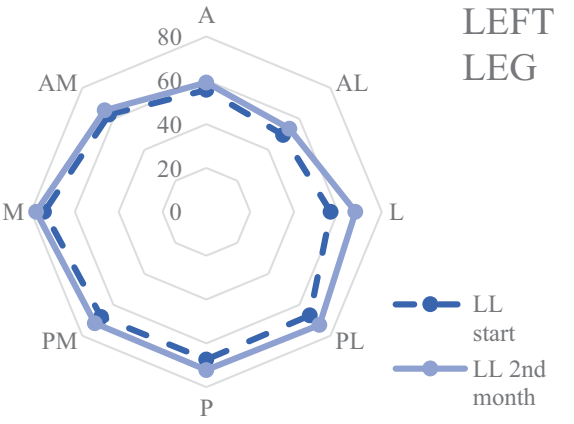


Figure 6. *SEBT Left Leg (LL)*

There was statistical significance for increasing the touch distance after the proprioceptive training for all 8 directions and for both legs, only except AM (88.256 P (t)) direction for the left limb. The highest mean increase for the right leg was seen in PL (d 8.89 cm), followed by PM (d 7.61 cm) and L (d 6.67cm). The left leg showed different order, where the highest mean increase was in L (d 11.33cm), followed by PL (d 6.28cm) and P (d 4.78 cm). The lowest mean increase was in the A direction (d 2.89cm) for the right leg and in AM (d 2.72 cm) direction for the left one (Table 2).

Single Leg Hop test for a time did not show any significant improvement in the performance after the testing period. The performance before starting the program was below 3 seconds for both right (2.98 sec) and left (2.97 sec) legs. After 2 months of practicing the proprioceptive exercises, the speed improved only by 0.26-0.24 sec respectively (Figure 7).

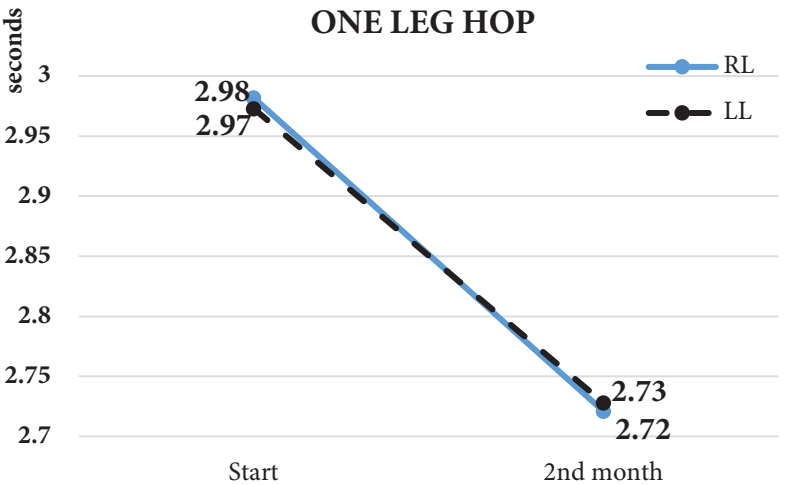


Figure 7. *Statistical results of One Leg Hop for time*

DISCUSSION

In general, the rhythmic gymnasts improved their dynamic postural balance after the period of proprioceptive training, confirmed by both dynamic functional tests. SEBT test improved the touch distances in all 8 directions. For the right leg, the highest tap increase was in the PL direction followed by PM and L directions. Where for the left one the sequence was different – the highest in the L direction, followed by PL and P. Compared to our other study (Grueva-Pancheva, 2021) concerning subjects with chronic ankle instability (CAI), the sequence order is quite different. There the patients with unstable ankle showed the highest improvement in the A direction, followed by L and AL. The performance of gymnasts was even the opposite, the shortest increase of tap distance for them was in the A direction for the right leg and AM direction for the left one.

It looks like the specific training for them helps to improve the postural control more in posterior and posterolateral directions than anterior and anterolateral directions. Comparing to other researchers, who performed 6 weeks of training of a group with vibration program to a group with the non-vibration program, on patients with CAI. They figured out improvement in M and PL directions of the SEBT for the vibrant group and M, PM improvement in SEBT performance for the non-vibrant group (Sierra-Guzman et al, 2018). The gymnast from our investigation showed that they have not got any problem with M and PM directions, as they performed the longest touch distance exactly in the medial direction, followed by the posteromedial one, as before proprioceptive training, and so after it.

We have not found other relevant literature concerning the estimation by SEBT of the postural balance of rhythmic gymnasts to compare our results with them. That is why we believe that the major contribution of this study is revealing some results of rhythmic gymnasts' postural balance behavior after 2 months of proprioceptive training. As postural stability is essential in RG both in balance positions and in pirouettes and jumps (Massion, 1994), more researchers will be attracted to the topic, and more interesting questions will be of concern.

There is a study comparing the motor (whole-body coordination, dynamic balance, static balance, sense of kinesthesis, whole-body movement time, and eye-hand coordination) and perceptual (whole-body reaction time, the anticipation of coincidence, and depth perception) skills of novice, elite RG gymnasts and nonathletic children at the same age. The elite gymnasts presented better dynamic and static balance, whole-body coordination than the controls. Moreover, they showed better anticipation of coincidence, one-hand coordination, and on static balance than novices (Kioumourtzoglou et al, 1997). This is supported also by Di Cagno et al. (2014) who claim that training experiences of the gymnast improve neuromuscular coordination, joint strength, and range of movement which act as mechanisms to improve balance.

Another group of authors (Agostini et al., 2017) showed that RG gymnasts present better qualitative and quantitative performance when they are trained with other methods, like plyometric exercises, in addition to traditional training. In addition, other study presents that the conjugate influence method developed better control in postural responses by RG gymnasts, resulting in better balance during the execution of static positions and better dynamic balance during the transition from one position to another (Palomares et al., 2019).

An interesting study by Gautier et al. (2008), presents that experience in gymnastics may enable the plasticity of the cortex to bring out a functional reorganization of motor behavior, making it more reactive. It is, therefore, necessary to train rhythmic gymnasts using techniques that will contribute to new experiences, to improve their dominion over their postural responses with greater balance and precision in movements during performance. We also support that statement, as our results show that specific proprioceptive training with the prevalence of kinaesthetic movement exercises helps to improve the dynamic postural balance of rhythmic gymnasts. Though to claim, if they help to prevent foot and ankle injuries, a longer period needs to be observed.

CONCLUSION

The 8-week proprioceptive training positively affects postural balance in elite rhythmic gymnasts. Though the tested period is short to make deep conclusions. A further prolonged investigation is needed to summarize the preventive effect of proprioceptive training.

REFERENCES

Agostini, B., Palomares, E., Andrade, R., Uchôa, F., & Alves, N. (2017). Analysis of the influence of plyometric training in improving the performance of athletes in rhythmic gymnastics. *Motricidade*, 13(2), 71.

Brown, T.G., Micheli, L.J. (2004). Foot and ankle injuries in dance. *Am J Orthop (Belle Mead NJ)* Jun;33(6):303-9. PMID: 15239359

Denton, J. (1997). Overuse foot and ankle injuries in ballet. *Clin Podiatr Med Surg.* Jul;14(3):525-32. PMID: 9257039

Di Cagno, A., Fiorilli, G., Iuliano, E., Aquino, G., Giombini, A., Battaglia, C., Piazza, M., Tdopano, D. & Calcagno, G. (2014). Time-of-Day Effects on Static and Dynamic Balance in Elite Junior Athletes and Untrained Adolescents. *International Journal of Sports Science & Coaching*, 9(4), 615–625.

Gautier, G., Thouvarecq, R., & Larue, J. (2008). Influence of Experience on Postural Control: Effect of Expertise in Gymnastics. *Journal of Motor Behavior*, 40(5), 400–408.

https://doi.org/10.3200/JMBR.40.5.400-408

Grueva-Pancheva T. (2021). Effect of proprioceptive training on postural balance in patients with chronic ankle instability. *Journal of Physical Education and Sport* ® (JPES) Vol. 21 (1), Art 1, pp. 3 - 11, Jan 2021; DOI: 10.7752/jpes.2021.01001

Kioumourtzoglou, E., Derri, V., Mertzanidou, O., & Tzetzis, G. (1997). Experience with Perceptual and Motor Skills in Rhythmic Gymnastics. *Perceptual and Motor Skills*, 84(3_suppl), 1363–1372

Magee, D. (2006). Orthopedic physical assessment, Fourth edition. Elsevier Science (USA) Chapter 12, p. 661-755

Massion, J. (1994). Postural control system. *Current Opinion in Neurobiology*, 4(6), 877–87

Movement assessment technologies - world-leading courses and products. Movement Assessment Technologies - World-Leading Courses and Products. (n.d.). Retrieved September 8, 2022, from https://www.matassessment.com/

Palomares B.R.A., Palomares E.M.G., Uchoa F.N.M., Andrade R.A., Alves N.F.D. (2019). Effectiveness of the conjugate influence method in improving static and dynamic balance in rhythmic gymnastics gymnasts. *Journal of Physical Education and Sport* ® (JPES), Vol 19 (Supplement issue 4), Art 204 pp 1407 – 1417.

Quirk, R. (1994). Common foot and ankle injury in dance. *Orthop Clin North Am.* Jan;25(1):123-33. PMID: 7904737

Schon, L.C. (1993). Foot and ankle problems in dancers. *Md Med J*. Mar;42(3):267-9. PMID: 8102471

Sierra-Guzmán, R., Jiménez-Diaz, F., Ramírez, C., Esteban, P., Abián-Vicén, J. (2018). Whole-Body-Vibration Training and Balance in Recreational Athletes With Chronic Ankle Instability. *J Athl Train.* Apr;53(4):355-363. doi: 10.4085/1062-6050-547-16. Epub 2018 Mar 23. PMID: 29569943; PMCID: PMC5967277

Corresponding author:
Tanya Grueva-Pancheva, PhD
National Sports Academy "Vassil Levski"
1, Gurgulyat 1, Str.
Sofia, Bulgaria
E-mail: tgrueva2000@gmail.com

COMBINED METHODS OF PHYSIOTHERAPY IN CASE OF CARPAL TUNNEL SYNDROME

Stefania Naydenova, Evgeniya Dimitrova
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
Purpose: This study aims to compare the efficacy of two different physiotherapy methods for relieving the symptoms of carpal tunnel syndrome (CTS), to supplement already imposed methods, and to summarize a new methodology for prevention.
Relevance: Improving the overall physical condition of patients, combating a sedentary lifestyle, and training in the correct body position is the way to prevent the disease. Our study provides scientific evidence to justify the role of physiotherapy for the treatment and prevention of relapses in this condition. Subjects: The randomized controlled trial has been conducted since January 2016 in a private physiotherapy practice. A total of 111 patients with clinically confirmed idiopathic CTS were divided in two groups of treatment. Interventions consisted of 15 physiotherapy sessions for at least 10 weeks and with two different physiotherapy programs -Group A (68 patients) and Group B (42 others). Material and methods: Manual muscle stretching and relaxation techniques, joint mobilization therapy and active exercises, strengthening program, soft tissue mobilization therapy, and mobilization of the nervous system in the wrist, and forearm area were already part of their treatment program. When contingent and conducting tests for functional examination showed us the presence of Upper cross syndrome in over 75% of cases participants. Manual therapy on the "Manuthera" table and the combination of active training with Electro Muscle Stimulation to overcome muscle dysbalance. Results: Analysis of the results so far shows that the findings are empirical data difference is not random, so the methodology has a proven effect.
During the experiment, the experimental group realized statistically significant results related to the symptoms and complaints typical of the syndrome. Conclusion: The results showed great statistical significance in proving the effect from the conducted experimental methodology.

Keywords: *EMS Training, „Manuthera" treatment table, Upper Cross syndrome,*

INTRODUCTION

Carpal tunnel syndrome (CTS) is the most common nerve compression condition in the body, affecting one or more peripheral nerves and resulting in numbness or weakness in the affected area. On average, at least 3.8% of people who complain of pain, decreased fine motor skills, and an itchy feeling in their hands have CTS (Kozak, Schedlbauer, 2015).

Carpal tunnel syndrome is the most common disease associated with the compression of nerves in the upper extremities. The most common treatment for this condition is surgery at the base of the wrist, to release the compression (in the United States, 463,000 operations are performed per year). CTS accounts for the longest periods of absence from work due to health reasons. The post-operative recovery period lasts up to 2 months (Brotzman, 2000).
In the research conducted, we try to include patients of different ages with carpal tunnel syndrome to prove the efficacy of combining conservative methods of physiotherapy. Certainly, we have considered the individual condition and needs of each patient.

Here we combine some already proven methods in the complex treatment and rehabilitation of patients with carpal tunnel syndrome. We apply manual mobilizations of the spine, and techniques to improve the muscular imbalance of the back and strengthen the musculature of the body, driven by the objective to look at the initial onset of the disease from a different side. The goal is to apply all our knowledge and skills to build a complex methodology with the maximum effect of treatment and prevention.

Sedentary lifestyle and lack of motor activity, postural changes, and muscle imbalance lead fast to diseases of the musculoskeletal system, like Cervical syndrome, Impingement syndrome, Radiculopathies, Upper cross syndrome, Carpal tunnel syndrome, "Maus Hand" syndrome, etc. These are diseases that occur as a result of reduced joint mobility and limited range of motion. That is why we emphasized the use of manual therapy in combination with EMS training and physical exercises, in search of a solution to the problem.

Aim and objectives of the study

So far, the study covers a 6-year period (from January 2016 till today), 111 persons participated, diag-

nosed with carpal tunnel syndrome. Prior to proceeding with data collection, an information sheet detailing the research was provided to the participants and informed written consent, approved by the Department of Theory and Methods of Physiotherapy, NSA, Sofia, Bulgaria, was obtained from all the participants.

What was common for 89 of the 111 patients who took part in the study is that they already had a course of physical therapy treatment without a long-term result, after that an operative intervention was recommended, which the patients refused (Table 1). For fear of the operation and possible complications, the long recovery period, etc. The remaining 22 cases are in the post-operative period of treatment, with CTS symptoms, which are still present.

Table 1. *Characteristics of the patient` contingent*

	Control group/ 48 participants		**Experimental group / 63**	
Sex	man 19	woman 29	man 27	woman 36
Age (years)	≤ 40 20	≥40 28	≤40 22	≥ 40 41
Profession	on a desk 41	heavy physical work 7	on a desk 54	heavy physical work 9
Experience (years)	≤20 12	≥20 36	≤20 16	≥20 47
In able-bodied age	≤ 60 years old 37	≥ 60 years old 11	≤60 years old 59	≥60 years old 4
Disease stages	preoperative 38	postoperative 10	preoperative 51	postoperative 12
Onset of symptoms	overnight 30	during the day 27	overnight 38	during the day 39
Practicing sport	less than 2 times 44	more than 2 times 4	less than 2 times 56	more than 2 times 7

From Table 1 we can see that over 60% of the patients who took part in the study were women. More than 65% do not exercise or exercise less than twice a week. Most of the participants, namely about 63%, are over 40 years, with many years of professional experience, but still active in their profession. Only 15% of the participants are over 60 years and only 3% are over 70.

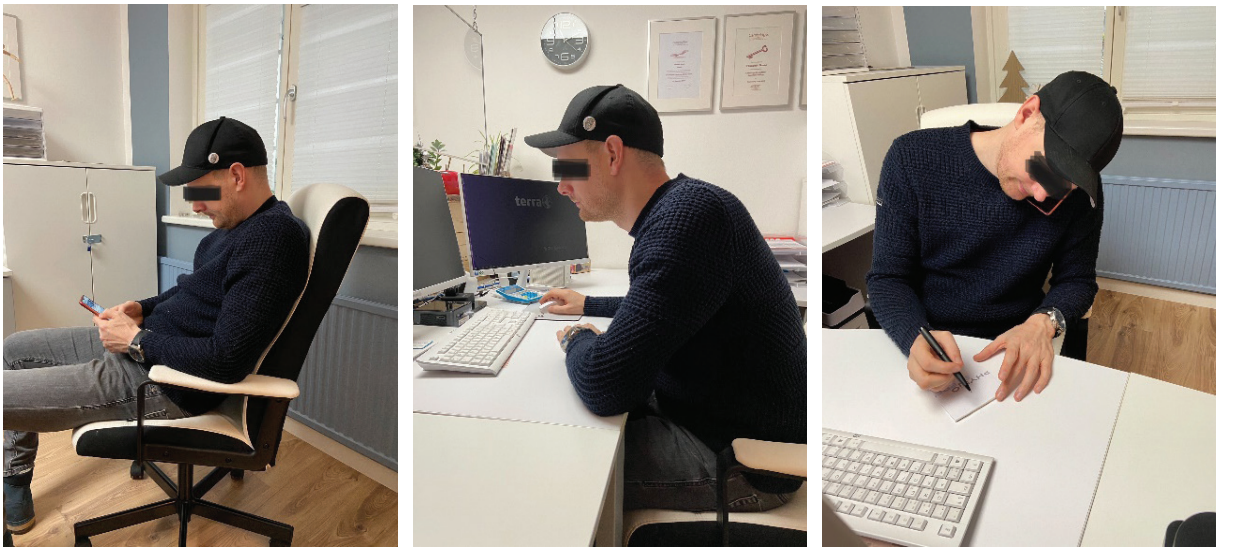
The etymology of CTS has not been clarified, but it is assumed that heavy physical work is the main reason for the onset of the disease. In our research, we found that the professions of the participants were different, but nearly 54% worked at a desk – in a sitting or standing position, but mostly static and in one place (teachers, musicians, working on a computer, hairdressers).

This distribution of the contingent and the conducted tests showed us the presence of Upper Cross Syndrome in more than 75% of the participants. That is the reason that we conducted treatment of the experimental group to improve muscle imbalance and postural control.

METHODS

In our research, we used a combination of many different treatments, but in the experimental methodology, we applied two methods, which have not been used in the treatment of CTS so far– EMS whole body training and manual therapy on the "Manuthera" treatment table.

The Electro-muscular stimulation of the whole body aims at of strengthening the weak muscles as quickly as possible, improving muscle balance and position. Our methodology is based on the negative influence of weak back muscles and incorrect body position during a large part of everyday life - during rest or travel in public transport, during work on a computer, or during telephone calls, etc. (Figures 1-3).



Figures 1, 2, 3. *An incorrect body position*

Muscular strength and optimal physical endurance play the most important role in the overall physical condition and correct body position. The deep stabilizers are those muscle groups that are difficult to be trained with conventional methods. Specific for the EMS training is the stimulation of the entire muscle system in the body, which in turn brings quick results in a shorter time, without the risk of muscle imbalance and one-sided loading, which often occurs in common fitness training. With proper execution of the EMS training, we manage to stimulate all muscle fibers at the same time. Through the so-called "random selection" of electrical stimulation, both muscle fibers (fast and slow) are stimulated. EMS training can be effectively combined with active movements, which additionally saves time for stretching and muscle development (Kemmler, Teschler, 2015). According to data from international studies, it is proven that in 83% of the participants back pain is significantly reduced. The frequency and duration of pain were found to be reduced by 80%. More than 40% of participants complained of persistent back pain at the start of the study. The number of people with complaints dropped to 9% after 6 weeks of training. The pain completely disappears in 44% of patients with chronic problems. The duration of typical back pain in daily life (lifting heavy loads, walking, bending, heavy physical work, sports, driving, or prolonged sitting) was reduced by 30% (Kemmler, Teschler, 2015).

The main problem that arises with the methodology carried out in the control group is precisely lack of time and persistence among the patients. Physiotherapy twice a week turns to be too short time for strengthening the muscles when the patients do not practice at home. This leads to loss of interest and lack of significant improvement in symptoms. This turned out to be the biggest problem in choosing the right methodology.

The proven effectiveness of the EMS device against back pain led us to test its effectiveness in combating upper cross syndrome by combining physical therapy exercises to affect muscle imbalances. As shown in Figure 4, we emphasized the importance of correct position of the head and neck during loading, isometric exercises, and mainly the use of light weights so as not to induce compensation. The emotional state is also positively affected, as well as motivation, which turned out to be a key factor for the overall therapy.

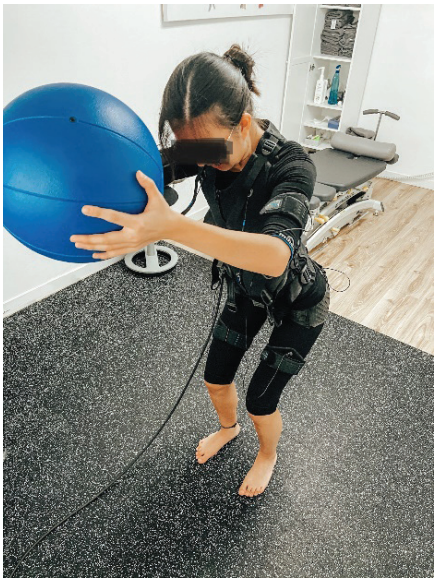


Figure 4. *EMS training*

The second treatment method that we used is *manual therapy on the „Manuthera" treatment table.* "Manuthera" treatment aims to relieve blocks in a joint, pinched nerve root, muscle, and tendon. Applying this innovative, extremely pleasant and safe method, releases tension in the tissue, improves blood circulation, thus reducing pain and increasing mobility and general functionality of the body. Due to the 3D functions, it is the first treatment table in the world of physiotherapy that allows easy access to the problem area even in an acute condition. In acute and subacute conditions, the excellent efficacy of "Manuthera" in combination with other physiotherapy methods, such as functional magnetic stimulation, Kinesio taping, and electrotherapy has been proven.

Figures 5, 6. *Thoracal flexion-extension mobilization on "Manuthera" treatment table*

With the help of the "Manutera" treatment table (Figure 5-6), we significantly improve the

quality of the treatment, because through the moving segments, we have the opportunity to reach the deep musculature and by using massage techniques and passive stretching, we influence the affected musculature extremely quickly. It results in deep manual mobilization of the cervical and thoracic vertebrae which influences and releases the nerve roots. Techniques from the lying position are used to start the procedure by gently massaging the neck and neck muscles to warm up the muscles and preparation for the manual mobilizations.

Mobilizations include neck traction and lateral flexion from a light traction position. After that, mobilizations are performed in the laying on the back position, in the head rotation direction, passive stretching of supraspinatus and trapezius muscles, and neck flexion with active assisted nodding motion.

Then we worked on the lateral inclinations of the body in the thoracal area. It is important that patients are as relaxed as possible, which makes the procedure much more effective. After performing the manual mobilizations of the cervical part and the lateral inclinations in the thoracal part of the spine, we proceed to the movement in the flexion and extension direction of the thoracal part. We have to support and push caudally the spinous process (Figures 5-6) Mobilization in the direction of extension of the spine is extremely important because it relaxes the tension between the vertebrae, prepares the thoracal part for the correct execution of exercises, improves the range of motion and performs deep stretching of the muscles.

RESULTS

The analysis of the results so far shows that the empirically determined difference is not accidental and that the conducted methodology has a proven effect.

During the study, *the experimental group* realized statistically significant results related to the symptoms and complaints typical of carpal tunnel syndrome:

- Dynamometry – an average increase of 1.24 kg or 3.86%, which is statistically significant (t_{emp}=7,20 > $t_{0,05}$=2,00).
- Pain improvement by 2.38 or 64.85% points, which result is also statistically significant (t_{emp} = 10,99 > $t_{0,05}$=2,00).
- Motor activity – an improvement of 1.38 points or 19.03%, (t_{emp} = 10,72 > $t_{0,05}$ = 2,00).
- Boston Carpal Tunnel Syndrome Questionnaire (BSTQ) – shows an improvement of 15.61 points or 32.80% (t_{emp} = 11,23 > $t_{0,05}$ = 2,00).

For the control group, we used standard methods of physiotherapy with an already proven effect to influence the symptoms, which also shows positive results. Dynamometry shows an average increase of 0,79 kg and the pain improvement is 1,29 or 33, 51% which is also a statistically significant result and proves the positive influence of physiotherapy. The conducted scientific research and the systematization, processing, and comparing of the results between the control and experimental group showed great statistical significance in proving the effectiveness of the conducted experimental methodology. Looking at the problem from another point of view, it turned out that, with the development of the technical side of business and industry, it leads to negative consequences. That is why it is necessary to simultaneously maintain and develop the mobility and the physical condition of the body for the prevention of various diseases, which can also include Carpal Tunnel Syndrome.

DISCUSSION

To look for new methods, a combination of methods and development of the knowledge is our aim. That is why we tried a new way to see the CTS, to understand why more and more people have the problem and to try to find a treatment and prevention. The combination of innovative methods and our aim to see the body as a whole system, pushed us to look for new ideas. This study is the first one to examine the psychological effects of EMS training in combination with manual therapy to improve Upper cross syndrome, followed by an improvement in CTS.

In their publication, Heena, Pratik, and Waquar (2022) state that several studies have found a high prevalence of upper cross syndrome in a symptomatic population such as students, desk job workers, dentists, laundry workers, etc. However, upper cross syndrome occurs due to assuming static posture for a prolonged period and can lead to symptoms such as chronic cervical pain, headache and in long term, it can also result in degenerative changes in the cervical spine. Thus, it is very important to look for signs of Upper cross syndrome (Heena, Patrik, 2022). Another cross-sectional overview which includes 244 physiotherapy undergraduates was done for determining occurrence plus risk factors in the development of the upper cross syndrome. There were 57 participants who were having pain in the neck in the passive range of motion during flexion and 187 were not having neck pain. There were 60 participants having thoracic pain during active range of motion during flexion and 184 had no thoracic pain in active range of motion during flexion (Deshmukh, Phansopkar, 2020). One publication presented Namita, Pratik (2021) a study where 30% of the participants with neck pain, rounded shoulder

and flexion posture with a considerable amount of pain over the thoracic area are mainly prone to UCS.

All that information brings us to combinate innovative methods and try to see a new point of view when we work with CTS. More than 75% of the participants in our study have the upper cross syndrome. We aim at treating the bigger problem zone and trying to prevent an eventual compression of nerve or instability in the neck. After several procedures, we received positive feedback and a weakening of the symptoms of the CTS.

A publication by Harvey, Bradley, and Aronica from 1992 examined the psychological effects of functional EMS in patients with spinal cord injuries. The functional EMS served to train the mobility and function of muscles atrophied because of spinal cord injury. In addition to the improvement of physiological parameters, a possible psychological benefit in spinal cord patients was discussed in the study (Harvey, Bradley, 1992).

Compared to standard resistance training, EMS has the advantage of being more time efficient. Kemmler have shown that EMS training is an effective, time-saving form of strength training that, when performed regularly, can achieve comparable results to conventional strength training (Kemmler, Teschler, 2016a).

All the studies analyzed reported a statistically significant improvement in the variables of pain and cervical disability index in the manual therapy intervention group, regardless of the protocol and the manual therapy technique applied. The manual therapy techniques of choice were divided among cervical manipulations, thoracic manipulations, cervical mobilization towards the intervertebral foramen opening, cervical traction, and neural mobilizations. The techniques with the best results were those whose objective was to increase the intervertebral foramen area by transverse mobilizations in the indicated segments. These techniques had been applied with positive results in 4 of the studies (Ojoawo, Olabode, 2018; Prabhkar, 2011; Shafique, Ahmad, 2019).

The classified information and our research show us the new opportunity to combinate methods and knowledge to reach the goal of prevention and therapy of the CTS.

REFERENCES

Brotzman, S. (2000). *Handbook of Orthopaedic Rehabilitation.* Mosby.

Deshmukh, M., Phansopkar, P., Kumar, K. (2020). Effect of Muscle Energy Technique on Piriformis Tightness in Chronic Low Back Pain with Radiation. *IJRPS.* 5(1), 312-15.

Harvey, J., Bradley, M., Aronica, M. (1992). Psychological effects of functional electrical stimulation: a review of the literature. *Neurorehabil Neural Repair.* 6(4):203–11. https://doi.org/10.1177/136140969200600406

Heena, P., Pratik, P., Waqar, M. (2022). Screening for Upper Cross Syndrome in Asymptomatic Individuals. *J. Med. P'ceutical & Allied Sci.* Vol 11- 12, pp. 3089-3093. doi:10.55522/jmpas.V11I2.1260.

Kemmler, W., Schliffka, R., Mayhew, J., von Stengel, S. (2010). Effects of whole-body electromyostimulation on resting metabolic rate, body composition, and maximum strength in postmenopausal women: the Training and Electrostimulation Trial. *J Strength Cond Res.* 24(7):1880–7. https://doi.org/10.1519/JSC.0b013e3181ddaeee.

Kemmler, W., Teschler, M., Weissenfels, A., Fröhlich, M., Kohl, M., von Stengel, S. (2015). Ganzkörper Elektromyostimulation versus HIT-Krafttraining – Einfluss auf Körperzusammensetzung und Muskelkraft. *Dtsch Z Sportmed.* 66:321–7.

Kemmler, W., Kohl, M., von Stengel, S. (2016). Effects of high intensity resistance training versus whole-body electromyostimulation on cardiometabolic risk factors in untrained middle-aged males: a randomized controlled trial. *J Sports Res.* 3(2):44–55. https://doi.org/10.18488/journal.90/2016.3.2/90.2.44.55.

Kemmler, W., Teschler, Mt., Weissenfels, A., Bebenek, M., Fröhlich, M., Kohl, M., et al. (2016a). Effects of whole-body electromyostimulation versus high-intensity resistance exercise on body composition and strength: a randomized controlled study. *Evid Based Complementary Altern Med.* 2016:9236809.

Kemmler, W., Teschler, M., Weissenfels, A., Bebenek, M., von Stengel, S., Kohl, M., et al. (2016b). Whole-body electromyostimulation to fight sarcopenic obesity in community-dwelling older women at risk: results of the Randomized Controlled FORMOsA-Sarcopenic Obesity Study. *Osteoporos Int.* 27(11): 3261–70. https://doi.org/10.1007/s00198-016-3662-z.

Kozak, A., Schedlbauer, G., Wirth, T., Euler, U., Westermann, C., Nienhaus, A. (2015). Association between work-related biomechanical risk factors and the occurrence of carpal tunnel syndrome: an overview of sys-

tematic reviews and a meta-analysis of current research. *BMC Musculoskelet Disord* 16: 231.

Lutskanova, S., Troev, T., Zalalieva, A. Modern physical methods for treatment of carpal tunnel syndrome. *Cont Med Prob.* 1:41–43.

Namita, B., Pratik, P., Ashish, B., Om, C., Sakshi, P., Neha, C. (2021). A Physiotherapy Approach in Lumbar Spondylosis and PIVD in a 44 years Old Male Patient. *Jour. of Med. P'ceutical & Allied. Sci.* 10(6), 3886-3888.

Ojoawo, A., Olabode, A. (2018). Comparative effectiveness of transverse oscillatory pressure and cervical traction in the management of cervical radiculopathy: a randomized controlled study. *Hong Kong Physiotherapy Journal,* Vol. 38, no. 2, pp. 149–160.

Ojoawo, A., Olabode, A., Esan, O., Badru, A., Odejide, S., Arilewola, B. (2016). Transverse oscillatory pressure in man-agreement of cervical radiculopathy: a randomized controlled study, *Hong Kong Physiotherapy Journal,* Vol. 34, pp. 19–26.

Prabhkar, R. (2011). Cervical spinal mobilization versus TENS in the management of cervical radiculopathy: a comparative, expert-mental and randomized controlled trial, *Indian Journal of Physiotherapy & Occupational Therapy,* Vol. 5, no. 1, pp. 95–99.

Shafique, S., Ahmad, S., Shakil-Ur-Rehman, S. (2019). Effect of Mulligan spinal mobilization with arm movement along with neurodynamics and manual traction in cervical radiculopathy patients: a randomized controlled trial, *The Journal of the Pakistan Medical Association,* Vol. 69, no. 11, pp. 1601–1604.

Corresponding author:
Stefaniya Naydenova,
Master's student in
National Sports Academy "Vassil Levski",
Sofia, Bulgaria
E-mail: naydenovast@gmail.com

 DOI: 10.37393/ICASS2022/146 463 - 468

PHYSIOTHERAPY FOR COLON CANCER IN THE EARLY POSTOPERATIVE PERIOD - A CASE REPORT

Nezabravka Gencheva
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT

Introduction: The Physiotherapy (PT) is an important part of cancer treatment and could be recovery PT, maintenance PT and palliative PT. The aim of the study is to investigate the impact of early postoperative PT on the functional and mental recovery of a 57-year-old patient with colon cancer.

Research methods: On the second and seventh postoperative day, we applied a Quality of Recovery-40 (QoR-15) questionnaire, Cumulated Ambulation Score (CAS) and Hospital Anxiety and Depression Scale (HADS) and a 6 min walk-test – on the third and seventh postoperative day. The special PT is used to improve the respiratory function, to alleviate the unpleasant sensations of the gastrointestinal tract, to reduce pain, to restore mobility through training in painless sitting, standing up, and walking, as well as to reduce anxiety and to overcome depressive symptoms.

Results: Applied PT in the early postoperative period in severe abdominal surgery for colon cancer prevented postoperative complications. The results show a significant improvement in the studied indicators and good quality of recovery; patient's independence in standing up, sitting, and walking; pain relief; reduced anxiety and depressive moods.

Conclusion: The application of early PT is an important part of patient's post-surgical care. It helps for optimal recovery and prepares him for the next additional therapies such as chemotherapy, radiation therapy, etc.

Keywords: *colon cancer, physiotherapy, recovery, early postoperative period.*

INTRODUCTION

In the last two to three decades, oncological diseases have increased significantly in industrialized countries. To inform a patient of a cancer diagnosis is extremely stressful news to them and their family because its perceived as a life-threatening disease. Colonrectal cancer is among the most common cancer diseases with great social significance. Colorectal cancer (CRC) is the third most common cancer worldwide, accounting for 1.8 million new cases in 2018. (Rawla et al.,2019). According to the National Statistical Institute, Bulgaria ranks first in the EU in terms of colon cancer incidence, with 19,850 people registered in 2020, which is 286.3 per 100,000 people with colorectal cancer (www.nsi.bg). The risk of getting CRC increases with age and is greater in men than in women. CRC is one of the leading causes of cancer death worldwide - it is the second most common cause of death after cardiovascular disease, breast cancer in women, and third after lung and prostate cancer in men (Haggar, 2009; Bray et al. 2018, World Cancer Research Fund International). The incidence of CRC is exacerbated by the prevalence of poor diet and sedentary lifestyles in developed countries (Rawla et al., 2019).

Colorectal cancer (CRC) is a rapid abnormal cell growth that affects the colon and/or rectum. These clusters of cells are called adenomatous polyps and develop from the tissue membrane of the glandular tissue (Gaillard, 2008). Polyps can start as benign and non-cancerous but over time can develop and become cancerous over time. The most common area of diagnosis is cancer of the rectum and the rectosigmoid junction, as well as the sigmoid, where it has the most favorable outcome. The clinical appearance is characterized depending on the localization, since right-sided tumors are larger and associated with iron deficiency anemia, left-sided tumors appear earlier with altered liver dysfunction (Gaillard, 2008). Common systemic symptoms of CRC are: unexplained weight and appetite loss, nausea or vomiting, diarrhea or constipation, anemia, jaundice, weakness, or fatigue (Nakayama,2014).

Colorectal cancer (CRC) treatment considers the grade, localization of the tumor, age, physical conditions, and other individual characteristics of the patient. CRC therapy includes surgery, chemotherapy, and/or radiotherapy, depending on the stage of the disease. Very good results, such as longer survival, can often be achieved in patients even with metastatic disease. Target therapies are particularly

relevant in recent years, offering great hope to patients (Ohhara et al., 2016).

Physical activity is an essential part of cancer prevention and treatment. A study by Vainio et al. (2002) shows that physical activity can prevent about 15% of colon cancer. Similar are the studies of Behrens et al. (2013) and Boyle et al. (2012), who found that regular physical activity can be a good prevention for various types of cancer.

Physiotherapy is an important factor in the recovery of patients who have undergone surgery for colon cancer. When the goal is a full functional recovery, then physical therapy helps the patient reintegrate into society and protect against cancer recurrence. In patients who have deficits as a result of disease, such as metastatic disease, for example, the goal of supportive physical therapy is to maximize functional independence and provide a better quality of life. When the patient is in a terminal stage, physiotherapy is palliative, providing maximum comfort to the patient.

Physiotherapy helps through all stages of treatment. Research shows better outcomes when preoperative supervised home physical therapy is included in the postoperative period. Mayo et al. 2016 found that one-third of patients with benign or malignant colorectal lesions who performed weight-bearing exercise or stationary cycling plus exercise with increased walking in the preoperative period of planned colorectal surgery improved mental health, vitality, and self-esteem.

Postoperative physiotherapy is applied with the aim of faster recovery of the patient's functional capacity ability after the operation and his preparation for the following treatment procedures. The primary goals of physical therapy are to prevent early postoperative complications, restore muscle strength, general endurance, and mental health to return the patient to activities of daily living (ADL). (Wong et al., 2016, Oruç, Kaplan, 2019; Gencheva, 2015). In support of the above is the study by Gillis et al. 2014, in which significant changes in functional capacity were noted after applying aerobic and resistance exercises, relaxation exercises, and nutritional advice with protein supplements.

Although the need for motor activity in the early postoperative period has been proven, we did not find sufficient and definitive conclusions and assessments of exact dosage, intensity, and type of exercises, as well as the impact of early physiotherapy on daily activities such as transfers - sitting, standing, standing up, walking, influencing postoperative pain, anxiety, and depression.

The ***aim*** of the study is to investigate the changes in some motor and psychological aspects of functioning in a patient who underwent surgery for colon cancer in the early postoperative period as a result of the application of a physiotherapy program.

Presentation of the patient. A 57-year-old patient diagnosed with colon carcinoma. The diagnosis was confirmed after a colonoscopy and biopsy. A median laparotomy was performed under general anesthesia and right hemicolectomy. It was evaluated in 3 A stage. The patient maintained a good physical condition through sports 5 times a week. Before the operation, he lost 10 kg of weight over a period of two months. He complained of fatigue and loss of strength. There are negative changes in hematological indicators and tumor markers. There were no significant comorbidities prior to diagnosis.

METHODS

1. HADS (assessment of anxiety and depression). HADS is easy and fast, it's not difficult for patients. It consists of 12 questions, 6 for the assessment of depression and 6 for the assessment of anxiety in hospitalized patients. We decided to apply it as a suitable assessment in a patient after a major surgical intervention.

2. Quality of recovery (QoR) The quality of recovery (QoR) after anesthesia is an important measure for evaluating the early postoperative health status of patients. This is a 15-step psychometric questionnaire. The patient completed the questionnaire 24 hours after surgery and then on day 7 to assess his overall postoperative recovery using a 100-mm visual analog scale (VAS) marked from "poor recovery" to "excellent recovery".

3. A 6-min walking test was conducted on day 2 and on day 7. The patient walks as far as possible in six minutes along a flat 30-meter track – the corridor of the clinic.

4. CAS Cumulated Ambulation Score – A Danish measure of mobility with 3 items. Describes the patient's independence in three activities (laying

down and getting out of bed, sitting and standing up from a chair, and walking). Each activity is rated on a three-point scale of 0-2 (0 = unable, despite help and verbal prompts, 1 = performs with help and/or verbal prompts from one or more people, 2 = performs safely, without human assistance or verbal prompts. The use of a walking aid is allowed), the total daily CAS score ranges from zero to six.

Physiotherapy methodology in the early postoperative (clinical) period

The applied rehabilitation program lacks pre-operative physiotherapy due to the operative intervention applied urgently one week after the diagnosis of the disease. Postoperative physical therapy aims to prevent early postoperative complications and quickly restore the patient's self-care. From the first postoperative day, exercises to improve respiratory function were included to prevent lung infection. Due to the large median longitudinal suture and the presence of two large postoperative drains in the first two days, special breathing exercises were of the chest type sparing the diaphragm in order not to cause pain from the increase in intra-abdominal pressure. After removing the nasal tube, the patient performed several inhalations through the nose and prolonged exhalation through the mouth pronouncing the sound "O". From the 3rd postoperative day, we included a slight movement of the diaphragm with folded lower limbs and an active cycle of breathing exercises to clear the lungs of any retained secretions after extubation and achieve full functional breathing.

To support general blood and lymph circulation and reduce pain, we used bed exercises for small muscle groups of the lower and upper limbs, including light resistance exercises using a Soft ball (Figure 1-4).

Soft ball exercises:

Figure 1. *Ankle joint Flection against elastic resistance by Soft ball*

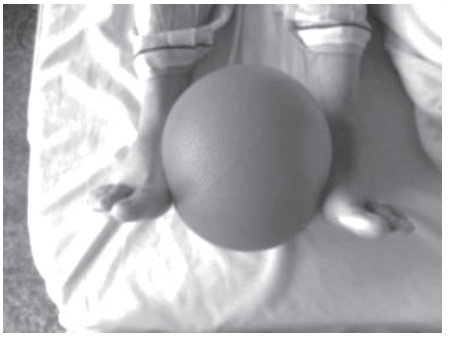


Figure 2. *Ankle joint Adduction against elastic resistance by Soft ball*

Figure 3. *Hip adduction against elastic resistance by Soft ball*

Figure 4. *Adduction at the shoulder joint against elastic resistance by Soft ball*

From the 5th postoperative day, we included active exercises for the lower limbs with the engagement of the abdominal muscles under reduced conditions through by tilting the pelvis as well as isometric exercises for the gluteal muscles to help restore the strength of the abdominal muscles, protect the surgical wound and stimulate urinary function. We focused on training the patient to transfer for quick standing and self-care. Already on the first postoperative day, we made the patient stand and

walk after training with several sitting exercises. The initial distance was short (about 10 m). From the 2nd to the 7th postoperative day, the walking distance gradually increased. The one-time length of the track (corridor) was 30 m.

RESULTS

The Results from the HADS (Zigmond, Snaith, 1983) show the following:

On the first postoperative day, high levels of anxiety and depressive syndrome are reported as a result of the pain, immobilization, hospital environment, etc. (As- 11 Abnormal, Ds - 8 Borderline abnormal). Before discharge, there is no depressive syndrome Ds - 6 Normal, and there is a positive influence on anxiety (As- 8 Borderline abnormal). The patient is in good mental condition awaiting discharge and homecoming. We believe that this is due to the complex post-operative care, as well as the applied systemic motor activity, which changed the mental status in a positive direction.

*Results of the assessment of Quality of recovery (QoR.) after anesthesia***.** A 15-question version of (QoR-40) was tested (Stark, 2013).

The psychometric questionnaire was personally completed by the patient 24 hours after surgery and on the 7th postoperative day and evaluates the early postoperative health status of patients. The maximum number of points is 150. On the second postoperative day, the result of the questionnaire was 31 points according to the visual analog scale. On day 7, the patient scored a total of 110 points, tracking responses to individual items, the most improved being sleep, communication, reduction of severe pain, breathing, absence of nausea and vomiting, activities of daily living, and improvement of mental status expressed by a feeling of anxiety and depression, that correlates with the HADS questionnaire.

6MWT test results

6MWT is a simple measure of cardiopulmonary fitness. We used the 6MWT in addition to a measure of cardiopulmonary fitness and training distance. On the second postoperative day, the patient was unable to complete the 6MWT, so we measured the distance traveled in 3 min, which was only 50 m once. On postoperative day 7 before discharge, the patient walked a distance of 320 m, with an average walking speed approaching the age-average of about 3 km/h (Table 1). We recorded one distance walked in 6 min, but the patient managed to walk the distance three times during the day. A walking program was prepared after the discharge from the clinic.

*Evaluation of patient's independence during transfers using the CAS Cumulated Ambulation Score***.** The results show the following changes:

On the first assessment on the second day for lying down - getting out of bed, sitting - standing up from a chair, and walking, the patient needs assistance and verbal motivation, therefore, the score is 1. At the end of the research period on day 7, the patient can get up, stand up and walk absolutely independently without assistance and has a score of 2 (Table 1).

Table 1. *Assessment of the psycho-physical status of the patient at the beginning and end of the early postoperative period*

TEST	2 day	7 day
HADS	As- 11 Abnormal Ds- 8 Borderline abnormal	As- 8 Borderline abnormal Ds 6 Normal
(QoR) after anesthesia	31	110
6MWT (m)	50	320
CAS	1	2

DISCUSSION

In the present study, a physiotherapy methodology was tested in the early postoperative period in a patient after colon surgery for carcinoma. In a significant diversity of interventions, we also wanted to test some evaluation tools that had not yet been implemented in Bulgaria for this type of patients. The applied test tasks assessing both functional capabilities and some psychological aspects, such as restlessness, anxiety, and depressive states on the second and 7th day after the operation, provide information on the patient's overall recovery. Early assessment of the patient's mobility after surgery is the cornerstone for tracking functional abilities in the future. Severe and prolonged surgical intervention, pain, and hypodynamia can quickly lead to muscle weakness, a

decrease in muscle mass, a loss of balance, and ability to stand, sit and walk independently. In support of our CAS results, immediately after surgery, are some studies (Ferriero, 2018; Trøstrup, 2019), which also emphasize that CAS is the most appropriate assessment to establish baseline mobility due to the adverse events associated with the lack of physical activity in the hospital, especially in the early postoperative period. Walking helps restore normal gastrointestinal function. Early standing and walking are very important factors in preventing pulmonary and thromboembolic complications, adhesions, loss of muscle mass, and stimulates the first defecation after surgery (Gencheva, 2015; Khoury, 2014).

Some studies have found a connection between preoperative 6MWT distance walked and postoperative complications (Awdeh et al., 2015). In our patient, we applied the test not to evaluate the cardiopulmonary capacity but the ability to walk, which is limited after surgery. The lower-than-normal-for-age distance traveled at the first measurement is believed to be due to postoperative pain, reduced muscle strength and endurance, and the balance to walk a longer distance requiring a higher speed of movement. In our opinion, the 6MWT can also be applied in surgical rehabilitation because it is easy to administer, requires a corridor space of 30 meters, and does not rely on patient self-report. Similar analyses were done by Moriello et al., 2008, according to which the 6MWT shows a moderate to strong correlation with musculoskeletal dysfunctions in individuals without other associated cardiopulmonary problems and can be used as an indicator of surgical recovery. We also agree with the analysis of this scientific team that the application of the 6MWT is a good way to evaluate the effect of surgery on patients, as it integrates all components of functional walking (balance, speed, endurance) (Moriello et al., 2008).

Due to the lack of application in more patients, we can only compare our QoR-15 result score with previously published average values from other studies. For example, Chazapis et al., 2016 found that Men had a total QoR-15 score on day 7, 102±23. Patients who experienced postoperative complications had a lower score than those who did not; (91±13 vs. 103±25). In this case, a slightly higher total score on the scale is reported in our study.

The stress of the operative intervention, the pain of tissue trauma, hypodynamia, feeling of a poor physical condition, malnutrition of the diet, uncertainty of the future due to the diagnosis are the predictors of higher anxiety and depressive state in the first postoperative days. With the improvement of self-care capabilities such as independent standing, sitting, walking, and toileting, the patient's mental status improved significantly, and this was shown by the changed HADS values at the end of the study period.

CONCLUSION

The presented physiotherapy program in a patient with colon cancer had a beneficial effect on reducing anxiety, depressive symptoms, and pain syndrome, prevented early postoperative complications and improved the patient's self-care in terms of standing, sitting, and walking. More research data using appropriate assessment methods are needed to establish standards for early rehabilitation in patients undergoing laparotomy for colon carcinoma.

REFERENCES

Awdeh, H., Kassak, K., Sfeir, P. et al. (2015). The SF-36 and 6-Minute Walk Test are Significant Predictors of Complications After Major Surgery. *World J Surg,* 39, pp.1406–1412.

Behrens, G., Leitzmann M. (2013). The association between physical activity and renal cancer: systematic reviewand meta-analysis. *Br J Cancer*; 108, pp. 798-811,

Boyle, T., Keegel, T., Bull, F., Heyworth, J., Fritschi, L. (2012). Physical activity and risks of proximal and distal colon cancers: a systematic review and meta-analysis. *J Natl Cancer Inst;* 104, pp. 1548-1561,

Bray, F., Ferlay, J., Soerjomataram, I., Siegel, R., Torre, L., Jemal, A. (2018). Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA: a cancer journal for clinicians*.;68(6) pp.394-424

Chazapis, M., Walker, E., Rooms, M., Kamming, S.R. (2016). Moonesinghe, Measuring quality of recovery-15 after day case surgery, *British Journal of Anaesthesia*, Vol. 116, Iss. 2, pp.241-248

Ferriero, G., Kristensen, M., Invernizzi, M., Salgovic, L., Bravini, E., Sartorio, F., et al. (2018). Psychometric properties of the Cumulated Ambulation Score: a systematic review. *Eur J Phys Rehabil Med*;54, pp.766-771.

Gaillard, F., Niknejad, M. Colorectal cancer. (2008). Reference article, *Radiopaedia.org.* https://doi.org/10.53347/rID-1153 (accessed on 15 .8 2022)

Gencheva, N. (2015). *Kinesiterapia pri nakoi hirurgicni zaboliavania*, Avangard, Sofia, // Генчева, Н. (2015).

Кинезитерапия при някои хирургични заболявания, Авангард, София

Gillis, C., Li, C., Lee L, et al. (2014). Prehabilitation versus rehabilitation. A randomized control trial in patients undergoing colorectal resection for cancer. *Anesthiesiology*;121, pp. 937-947.

Haggar, F., Boushey, R. (2009). Colorectal cancer epidemiology: incidence, mortality, survival, and risk factors. *Clinics in colon and rectal surgery*; 22(04) 191–197.

Khoury, W., Dakwar, A., Sivkovits, K., Mahajna, A. (2014). Fast-track rehabilitation accelerates recovery after laparoscopic colorectal surgery. *Journal of the Society of Laparoendoscopic Surgeons*;18(4):e2014.00076. PMID: 25489207; PMCID: PMC4254471.

Mayo, N., Feldman, L., Scott, S., et al. (2011). Impact of preoperative change in physical function on postoperative recovery: argument supporting prehabilitation for colorectal surgery. *Surgery.*;150. pp. 505–514.

Moriello, C., Mayo, N., Feldman, L., Carli, F. (2008). Validating the six-minute walk test as a measure of recovery after elective colon resection surgery. *Arch Phys Med Rehabil.*;89(6).pp.1083-1089.

Nakayama, G., Tanaka, C., Kodera, Y. (2014). Current options for the diagnosis, staging, and therapeutic management of colorectal cancer. *Gastrointestinal tumors*;1(1). pp. 25-32.

Nazionalen zentar po obsshtestveno zdrave i analisi, (2021). Zdraveopazvane, 2020

Available from www.nsi.bg/sites/default/files/files/publications/Zdraveopazvane_2020.pdf (last accessed 11.5.2022)

Ohhara, Y., Fukuda, N., Takeuchi, S., Honma, R., Shimizu, Y., Kinoshita, I., & Dosaka-Akita, H. (2016). Role of targeted therapy in metastatic colorectal cancer. *World J Gastrointest Oncol*, 8(9), pp. 642–655.

Oruç, Z., Kaplan, M. (2019). Effect of exercise on colorectal cancer prevention and treatment. *World J Gastrointest Oncol*; 11(5): pp.348-366

Rawla, P., Sunkara, T., Barsouk, A. (2019). Epidemiology of colorectal cancer: incidence, mortality, survival, and risk factors. *Przeglad gastroenterologiczny*,14(2), pp.89–103.

Stark, A., Myles P., Burke J. (2013). Development and Psychometric Evaluation of a Postoperative Quality of Recovery Score: The QoR-15. *Anesthesiology*; 118, pp.1332–1340

Trøstrup, J., Andersen,H., Kam, Ch. Agger M., Magnusson, P., Beyer, N, (2019). Assessment of Mobility in Older People Hospitalized for Medical Illness Using the de Morton Mobility Index and Cumulated Ambulation Score-Validity and Minimal Clinical Important Difference. *Journal of Geriatric Physical Therapy*: Vol 42 - Issue 3 – pp. 153-160

Vainio, H., Kaaks, R., Bianchini, F. (2002). Weight control and physical activity in cancer prevention: international evaluation of the evidence. *Eur J Cancer Prev;* 11 Suppl 2: pp. 94-100

Wong, C., Lee, H., Chang, C. (2016). Colorectal cancer rehabilitation review. *Journal of Cancer Research and Practice*. 1;3 (2), 31–33.

World Cancer Research Fund International, Available from www.wcrf.org/cancer-trends/cancer-survival-statistics/(last accessed 11.5.2022)

Zigmond, A., Snaith, R. (1983). The Hospital Anxiety and Depression Scale, *Acta Psychiatrica Scandinavica* 67/6, 361-370

Corresponding author:
Prof. Nezabravka Gencheva, PhD
Department of Kinesitherapy and Rehabilitation,
National Sports Academy "Vassil Levski",
Sofia, Bulgaria
E-mail: nezig@yahoo.com

COMPLEX RECOVERY OF THE UPPER LIMB AFTER NERVE TRANSFERS IN PATIENTS WITH ADULT BRACHIAL PLEXUS INJURIES

Nadezhda Popova
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
Introduction. Adult brachial plexus injuries may lead to a permanent physical impairment in the affected upper extremity. One of the most successful operative methods of treating these injuries is nerve transfer. Depending on the extent of the injury, one or more nerve transfers are usually done for better functional recovery. That is why the aim of our study is to present the results of a two-year postoperative follow-up of the complex upper limb function in patients with different nerve transfers after adult brachial plexus injuries. Methods: All of our 14 patients (mean age of 35.0 years) had one or more nerves in the shoulder and the elbow. The average time between injury and the first surgery was 7.1 months, and the average time between surgeries was 3.4 months. All patients underwent a physiotherapy program with electrostimulation, donor nerve activation exercises, and training activities for daily living. Some patients had also individual hand splints. The complex function of the upper extremity was assessed on the 12th and 24th postoperative month (POM) by the Bulgarian version of the questionnaire Disabilities of Arm, Shoulder, and Hand (DASH). Results: On the 12th POM the average total score of DASH was 49.3 points, and on the 24th POM it decreased to 27.6 points ($\alpha \leq 0.000$) which shows an improvement in the complex function of the upper extremity. By the end of the 24th POM almost all of the patients have returned to their job before the accident. Six of our patients have also been practicing sports without serious difficulties in the end of the second postoperative year. Conclusion: The studied patients showed good recovery of the complex function of the upper limb after the nerve transfers. This led to both returning to work after the injury and practicing sports. Although the sample is small, it gives us valuable information about what function of the upper extremity could be expected in these patients.

Keywords: *nerve transfers, functional recovery, DASH score, brachial plexus*

INTRODUCTION

Adult brachial plexus injuries could be devastating for the patients. These injuries may lead to a permanent physical impairment in the affected upper extremity. One of the most successful operative methods for treating these injuries is nerve transfer, also known as neurotisation. This is a procedure in which a healthy peripheral nerve is engrafted to a damaged one in order to restore the initial function. Depending on the extent of the injury, one or more nerve transfers are usually performed in order to restore the function of the upper limb to recovery as completely as possible. The first priority for recovery of the upper limb with neurotisation is the function of the elbow, followed by the shoulder and the hand (Chung, 2012; Kateva, 2019). The functional recovery after nerve transfer is a long process, in which training in the activities of daily living (ADL) should be included as soon as possible in order to adapt the patient to their new condition. That is why the *aim* of our study is to present the results of a two-year postoperative follow-up of the complex upper limb function in patients with different nerve transfers after adult brachial plexus injuries.

METHODS

The contingent of the study included 14 men (mean age of 35.0 years). Each of them had one or more nerve transfers. All patients had given informed consent for the study. The nerve transfers used are n.accessorius-n.suprascapularis, n.phrenicus-n.axillaris, n.radialis (a branch for the medial head of m.triceps brachii)-n.axillaris, modified Oberlin technique, n.phrenicus-n. musculocutaneus. The average time between injury and the first surgery is 7.1 months, and the average time between surgeries is 3.4 months. All patients underwent a physiotherapeutic program. It included mostly donor activation exercises depending on the performed nerve transfers. Examples of such exercises are simultaneous finger flexion and trunk flexion combined with a passive elbow flexion in the full possible range of motion for the modified Oberlin technique; simultaneous resistive diaphragmatic breathing and shoulder abduction for the n.phrenicus to n.axillaris nerve transfer, etc. (Figure 1 and 2).

Figure 1. *Simultaneous finger flexion and trunk flexion combined with passive elbow flexion*

Figure 2. *Simultaneous resistive diaphragmatic breathing and shoulder abduction*

The postoperative inclusion of the operated limb in the ADL has been started as soon as possible. Before the re-innervation, the limb was used as a "supporting hand", sometimes just as an attempt of preventing the "learned non-use". Once the muscle strength and muscle control increased enough to overcome gravity, the range of the possible ADL also increased and the operated limb was leading in several of the activities. Some examples of training using these activities are shown in Figure 3 (A to E):

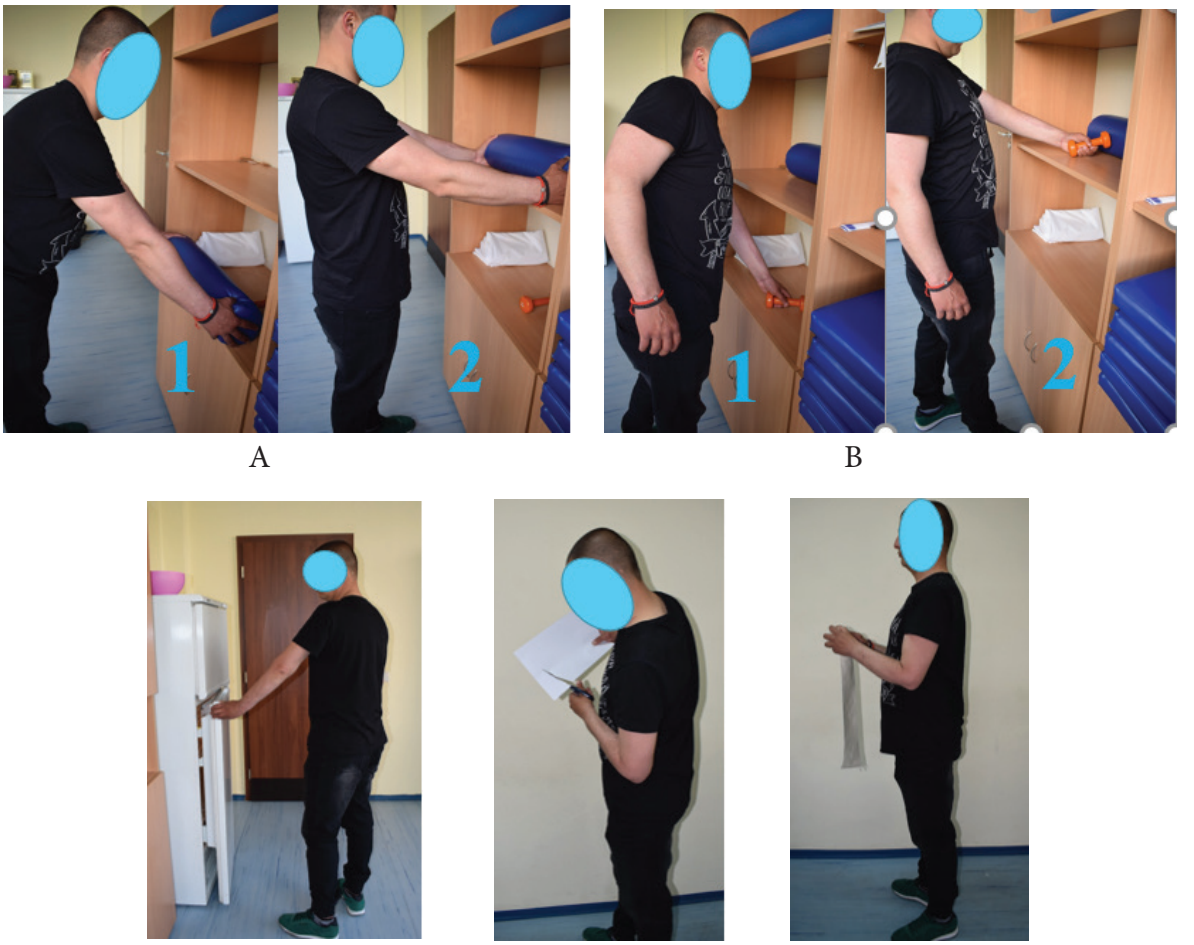


Figure 3. *Training by using some ADL*

Some patients had also individual hand splints in order to improve the performance of the ADL (Figure 4 - A to C).

A B C

Figure 4. *Splints for better performance in the ADL and sports activities*

The assessment of the complex function of the upper extremity was made on the 12th and 24th of the postoperative month. We used the Bulgarian version of the questionnaire Disabilities of Arm, Shoulder, and Hand (DASH) (Jacobson-Petrov, Simeonov, 2017; Jacobson-Petrov, 2019). The DASH questionnaire aims to determine the difficulties and limitations in various ADL, which occur because of the impairment of the upper extremity. Both upper limbs are required to perform each of the activities included in the questionnaire. The DASH contains one essential module with questions about the most common ADL and two optional modules about working and participating in sports or performing music. The score is calculated using a points formula or automatically at www.dash.iwh.on.ca/app.

RESULTS

Table 1 are presented the results of the total DASH score. At the 12th POM, the average total DASH score was 42.3 points, and at the 24th POM, it decreased to 27.4 points ($\alpha \leq .000$, Student's T-criteria for dependent excerpts).

Table 1. *Results of the total DASH score*

Total DASH score (points)	12th POM		24th POM		d	t	α
	$\overline{X}_1$	S1	$\overline{X}_2$	S2			
	42.3	21.1	27.4	16.2	14.9	7.201	0.000

The optional work module at the 12th POM was completed by 44.4% of the patients, with an average value of 33.6 points. At 24th POM 88.8% of the patients returned to work, as the average value decreased to 32.8 points (Figure 5).

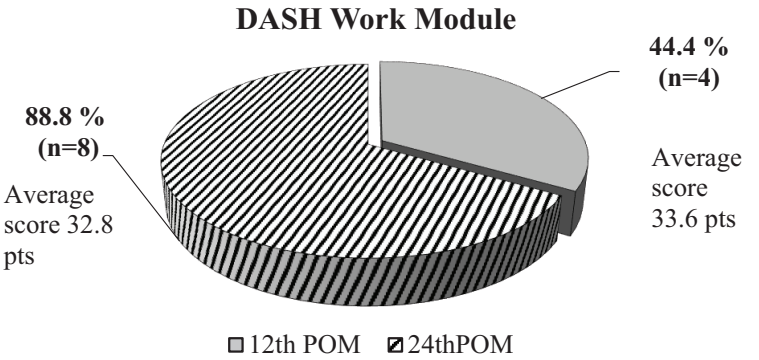


Figure 5. *Results of DASH Work Module*

At the 12th POM, none of the patients had played sports, and at 24th POM three of them returned to practicing sports without serious difficulties (average value of 17.2 points). Figure 6 (A and B) is shown one of our patients, who returned to his job and hobby from before the accident.

A B

Figure 6. *One of our best results. The patient fully returned to his job at 14th POM. He was back on the motorcycle at the 18th POM*

DISCUSSION

The complex function of the upper extremity after nerve transfers in adult brachial plexus injury can be adequately assessed by the DASH questionnaire. However, there are relatively few publications on the subject in the available scientific literature (Escudero et al., 2017; Maricq et al., 2014; Carlsen et al., 2011; Liu et al., 2011; Dodakundi et al., 2013). This variation might be related to the different preoperative statuses of the patients, the severity of the injuries, and the different time of postoperative follow-ups. The closest to our mean total DASH score on the 24th POM is Dodakundi et al. (2013) – an average of 36 points total DASH score on the 36th POM. In the other author's works, the follow-up time is too extensive (Liu et al., 2011), or the patients have only one nerve transfer, or in addition to nerve transfers, they have other procedures performed, such as tendon transfer, or a free-muscle transfer (Escudero et al., 2017; Maricq et al., 2014; Carlsen et al., 2011).

Acknowledgments

The author expresses her sincere gratitude and deep appreciation for working together with the team of Prof. Dr. Margarita Kateva, MD – Chief of Clinic of Hand Surgery and Reconstructive Surgery at Sofiamed University Hospital, Sofia, Bulgaria; and physiotherapist Georgi Petrov, MSc from Physiotherapy office "Handrehab Consult", Sofia, Bulgaria.

CONCLUSION

The studied patients show a statistically significant recovery of overall upper limb function between the first and second year after the nerve transfers. The active participation and involvement of patients in the rehabilitation process and in the implemented rehabilitation program may be considered as the main factors for the improvement. Although the sample is small, it gives us valuable information about fasiable expectations for the recovery of patients who have undergone nerve transfers in the shoulder and elbow area due to a brachial plexus injury within the first two postoperative years.

REFERENCES

Carlsen, B. T., Kircher, M. F., Spinner, R. J., Bishop, A. T., & Shin, A. Y. (2011). Comparison of Single versus Double Nerve Transfers for Elbow Flexion after Brachial Plexus Injury. *Plastic and Reconstructive Surgery*, 127(1), 269–276. doi:10.1097/prs.0b013e3181f95be7

Chung, K., Yang L., McGillicuddy J. (2012). *Practical management of pediatric and adult brachial plexus palsies*. Elsevier, ISBN: 9871437705751, p.198-212

Dash outcome measure iPad application. DASH. (n.d.). Retrieved September 20, 2022, from https://dash.iwh.on.ca/app

Dodakundi, C., Doi, K., Hattori, Y., Sakamoto, S., Fujiha-

ra, Y., Takagi, T., Fukuda, M. (2013). Outcome of Surgical Reconstruction After Traumatic Total Brachial Plexus Palsy. *The Journal of Bone and Joint Surgery-American,* Volume, 95(16), 1505–1512. doi:10.2106/jbjs.k.01279

Escudero, R. B., Rezende, M. R. de, Wataya, E. Y., Pontes, F. V. de, Cho, Á. B., & Pisani, M. J. (2017). Correlation between the elbow flexion and the hand and wrist flexion after neurotization of the fascicles of the ulnar nerve to the motor branch to the biceps. *Revista Brasileira de Ortopedia (English Edition)*,52(3),309–314. doi:10.1016/j.rboe.2017.04.006

Jacobson, J., Simeonov L. (2017). Mezhdukulturna adaptatsia na skalata Disabilities of the arm, shoulder and hand (DASH) na balgarski ezik. *Sp. Ortopedia i travmatologia,* br. 54/ Suppl.1, ISSN 0473-4378, s. 247-255 // Джейкъбсън Дж., Симеонов Л. (2017). Междукултурна адаптация на скалата Disabilities of the arm, shoulder and hand (DASH) на български език. Сп. Ортопедия *и* травматология*,* Vol.54 Suppl.1, ISSN 0473-4378, с. 247 – 255

Jacobson-Petrov, J. Jerosch-Herold, C., Simeonov L. (2019). The Use of Cognitive Interviewing to Assess the Content Validity of the Bulgarian Disabilities of the Arm, Shoulder and Hand. Abstract no.: IFSHT19-1214, *Abstract book 11th IFSHT Congress, Berlin 17-21.06.2019*, ISBN 978-3-00-063585-4, p. 114

Kateva M. (2019). *Ranno operativno lechenie na travmi na plexus brachialis*. Monografiya. Izdatelstvo BULGED, Sofia, ISBN: 978-619-91405-0-5 // Кътева М. (2019). Ранно оперативно лечение на травми на *plexus brachialis*. Монография, издателство БУЛГЕД, София, ISBN: 978-619-91405-0-5

Liu, Y., Lao, J., Gao, K., Gu, Y., & Xin, Z. (2011). Outcome of nerve transfers for traumatic complete brachial plexus avulsion: results of 28 patients by DASH and NRS questionnaires. *Journal of Hand Surgery (European Volume),* 37(5), 413–421. doi:10.1177/1753193411425330

Maricq, C., Jeunehomme, M., Mouraux, D., Rémy, P., Brassinne, E., Bahm, J., & Schuind, F. (2014). Objective evaluation of elbow flexion strenght and fatigability after nerve transfer in adult traumatic upper brachial plexus injuries. *Hand Surgery,* 19(03), 335–341. doi:10.1142/s0218810414500245

Corresponding author:
Nadezhda Popova, PhD
National Sports Academy "Vassil Levski"
Department „Theory and methodics of physiotherapy"
Studentski grad,
Sofia 1700, Bulgaria
E-mail: popova_nadia@abv.bg

ASPECTS OF PHYSIOTHERAPY AFTER NONOPERATIVE TREATMENT OF LATERAL ANKLE SPRAIN

Lyubomira Sazdova
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
Introduction: Lateral ankle sprain is a common injury and, if not treated properly, could result in chronic ankle pain and instability. Well-structured and timely applied appropriate physiotherapy program is of great importance for the purpose of good functional recovery. The study aims to outline the main aspects of physiotherapy after nonoperative treatment of lateral ankle sprain and to assess its effectiveness on the functional outcome in patients with this kind of injury. Material and methods: The study was conducted on seven patients undergoing nonoperative treatment with an acute lateral ankle sprain. Depending on the phases of the soft tissue regeneration, the physiotherapeutic program included specialized manual techniques and exercises for controlling inflammatory process, stress to collagen fibers for proper orientation along the stress lines, restoring ROM, reactivation of the fibular muscles, training of the dynamic stabilization and improvement of the muscle strength, progressive neuromuscular, proprioceptive and postural control training, as well as return to recreational and sport-specific training. The functional outcome was assessed by Foot and Ankle Disability Index, Y balance test, and One-leg stance test. Results: The results of the conducted functional tests at the latest follow-up showed statistically significant improvement in all of the studied indicators, but some deficit in proprioception and the dynamic stabilization still persists. To achieve optimal functional results, the implementation of the supervised physiotherapeutic program should continue. Conclusion: Early mobilization after lateral ankle sprain and an individualized physiotherapeutic program could reduce the deficit in proprioception, muscular imbalance and impaired neuromuscular control, and the risk of recurrent sprain.

Keywords: *ankle sprain, physiotherapy, proprioceptive training, functional outcome*

INTRODUCTION

Lateral ankle sprain (LAS) is a common injury with a high recurrence rate and if not treated properly, could result in persistent injury-associated symptoms and chronic ankle instability (CAI). According to some researches, up to 40% of patients who sustain an ankle sprain go on to develop persistent symptoms (van Rijn et al., 2008). Residual deficit in proprioception, muscular imbalance and impaired neuromuscular control at the time of initial injury may contribute to the development of CAI (Chen et al., 2019).

Treatment strategies of LAS varied depending on the severity of the trauma, and functional brace support is preferable for immobilization. Recommendations for management of the acute ankle sprain include symptom management during the acute phase, followed by a gradual program of functional rehabilitation (Lin et al., 2010).

Altomare et al. (2022) suggested that after the initial rest, the application of gentle tension could be applied to align newly growing ligament fibers into compact parallel strands correctly. To counteract the tissue's tendency to contract after trauma, prevent re-injury, and realign newly forming collagen fibers in the ligament, range of motion (ROM), isometric and isotonic exercises could be included.

The positive effect of manual therapy after acute and subacute LAS has been shown in numerous studies and the main effects of manual mobilization techniques and Mulligan MWMs are improved ankle dorsiflexion, pain reduction, improved stride length and balance (Gogate et al., 2021; Green et al., 2001; Loudon et al., 2014; Prabhakaradoss et al., 2021).

Ankle injuries often lead to disruption of muscles and tendons with associated damage to inherent mechanoreceptors (Herb, Hertel, 2014; Röijezon et al., 2015). This alters the quality of proprioceptive information required for balance control and, if not rehabilitated properly, could impair ankle proprioception (Hertel, 2008; Munn et al., 2010; Witchalls et al., 2014; Yokoyama et al., 2008) and can subsequently result in long-term deterioration of postural and balance control, functional instability, alterations in gait and elevated risk of recurrent injury (Han et al., 2015; Punt et al., 2015). Early implementation of neuromuscular retraining in patients with LAS and CAI results in significant improvement in ankle functional outcome measures, such as Foot and Ankle Disability Index and Foot and

Ankle Ability Measure (FAAM), Star Excursion Balance Test (SEBT), and Y balance test (Grueva-Pancheva, 2021; McKeon et al., 2008; Wells et al., 2019), and reduce the prevalence of recurrent injury and functional instability (Postle et al., 2012; van der Wees et al., 2006; Zech et al., 2009).

The study aims to outline the main aspects of physiotherapy after nonoperative treatment of lateral ankle sprain and to assess the effectiveness of a specialized physiotherapy program on functional outcomes in patients with this kind of injury.

MATERIAL AND METHODS

Seven patients with grade II LAS undergoing nonoperative treatment were included in the study. The mean age of the participants was 26.7 (range 21-45), 2 male and 5 female. All participants are actively engaged in recreational or non-professional sports activities. *Inclusion criteria*: unilateral LAS, treatment with functional immobilization, no history of previous ankle sprains. *Exclusion criteria:* grade III LAS, previous ankle sprain, fractures, systematic diseases, neurological diseases, or any other impairments of the affected lower extremity (history of ACL reconstruction). Patients started treatment an average of 5.2 days following injury (range 3-7 days). They were treated for an average of 12 weeks with a specialized physiotherapy (PT) program, individualized according to the patient's functional limitations. All patients gave informed consent to participate in the study.

To evaluate the effect of the applied PT program and patients' functional outcomes were used: Foot and Ankle Disability Index (FADI), One-leg stance (OLS) test, and Y balance test (YBT).
To assess the complex function, FADI was used. FADI is a reliable and valid region-specific self-report of function, which consists of 26 items – 4 pain-related (scored from 0 - none to 4 - unbearable) and 22 activity-related (scored from 0 – unable to do to 4 - no difficulty at all). The FADI has a total point value of 104 points.

To assess the static balance performance One-leg stance (OLS) test was used, where the participants were instructed to stand on the injured leg with eyes closed and hands resting at the waist level. OLS duration was measured in seconds.
The Y-balance test (YBT) was used to assess the lower extremity proprioception and dynamic balance. While maintaining a single leg stance on the affected leg, the subject was asked to reach with the free limb in the anterior, posteromedial, and posterolateral directions in relation to the stance foot. The greatest reach distance (cm) of the three trials for each direction was used to analyze the reach distance in each direction.

All patients were tested prior to start PT on the 1st, 2^{nd,} and 3rd post-treatment months. The OLS test and YBT were not performed at baseline in order to limit the stress on the injured ankle. Therefore they were performed at 4th, 8^{th,} and 12th weeks follow-ups. Means and standard deviations were calculated for each of the investigated indicators. A dependent-sample *t*-test was used to determine if there was a difference between pre-training and post-training results, and the significance level was considered at $\alpha<.05$.

In the acute phase, the PT focused on protecting the injured tissue and controlling the inflammation. To avoid the stress of the healing tissues, pain-free protected range of motion (ROM) exercises were initiated while avoiding movements into direction of the injuring mechanism (plantar flexion with inversion). Studies on anterior talofibular ligament (ATFL) strain have found that ATFL become taut when the ankle is placed into inversion, 12° plantarflexion, and 25° of internal rotation (Wiebking et al., 2015). Because during the proliferative phase after ligaments injury, which lasts for weeks, the ligaments remains mechanically weak and subject to reinjury (Cottrell et al., 2016), strain on ATFL and painful and forceful movements during this phase were avoided. Early supervised and protected stress to the collagen fibers for proper fiber orientation along the specific lines of stress was applied from week 3 with gentle to moderate pain-free inversion movements in various positions of plantar and dorsal flexion.

To maintain and restore ROM Mulligan's MWMs and manual joint mobilization techniques according to the patients' tolerance for talocrural, distal tibiofibular, and subtalar joints were included. If there were limited and symptom producing movements, mobilization of mediotarsal, tarsometatarsal, and proximal tibiofibular joints were also applied.
Once pain and swelling were controlled, and pain-free ROM was achieved, the patients progressed to the strengthening phase of rehabilitation. Exercises were focused on reactivation and strengthening of

the fibular muscles. Strengthening began with isometric exercises against manual and Theraband resistance (so that pain of uncontrolled movements is avoided) and progressed to isotonic training in a pain-free arc. To develop strength and neuromuscular control so that the ankle is better controlled and protected, all ankle muscles were trained, and exercises were performed with an emphasis on the eccentric phase.

The main accent of our PT program was focused on regaining balance, proprioception, and functional activity training. Proprioceptive training started as soon as the patients tolerated after injury, from non-weight bearing position, with exercises for kinesthetic (joint position) sense. To activate postural mechanisms, exercises on soft and unstable surfaces (such as stability Theraband trainers, balance air pads, and balance boards) were used. The progression in balance exercises was to move from a non-weight bearing to weight bearing position, from bilateral to unilateral stance on the affected limb (as soon as patients tolerate). The participants were challenged by adding trunk perturbations from the physician and with Therabands, incorporating head and upper and lower extremities movements, as well as Theraband resistance exercises performed on unstable surfaces. The balance training exercises progressed by incorporating functional activities and sports-specific tasks – forward and lateral lunges, mini squats, steps up/down, and walking. All exercises were performed on soft or unstable surfaces with both affected and unaffected lower limbs.

RESULTS

The statistical results of FADI are presented in Table 1. At the initial assessment, most of the patients demonstrated moderate self-reported disability, with mean activity score of 48.14 (range 44-52) and mean pain score of 9.43 (range 8-11). The total FADI score was 57.57 (range 53-63). The rapid change in self-reported function, especially pain, was observed in the first 4 weeks. The results showed statistically significant improvement (α<.001) of total FADI score (mean 74.86, range 70-79), and those clinically meaningful improvements persisted at 2nd month (mean 89.86, range 86-94) and last (3rd month) post-intervention follow up (mean 100.14, range 97-102).

Table 1. *Statistical results of FADI.*

FADI Affected lower limb	**Start**		**4 week**		ΔX	t	α
	$\bar{x}$	S	$\bar{x}$	S			
	57.57	3.64	74.86	3.34	17.28	9.25	α<.001
	4 week		**8 week**		ΔX	t	α
	$\bar{x}$	S	$\bar{x}$	S			
	74.86	3.34	89.86	2.79	15	9.12	α<.001
	8 week		**12 week**		ΔX	t	α
	$\bar{x}$	S	$\bar{x}$	S			
	89.96	2.79	100.14	1.95	10.28	7.98	α<.001

Legend: $\bar{x}$ - mean value in sec.; *S* – standard deviation; Δ*X* – mean difference; *t* – Student's t-test ; α- significance level.

Baseline OLS and YBT measures were first assessed at the 1st month after the start of PT. Results of the initial examination of OLS test showed 10.57 sec. mean score for the injured lower limb, and after 4 weeks of exercising improved to 15.43 sec. The mean result at the final follow-up (3th month) was 20.42 sec., which indicates a statistically significant improvement (α<.001) (Table 2).

Table 2. *Statistical results of One Leg Stance Test.*

OLS Affected lower limb	**4 week**		**8 week**		*ΔX*	*t*	α
	$\bar{x}$	*S*	$\bar{x}$	*S*			
	10.58	2.07	15.43	2.22	4.86	4.22	α<.01
	8 week		**12 week**		*ΔX*	*t*	α
	$\bar{x}$	*S*	$\bar{x}$	*S*			
	15.43	2.22	20.42	1.99	5	4.43	α<.001

Legend: $\bar{x}$ - mean value in sec.; *S* – standard deviation; Δ*X* – mean difference; *t* – Student's t-test ; α – significance level.

Analysis of the change of reach direction of YBT also revealed a statistically significant difference between pre-training and post-training results. Initial data for the affected lower limb showed a mean 50.86 cm anterior (A), 63.57 cm posteromedial (PM), and 60.64 cm. posterolateral (PL) reach. After four weeks of proprioceptive training A reach improved to 55 cm, PM to 67.28 cm, and PL to 64.42 cm (Table 3).

Table 3. *Statistical results of Y-Balance test*

YBT Reach distance	4 week		8 week		ΔX	t	α
	$\bar{x}$	S	$\bar{x}$	S			
Anterior	50.86	3.10	55	2.72	4.14	2.65	α<.05
Posteromedial	63.57	2.86	67.28	3.02	3.71	2.36	α<.05
Posterolateral	60.64	3.21	64.42	3.10	3.78	2.24	α<.05
Reach distance	**8 week**		**12 week**		ΔX	t	α
	$\bar{x}$	S	$\bar{x}$	S			
Anterior	55	2.72	58.71	3.19	3.71	2.34	α<.05
Posteromedial	67.28	3.02	71.43	3.27	4.14	2.46	α<.05
Posterolateral	64.42	3.10	68.14	3.13	3.71	2.23	α<.05

Legend: $\bar{x}$ - mean value in cm; *S* – standard deviation; Δ*X* – mean difference; *t* – Student's t-test ; α – significance level.

Statistically significant improvement (α<.05) in all three directions was seen also at the 3rd month follow-up, where measurements of the mean A, PM, and PL reaches were 58.71cm., 71.43 cm. and 68.14 cm. respectively.

DISCUSSION

The initial results of FADI showed a significant restriction of self-reported function in our patients, as well as significant pain. Four weeks after the start of PT a statistically meaningful improvement in FADI score was found, mainly associated with decreasing of pain, which in turn expands the functional abilities of the patients. The statistically reliable improvement of the results continued in the next control examinations and at the last follow-up (12 weeks) was found close to the maximum result. The minimal limitation is mostly associated with still limited abilities of the patients to participate in sports and recreational activities. The results of our research are comparable with those in a study of McKeon et al. (2008), where was found that 4-week balance training leads to a significant improvement in the self-reported function (assessed by FADI) in patients with CAI, compared with their pretest measures, and to significantly greater results than the control group posttest measures. Similar findings in self-reported function in patients with acute grade II LAS were also found in the research of Wells et al. (2019), where at the intake all patients showed moderate self-reported disability (mean 63% based on FAAM), but demonstrated clinically meaningful improvement and at the 12 weeks follow up they reached 99% functional recovery.

The results of our research confirm the statement that postural impairments are present in patients with LAS, so the main accent of our PT program was proprioceptive and balance control training. In a systematic review, Wikstrom EA et al. (2010) found strong evidence that balance is bilaterally impaired after an acute LAS, so authors suggested that the uninvolved limb should not be used as a reference for "normal balance" and patients with LAS should undergo balance training on both limbs. That's why our patients performed all exercises with both affected and unaffected lower limb, but we analyzed only the results of the injured lower limb. The initial assessment of OLS and YBT showed in general diminished static and dynamic postural control, which is mostly associated with damaged mechanoreceptors during the initial trauma, the feeling of instability, and presence of pain in some of the patients. After 8 weeks proprioceptive training a statistically significant improvement was found in both static and dynamic postural control, greater in OLS, but still away from the results compared with healthy subjects, found in our previous study (Sazdova, 2019). In her research Grueva-Pancheva (2021) showed similar results while patients with

CAI perform Stork test with eyes closed. After 8 weeks of proprioceptive training, they improved their static balance abilities.

Statistically significant improvement was also found in the dynamic balance assessment of our patients, confirmed by the improvement of all three reach distances of YBT. The results showed that the most difficult task for our patients was the anterior reach, with the least distance reached. Posteromedial reach was the easiest for our patients, and according to study of Hertel et al. (2006) the PM component of the SEBT is highly representative of the performance of all 8 directions of the SEBT in subjects with and without CAI. In their study Wells et al. (2019) found that mean anterior reach on the injured ankle in patients with acute LAS was significantly less compared to the uninjured ankle at 4-week assessment (48,5 cm. and 55,1 cm. respectively), but at 8- and 12-weeks measurements the mean anterior reach have been within normal limits. Similar to our results were found in a research of Grueva-Pancheva (2021), where after 8 weeks proprioceptive training statistically significant improvement in all 8 directions of the SEBT were established. In their study McKeon et al. (2008) also found that 4 weeks balance training subjects with CAI showed statistically significant improvement in PM and PL reach distances of SEBT, compared to no balance training controls, but there was no significant change in the anterior reach between pre- and post-training measures of the experimental group.

CONCLUSION

The results of our study suggested that early mobilization after LAS and individualized PT program could reduce the deficit in proprioception and impaired neuromuscular control, and the risk of recurrent sprain. In order to achieve optimal functional results the implementation of a supervised PT program should continue until the deficit in ankle joint stabilization, proprioception and function is overwhelmed. A treatment approach should be designed according to the patients' functional limitations and their needs and expectations to return to daily functional, and recreational and sport activities.

REFERENCES

Altomare, D., Fusco, G., Bertolino, E., Ranieri, R., Sconza, C., Lipina, M., Kon, E., Marcacci, M., Bianchini, L., Di Matteo, B. (2022). Evidence-based treatment choices for acute lateral ankle sprain: a comprehensive systematic review. *Eur Rev Med Pharmacol Sci.* Mar; 26 (6), pp. 1876-1884. doi: 10.26355/eurrev_202203_28333. PMID: 35363336

Chen, E.T., Borg-Stein, J., McInnis, K.C. (2019). Ankle Sprains: Evaluation, Rehabilitation, and Prevention. *Curr Sports Med Rep*. Jun; 18 (6), pp. 217-223. doi: 10.1249/JSR.0000000000000603. Erratum in: Curr Sports Med Rep. Aug;18(8), pp. 310. PMID: 31385837

Cottrell, J.A., Turner, J.C., Arinzeh, T.L., O'Connor, J.P. (2016). The Biology of Bone and Ligament Healing. *Foot Ankle Clin.* Dec; 21(4), pp. 739-761. doi: 10.1016/j.fcl.2016.07.017. PMID: 27871408.

Gogate, N., Satpute, K., Hall, T. (2021) The effectiveness of mobilization with movement on pain, balance and function following acute and sub acute inversion ankle sprain - A randomized, placebo controlled trial. *Phys Ther Sport*. Mar;48, pp. 91-100. doi: 10.1016/j.ptsp.2020.12.016. Epub 2020 Dec 23. PMID: 33401232.

Green, T., Refshauge, K., Crosbie, J., Adams, R. (2001) A randomized controlled trial of a passive accessory joint mobilization on acute ankle inversion sprains. *Phys Ther*; 81, pp. 984–94. PMID: 11276181.

Grueva-Pancheva, T. (2021). Effect of proprioceptive training on postural balance in patients with chronic ankle instability. *Journal of Physical Education and Sport*, 21 (1), pp. 3 - 11, online © JPES DOI: 10.7752/jpes.2021.01001

Han, J., Anson, J., Waddington, G., Adams, R., Liu, Y. (2015). The Role of Ankle Proprioception for Balance Control in relation to Sports Performance and Injury. *Biomed Res Int*. 2015:842804. doi: 10.1155/2015/842804. Epub 2015 Oct 25. PMID: 26583139; PMCID: PMC4637080.

Herb, C. C., Hertel, J. (2014). Current concepts on the pathophysiology and management of recurrent ankle sprains and chronic ankle instability. *Current Physical Medicine and Rehabilitation Reports*. 2(1), pp. 25–34. doi: 10.1007/s40141-013-0041-y.

Hertel, J., Braham, R., Hale, S., Olmsted-Kramer, L. (2006). Simplifying the star excursion balance test: analyses of subjects with and without chronic ankle instability. *J Orthop Sports Phys Ther*. Mar; 36(3), pp. 131-7. doi: 10.2519/jospt.2006.36.3.131. PMID: 16596889.

Hertel, J. (2008) Sensorimotor deficits with ankle sprains and chronic ankle instability. *Clinics in Sports Medicine*. 27(3), pp. 353–370. doi: 10.1016/j.csm.2008.03.006.

Lin, C.W., Hiller, C.E., de Bie, R.A. (2010). Evidence-based treatment for ankle injuries: a clinical perspective. *J Man Manip Ther*. Mar; 1 8(1), pp. 22-8. doi: 10.1179/106698110X12595770849524. PMID: 21655420; PMCID: PMC3103112

Loudon, J.K., Reiman, M.P., Sylvain, J. (2014). The efficacy of manual joint mobilisation/manipulation in treatment of lateral ankle sprains: a systematic review. *Br. J. Sports Med*. 48, pp. 365–70. doi: 10.1136/bjsports-2013-092763. Epub 2013 Aug 26. PMID: 23980032.

McKeon, P.O., Ingersoll, C.D., Kerrigan, D.C., Saliba, E., Bennett, B.C., Hertel, J. (2008). Balance training improves function and postural control in those with chronic ankle instability. *Med Sci Sports Exerc*. Oct;40(10), pp. 1810-9. doi: 10.1249/MSS.0b013e31817e0f92. PMID: 18799992.

Munn, J., Sullivan, S. J., Schneiders, A. G. (2010). Evidence of sensorimotor deficits in functional ankle instability: a systematic review with meta-analysis. *Journal of Science and Medicine in Sport*. 13(1):2–12. doi: 10.1016/j.jsams.2009.03.004.

Postle, K., Pak, D., Smith, T.O. (2012). Effectiveness of proprioceptive exercises for ankle ligament injury in adults: a systematic literature and meta-analysis. *Man. Ther*. 17, pp. 285–91. doi: 10.1016/j.math.2012.02.016. Epub 2012 Mar 27. PMID: 22459604.

Prabhakaradoss, D., Sreejesh, M. S., Mohamed, S. H., Subbarayalu, A. V., & Prabaharan, S. (2021). Effect of manual therapy and conventional physiotherapy on pain, movement, and function following acute and sub-acute lateral ankle sprain: A randomized clinical trial. *International Journal of Sport, Exercise and Health Research*, *5*(2), 76–82. https://doi.org/10.31254/sportmed.5210

Punt, I.M., Ziltener, J.L., Laidet, M., et al. (2015) Gait and physical impairments in patients with acute ankle sprains who did not receive physical therapy. PM R. 7, pp. 34–41. doi: 10.1016/j.pmrj.2014.06.014. Epub 2014 Jul 1. PMID: 24998405.

Röijezon, U., Clark, N. C., Treleaven, J. (2015). Proprioception in musculoskeletal rehabilitation. Part 1: basic science and principles of assessment and clinical interventions. *Manual Therapy*. 20(3), pp. 368–377. doi: 10.1016/j.math.2015.01.008.

Sadova, L. (2019). Effect of proprioceptive training exercises on balance in healthy subjects. *Congress Proceeding Book ICASS*, pp.543-546. ISBN 978-954-718-601-9.

van der Wees, P.J., Lenssen, A.F., Hendriks, E.J., et al. (2006). Effectiveness of exercise therapy and manual mobilisation in ankle sprain and functional instability: a systematic review. *Aust. J. Physiother*. 52, pp. 27–37. doi: 10.1016/s0004-9514(06)70059-9. PMID: 16515420.

van Rijn, R.M., van Os, A.G., Bernsen, R.M., et al. (2008). What is the clinical course of acute ankle sprains? A systematic literature review. *Am. J. Med*. 121, pp. 324–331. doi: 10.1016/j.amjmed.2007.11.018. PMID: 18374692.

Wells, B., Allen, C., Deyle, G., Croy, T. (2019). Management of acute grade II lateral ankle sprains with an emphasis on ligament protection: a descriptive case series. *Int J Sports Phys Ther*. Jun;14(3), pp. 445-458. doi: 10.26603/ijspt20190445. PMID: 31681503; PMCID: PMC6816301.

Wiebking, U., Pacha, T.O., Jagodzinski, M. (2015). An accuracy evaluation of clinical, arthrometric, and stress-sonographic acute ankle instability examinations. *Foot and ankle surgery*:official journal of the European Society of Foot and Ankle Surgeons. 21(1), pp.42-48.

Wikstrom, E.A., Naik, S., Lodha, N., Cauraugh, J.H. (2010). Bilateral balance impairments after lateral ankle trauma: a systematic review and meta-analysis. *Gait Posture*. Apr;31(4), pp.407-14. doi: 10.1016/j.gaitpost.2010.02.004. Epub 2010 Mar 19. PMID: 20303759.

Witchalls, J. B., Waddington, G., Adams, R., Blanch, P. (2014). Chronic ankle instability affects learning rate during repeated proprioception testing. *Physical Therapy in Sport*. 15(2), pp. 106–111. doi: 10.1016/j.ptsp.2013.04.002.

Yokoyama, S., Matsusaka, N., Gamada, K., Ozaki, M., Shindo, H. (2008). Position-specific deficit of joint position sense in ankles with chronic functional instability. *Journal of Sports Science and Medicine*. 7(4), pp. 480–485. PMID: 24149954; PMCID: PMC3761917.

Zech, A., Hübscher, M., Vogt, L., et al. (2009). Neuromuscular training for rehabilitation of sports injuries: a systematic review. *Med. Sci. Sports Exerc*. 41, pp. 1831–41. e3181a3cf0d. PMID: 19727032.

Correspondence address:
Lyubomira Sazdova, PhD
Department of "Theory and Methods of kinesitherapy"
National Sports Academy "Vassil Levski"
Gurgulyat 1 Str.
Sofia 1000, Bulgaria
E-mail: l_sazdova@abv.bg

SCAPULOTHORACIC DYSKINESIA - ETIOLOGY, FUNCTIONAL STUDY AND GUIDELINES FOR PHYSIOTHERAPY

Daniela Popova[1], Mariela Filipova[2] & David Kantchev[1]
[1] Medical University, Faculty of Public Health, Department Physiotherapy
[2] SWU "Neofit Rilski", Faculty of Public Health, Health Care and Sport, Department of Physiotherapy

ABSTRACT
Introduction. In recent years, the attention of orthopedists and physiotherapists involved in the rehabilitation of upper limbs has often focused on the evaluation and overcoming of scapulothoracic dyskinesias observed in shoulder pathologies, which is a key point in restoring the complex function of the shoulder.
Purpose of the report. To present the causes of changes in the movement of the scapulae or anomalies in their position, defined by the scientific community as "scapulo-thoracic dyskinesia" and methods of functional research, as well as guidelines for overcoming with physiotherapy.
Material and methods. An object of the study were 27 patients, aged 45 to 55 years old, with rotator cuff pathologies treated conservatively. Scapulothoracic dyskinesia was found in all of them. The patients were divided into 2 groups - control and experimental, in which the author's methodology for physiotherapy was applied for 6 weeks. We applied: tests for the stabilizer muscles of the scapula, manual muscle testing, and goniometry.
Results and discussion. The results show that reducing scapulothoracic dyskinesia significantly reduces pain and improves joint mobility and complex function of the shoulder girdle. In the frontal plane, we found an increase in abduction of an average of 43±5.61 ° in the experimental group. In MMT of the scapular stabilizers, an average increase in muscle strength of about one unit was found.
Conclusion. The full restoration of the function of the shoulder girdle is impossible without a correct concept of the restoration of the kinematics of the scapulo-thoracic joint. Restoration of physiological kinematics of the scapulothoracic joint provides reliable prevention for subsequent rotator cuff pathologies.

Keywords: *scapulo-thoracic dyskinesia, shoulder girdle, functional examination, physiotherapy/kinesitherapy*

INTRODUCTION

In recent years, the attention of orthopedists and physical therapists involved in shoulder rehabilitation has often focused on the evaluation of scapulothoracic dyskinesias seen in various shoulder pathologies. Our observations indicate that often in our practice, both the diagnosis and the means to overcome the scapulo-thoracic dyskinesias are neglected, which leads to the impossibility of restoring the full mobility of the glenohumeral joint and the complex function of the upper limb. Especially harmful is the loss of ability to partake in daily activities. (Nikolova, 2022). All this directed our attention to this problem, in search of suitable means to overcome it. The main function of the shoulder is to position the hand in the space for carrying out the daily needs of a person's life. The coordinated movements between the joints that make up the shoulder complex, as well as the interaction between the muscles of the rotator cuff and the stabilizers of the scapula, are essential. In general, of the total 60° of upward rotation of the scapula, 30° is accomplished by elevation of the clavicle at the sternoclavicular joint, and the remaining 30° by upward rotation at the acromioclavicular joint. (Popov, 2009). Effective elevation of the upper extremity requires at least 45-60° rotation of the scapula as well as 30-40° elevation of the clavicle. According to Panagiotopoulos, and Crowther (2019), the scapula fulfills four biomechanical roles: it is the center of rotation of the humerus, it anchors it to the chest wall, it provides prevention of the acromion in terms of impeding the movement of the humerus in flexion and abduction, and last but not least, it is the means by which forces are transmitted from the center to the periphery of the shoulder. Synchronous movement between the clavicle, scapula, and humerus was defined as scapulo-humeral rhythm as early as 1944 by Inmann. The ratio of the arm to scapula mobility is variable in different sectors of arm elevation, but a 2:1 ratio is generally accepted. (Popov, 2009). More recent studies prove that this ratio varies significantly and is different: in flexion-1,1:1, abduction-2:1 and scaption-1,6:1.

We associate the term scapulothoracic dyskine-

sia (SD) with changes in the natural movement of the scapula along the homolateral joint surface. Scapular dyskinesia, or abnormal dynamic scapular control, is a condition usually associated with shoulder pathology, but it also occurs in people who are free of pathology and clinical symptoms. Scapulothoracic dyskinesia occurs when there is a noticeable disturbance in the typical position and movement of the scapula, which can lead to atypical and inefficient movements of the shoulder and arm (Jildeh et al., 2021). Indeed, it can be detected in asymptomatic subjects or in patients with shoulder girdle pain (Silva et al, 2010). There is currently no reliable clinical objective method for establishing this condition. The research being done on the subject varies depending on whether it is a cause or a symptom of shoulder pathology. It is believed to be a risk factor and predictor of various types of shoulder injuries. Clinical identification focuses on visual observation and exploration maneuvers. Treatment of the pathological component (scapular dyskinesia of the scapula) has been shown to improve movement kinematics in the shoulder region (Burn et al., 2016). Another team of authors conducted a study to establish scapular dyskinesia after the application of the Latarjet procedure or a modified iliac crest bone graft transfer (ICBGT) procedure - (J-bone graft). The author team used a research protocol and recorded the results with the following tests: Western Ontario Instability Index, the Rowe Score, and the Subjective Shoulder Value. The scapulothoracic position was studied according to the dyskinesis "yes/no method". In the scientific study, scapular dyskinesia was found in 5 (of 20 patients) undergoing the Latarjet procedure. The conclusion given by the authors is that dyskinesia may be related to the separation of m. pectoralis minor and the change of the vector and working arm of action of m.coracobrachialis and the short head of the biceps (Carbone et al., 2016). A team of scientists also conducted a literature review (systematic review) of all twelve publications related to scapulothoracic dyskinesia through the PubMed database, searching for studies published before October 2014. Studies that did not include data on the prevalence of scapular dyskinesia were excluded from the review. The methodological quality of the study was assessed using the modified Coleman method score. By means of descriptive statistics, the data were compared and the presence of scapular dyskinesia was found in athletes in which there is an extension of the upper limbs above the level of the head - 61 % Burn et al., (2016). Another team of authors conducted a double-blind, randomized clinical trial of 46 patients with mechanical neck pain and scapular dyskinesia. Patients were randomly assigned to a scapulothoracic mobilization and physiotherapy group and a physiotherapy treatment-only group. In both groups, 5 sessions per treatment were applied, for 1 week. In this study, the research methods included – an assessment of pain intensity and grip strength, performed 3 times: at baseline, after the first session, and after the fifth session. In addition, functional impairment of the upper limbs and neck (assessed before and during the fifth session) was examined. The results showed that pain intensity was reduced and grip strength increased significantly after the first session (P = .01) and at the end of the treatment (P = .01) in the first group, compared to the group that received only physical therapy procedure (Shirzadi et al., 2019). Camargo PR and colleagues (2019) describe in a paper the anatomy, kinesiology, and pathokinesiology of the m. trapezius, as well as exercises that are selectively aimed at activating the different parts of this complex muscle. The study was conducted to develop exercises that optimize the position and rhythm of the scapula, which in turn, reduce pain and increase active movements in the shoulder complex. This publication provides an opportunity to clarify the anatomical structure and kinesiology of the trapezius muscle, with the primary intention of understanding how this muscle contributes to the normal mechanics of the scapula as well as the entire shoulder complex. Additionally, it allows the therapist to be guided to include exercises that specifically target different parts of the muscle and this can be a kinesiological consideration for targeting additional activation of the scapulothoracic muscles.

The purpose of this publication is to analyze the causes of the disorders of the normal kinematics of the scapula and to present a protocol for research and physiotherapy in patients with scapulothoracic dyskinesia, which minimizes errors in the preparation of precise physiotherapeutic methodology. Simultaneously, we will follow up on the initial, short-term results of our applied analytic physiotherapy program in patients with such problems.

MATERIAL AND METHODS

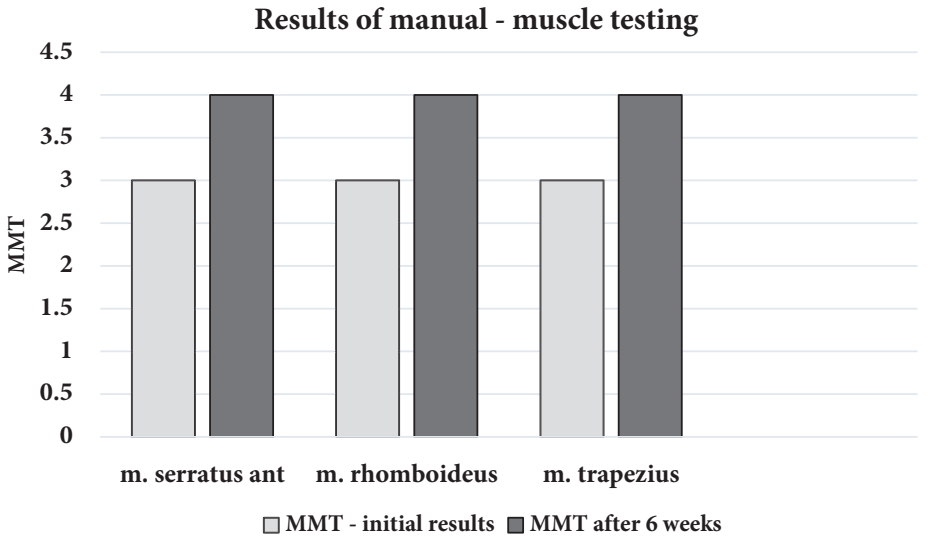
For the period 2017-2022 in the Department of Physical Therapy and Rehabilitation at MBAL –

Blagoevgrad, and USBAL "Prof. B. Boychev" - Sofia, 27 patients aged 45 to 55 years old, with injuries in the shoulder area and rotator cuff pathologies, who prior to the experiment have been treated conservatively were observed. Scapulothoracic dyskinesia was found in all of them to varying degrees. All of the patients in the current research have been informed and signed their agreement to participate in the following experiment and informed consent. The patients are divided into 2 groups - control and experimental and included in the experimental group 15 (10 men and 5 women with an average age of 48±3.5 years) and the remaining 12 (8 men and 4 women with an average age of 49±2.6 d) were included in the control room. Six-week physiotherapy was conducted in both groups. Individuals from the experimental group were given their own physiotherapy methodology with an emphasis on the muscles that stabilize the scapula (m. serratus anterior, m. trapezius, m. rhomboideus, m. pectoralis minor), while patients from the control group received routinely applied physiological treatment in the clinical bases, including exercises in the different planes of the glenohumeral joint and exercises for the muscles of the rotator cuff. The applied proprietary methodology of physiotherapy includes: exercises for the stabilizers of the scapula through gradual and progressive application of load, performed initially without resistance. Gradually, the exercise progresses with elastic resistance on a Swedish wall, exercises with dumbbells, special exercises with a large Swiss ball, exercises in isometric mode to a wall from sitting, standing, and lying down, and exercises with a balance board. We focused on training to improve the strength of m. trapezius, m. serratus anterior and m. rhomboidei. We worked on relaxation of m. pectoralis minor. In the final phase of functional recovery, the performance of the analytical movements progresses to their performance in diagonal-spiral patterns in combined planes.

The goal of physiotherapy in both groups of patients is to restore the correct position and dynamics of the scapula, and hence the maximum functional restoration of the complex function of the upper extremity. For the purposes of the study, individuals from the groups were evaluated twice at the beginning and at the end of physiotherapy. The following were assessed: the strength of the muscles stabilizing the scapula and the range of motion in the sagittal and frontal planes at the glenohumeral joint. We also assessed the extent of the scapulothoracic dyskinesia using the following tests: Gagest test, Scapular retraction test (Scapular Retraction test), Scapular Assist Test (Scapular assistance test). Statistically sign ificant difference is reported using nonparametric statistics and also nonparametric statistics Mann-Whitney tests. A statistical package was used Prism 3.0.

RESULTS

In the present study, statistically reliable results were obtained, which allow us to claim that the application of our proposed methodology is effective. H capital pain symptoms decrease, joint mobility and muscle strength are improved, and from there the complex function on the shoulder girdle is improved (Figure 1). In the frontal plain, we found out increased abduction with an average of 43±5.61 ° in the experimental group. At MMT of the stabilizers on the scapula everything establishes an increase of the muscular strength on average with approximately one unit. There was a reduction in pain symptoms, examined by visual analog pain scale (VAS) in the experimental group - Mann-Whitney tests ($p<.0002$). In CG, a statistically reliable dependence is not established.



	m. serratus ant	m. rhomboideus	m. trapezius
MMT - initial results	3+	3-	3+
MMT after 6 weeks	4+	4-	4+

Figure 1. *Dynamics of the results of manual muscle testing of the muscles, stabilizers of the scapula*

DISCUSSION

According to a number of authors, scapulo-thoracic dyskinesia is a condition associated with pathology in the shoulder area, but also occurs in people who are free of pathology and/or with pronounced clinical symptoms (Jildeh et al., 2021; Silva et al., 2010). Physiotherapy is based on methods for reduction of muscle imbalance, muscle strength, reduction of pain symptoms, improvement of joint mobility in the shoulder complex, and normalization of the scapulo-thoracic rhythm. Practice shows that analytically selected exercises, consistent with the pathokinesiological analysis of the patient's condition, create an excellent basis for their more effective and quick recovery. We have established that in different patients, this condition exhibits variability, proceeds strictly individually and depends on a number of factors such as age, gender, initial level of motor activity, and predisposing factors. The data from our research is comparable to the results published by other authors - (Shirzadi et al., 2019; Camargo et al., 2019).

CONCLUSION

Dyskinesia of the scapula is a misunderstood state and presents a challenge for the clinician and the physiotherapist in diagnostics, as well as in the treatment of shoulder pathologies. Assessment of the presence or absence of scapulothoracic dyskinesia must be included as a part of the functional examination of patients. The full recovery of function of the shoulder complex is impossible without the right concept to tone the scapular stabilizers. The restoration of the physiological kinematics of scapulothoracic joint provides reliable prevention for subsequent pathologies on the rotator muff.

REFERENCES

Burn, M.B., McCulloch, P.C., Lintne, r D.M., Liberman, S.R., Harris, J.D. (2016). Prevalence of Scapular Dyskinesis in Overhead and Nonoverhead Athletes: A Systematic Review. *Orthop J Sports Med.* Vol. 4 no. 2 pp: 2325967115627608. Doi: 10.1177/2325967115627608. PMID: 26962539; PMCID: PMC4765819.

Camargo, P.R., Neumann, D.A. (2019). Kinesiologic considerations for targeting activation of scapulothoracic muscles - part 2: trapezius. *Braz J Phys Ther*. 2019 Nov-Dec; Vol. 23 No. 6, pp. 467-475. doi: 10.1016/j.bjpt.2019.01.011. Epub 2019 Feb 3. PMID: 30797676; PMCID: PMC6849087.

Capizzi, M.T., Ferguson, R. (2005). Loyalty trends for the twenty-first century, *Journal of Consumer Marketing*, Vol. 22 no. 2, pp. 72-80

Carbone, S, Moroder, P, Runer, A, Resch, H, Gumina, S, Hertel, R. (2016). Scapular dyskinesis after Latarjet procedure. *J Shoulder Elbow Surg*. 2016 Vol. 25 No. 3, pp. 422-427. doi: 10.1016/j.jse.2015.08.001. Epub 2015 Oct 9. PMID: 26456431.

Jildeh, T.R., Ference, D.A., Abbas, M.J., Jiang, E.X., Okoroha, K.R. (2021) Scapulothoracic Dyskinesis: A Concept

Review. *Curr Rev Musculoskelet Med*. 2021 Vol. 14 No. 3, pp. 246-254. doi: 10.1007/s12178-021-09705-8. Epub 2021 Apr 6. PMID: 33822304; PMCID: PMC8137745.

Nikolova, A. (2022). *Guide to postoperative physiotherapy by fractures in the elbow field*. Published by Central medical library by medical university, Sofia, Bulgaria. p.15., Vol.1

Panagiotopoulos, A.C., Crowther, I.M. (2019). Scapular Dyskinesia, the forgotten culprit of shoulder pain and how to rehabilitate. *SICOT J.* 2019; Vol. 5 no. 29. pp. 1-5 doi: 10.1051/ sicotj / 2019029. Epub 2019 Aug 20. PMID: 31430250; PMCID: PMC6701878.

Shirzadi, Z., Rojhani -Shirazi, Z., Hemmati, L. (2019). A Comparison Between the Effects of Scapulothoracic Mobilization Plus Physical Therapy With Physical Therapy Alone in Patients With Mechanical Neck Pain: A Randomized Clinical Trial. *J Chiropr Med.* 2018 Vol. 17 No. 4, pp. 237-243. doi: 10.1016/j.jcm.2018.04.003. Epub 2019 Jan 21. PMID: 30846916; PMCID: PMC6391228

Silva, R.T., Hartmann, L.G., Laurino, C.F., Biló, J.P. (2010). Clinical and ultrasonographic correlation between scapular dyskinesia and subacromial space measurement among junior elite tennis players. *Br J Sports Med*. 2010 Vol. 44, No. 6, pp. 407-410. doi: 10.1136/bjsm.2008.046284. Epub 2008 Apr 8. PMID: 18397969.

Corresponding author:
Daniela Popova, PT MSc PhD
Department "Physiotherapy",
Medical University - Sofia ",
Sofia, Bulgaria
E-mail: d.popova@foz.mu-sofia.bg

COMPARISON OF TWO PHYSIOTHERAPY METHODS IN PATIENTS WITH SHOULDER IMPINGEMENT

Evgeniya Dimitrova, Faton Daci
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
Introduction: Shoulder impingement syndrome is the most common diagnosis of shoulder dysfunction. Physical therapy has been found to be effective in reducing pain and disability in these patients. Methodology: The purpose of this study was to compare the effectiveness of two physical therapy interventions in the treatment of primary shoulder impingement syndrome: 1) supervised exercise only, and 2) supervised exercise with manual therapy techniques. Thirty-six subjects diagnosed with primary shoulder impingement were randomly assigned to one of these two groups. Physiotherapy protocol involved twelve treatment sessions over a 6-weeks period. Participants in the exercise-only group performed exercises focusing on strengthening the rotator cuff and scapular stabilizing musculature, stretching to decrease capsular tightness, and patient education on proper posture. Participants in the exercise with the manual therapy group received the standard exercise protocol with the addition of joint mobilization and manual muscle techniques. Main outcome measures included 24-hour pain (Visual Analogue Scale – VAS), shoulder active range of motion (AROM), and shoulder function (Shoulder Pain and Disability Index – SPADI). Results: The statistical analyses were carried out using an SPSS package. Repeated-measures analyses indicated significant decreases in pain, improved function, and increases in AROM. Univariate analyses on the change from pre- to post-treatment for each dependent variable found statistically significant differences ($\alpha \leq .05$) between the two groups. The Manual therapy group had a higher level of change from pre- to post-treatment on pain measures (VAS), SPADI, and AROM, in comparison with the Exercise therapy group. Conclusions: This study suggests that performing manual therapy techniques in combination with a supervised exercise program may result in a greater decrease in pain and improved function although studies with larger samples are needed.

Keywords: *shoulder impingement syndrome, physiotherapy.*

INTRODUCTION

Shoulder impingement syndrome (SIS) is the most common diagnosis of shoulder dysfunction (Millar et al., 2006). It is often described as shoulder pain exacerbated by overhead activities (Hawkins, Kennedy, 1980; Neer, 1983). It appears as the mechanical block, repeated compressive of the rotator cuff tendons as they pass through the subacromial space; these can result in problems with shoulder functions. Physical therapy has been found to be effective in reducing pain and disability in patients with shoulder impingement. Effective interventions include therapeutic exercises focusing on strengthening the rotator cuff and scapular stabilizing musculature (Bang, Deyle, 2000; Ludewig, Borstad, 2003; Desmeules et al., 2003; Ganchev et al., 2007; Sazdova, 2017) stretching to decrease capsular tightness (D'Hespeel, 2004), scapular taping techniques, and patient education of proper posture (Borstad, 2006). Although therapeutic exercise has been shown to be effective in treating shoulder impingement symptoms (McClure et al., 2004), very few studies, have evaluated the effectiveness of incorporating glenohumeral joint mobilizations (Bang, Deyle, 2000; Conroy, Hayes, 1998; Sole, 2003) and other manual therapy techniques.

METHODOLOGY

The purpose of this study was to compare the effectiveness of two physiotherapy interventions within the treatment of primary shoulder impingement syndrome: 1) supervised exercise only, and 2) supervised exercise with manual therapy techniques.

Thirty-six subjects diagnosed with primary shoulder impingement were randomly assigned to 1 of those two groups: control group (CG) – supervised exercise only (18 patients) and experimental group (EG) – supervised exercise with manual therapy techniques (18 patients).

Inclusion criteria, additionally to age 18-65, included superiolateral shoulder pain and two out of 4 specified objective signs and symptoms (Michener et al., 2004):

- a positive (painful) Neer impingement test
- a positive (painful) Hawkins-Kennedy impingement test
- painful limitation of active shoulder elevation (flexion, abduction, scaption)
- pain or limitation with the functional movement patterns of hand-behind-back or hand-behind-head.

Exclusion criteria included:

- adhesive capsulitis
- grade III rotator cuff tear
- calcific tendonitis confirmed by radiology
- systemic or neurological disorder
- cervical radiculopathy
- a history of shoulder surgery
- corticosteroid injection within the past month
- subjects who had received physiotherapy treatment for their shoulder within the past three months.

A recent systematic review reveals that these inclusion and exclusion criteria have been used in many clinical trials (Michener et al., 2004).
All subjects signed consent forms approved by the Department of Theory and Methods of Physiotherapy, NSA, Sofia, Bulgaria.

Physiotherapy protocol involved 12 treatment sessions over a 6-weeks period.

Participants in *CG* (the exercise-only group) performed exercises under the direct one-on-one supervision of the physiotherapist. Physiotherapy interventions include:

- pendulum exercises.
- active-assisted ROM exercises in a non-painful range, with a gentle and gradual increase of motion to tolerance.
- strengthening program for the weaken muscles (rotator cuff and scapular stabilizing musculature).
- stretching to decrease capsular and muscle tightness
- patient education on proper posture, activities of daily living (ADL), and work.

Participants in EG (the exercise + manual therapy group) received the standard exercise protocol as per CG with the addition of:

- joint mobilization techniques (glenohumeral joint anterior, posterior, and inferior glides, and long-axis distraction passive accessory motions)
- glenohumeral joint mobilization with movement (Mulligan, 1999)
- manual muscle relaxation and stretching techniques for the tighten and shorten muscles.

The grade of joint mobility and reactivity were used to determine the direction and intensity of the joint mobilization (e.g., caudal glide for full elevation, anterior glide for full external rotation with abduction, posterior glide if flexion and internal rotation were limited, lateral glide and traction, for all glenohumeral movements). Grades I and II oscillations were used for pain; grades III and IV were for stiffness. Each mobilization was applied for a total of 3 sets of 30-second mobilizations.

The treatment technique under investigation in this study was a *Mulligan MWM* for shoulder elevation through abduction. The technique involved the manual application of a sustained posterior glide of the head of the humerus while the subject actively abducted the arm to the end of the pain-free range. The therapist then applied passive overpressure. The MWM was repeated three sets of 10 repetitions during treatment.

Manual muscle relaxation and stretching techniques (Post Isometric Relaxation, Reciprocal Inhibition, Post Facilitation Stretching) were designed to increase the flexibility of the glenohumeral capsule and other soft tissues, as well as the pectoral muscles, the lower trapezius, and other tight muscles, and thoracic spine. Immediately after the manual therapy, subjects were asked to perform *four stretching exercises* in the following fixed sequence: stretching in external rotation, in flexion, followed by stretching in hand-behind the-back, and cross-body adduction. They were asked to repeat the stretches four times (30 sec stretch, with 10-sec rest between each stretch).

Participants in both groups were instructed to perform *a home exercise program* once a day, mimicking the exercises performed in the clinic. If any prescribed exercise produced lasting or significant symptoms, it was avoided or modified.

Main outcome measures included maximum pain over the preceding 24-hour period graded by a 10-point visual analog scale (VAS) scale; pain intensity with the Neer test assessed by the same 10-point VAS scale; pain intensity with the Hawkins-Kennedy test via the 10-point VAS; pain-free active ROM measured with a standard goniometer for flexion and scaption; and measurement of shoulder function assessed with the Shoulder Pain and Disability Index (SPADI). One physical therapist with ten years of clinical experience performed pre- and post-treatment assessment measurements.

RESULTS AND DISCUSSION

The statistical analyses were carried out using an SPSS package. Differences were considered statistically significant when the $p \leq .05$.

Patients' characteristics

The demographic characteristics of the patients at baseline are presented in Table 1. Chi-square analyses and univariate analyses (ANOVA) were conducted to determine whether both groups differed in their demographic characteristics and pre-treatment measures.

Table 1. *Baseline demographic characteristics*

Characteristic	EG (n=18)	CG (n=18)	Sig.
Gender, n (%)			
Male	10 (55.6)	7 (38.9)	
Female	8 (44.5)	11(61.1)	.36*
Age (years)			
Mean (SD)	47.6 (14.4)	46.1 (14.8)	
Median (min., max.)	47.6 (33, 62)	46.1 (31, 66)	.45**
Involved Shoulder, n (%) Left Right	 6 (33.3) 12 (66.7)	 4 (22.3) 14 (77.8)	 .55**
Hand Dominance	**16R, 2L**	**18R**	**.57****

*Abbreviations: R = right; L = left; * One-way ANOVA; ** Chi-square tests.*

The mean age of patients was 47.6 (14.4) for EG and 46.1 (14.8) for CG. The treatment groups appeared balanced for these characteristics, including gender, age, involved shoulder, and hand dominance.

Table 2. *Baseline pre-treatment means (sd) for the dependent variable for each group*

	EG (n=18)	CG (n=18)	Sig.
VAS pre-test	5.6 (1.3)	5.7 (1.2)	.39*
NEER pre-test	5.3 (1.1)	5.4 (1.2)	.15*
HK pre-test	4.9 (0.9)	5.3 (0.9)	1.22*
Flexion pre-test	143.3 (22.9)	145.6 (18.5)	.33*
Scaption pre-test	147.8 (14.2)	151.1 (14.9)	.63*
SPADI pre-test	65.6 (34.1)	58.7 (26.7)	.02*

*Abbreviations: VAS = visual analog scale; NEER = Neer impingement test; HK = Hawkins-Kennedy impingement test; SPADI = Shoulder Pain and Disability Index; * One-way ANOVA.*

One-way ANOVA analysis indicated no statistically significant differences between the groups on baseline pre-treatment scores. The total SPADI score at baseline was similar to the scores found in other studies investigating shoulder complaints. However, the pain sub-score was markedly higher than the value for functional restriction.

Repeated-measures ANOVAs were conducted for each dependent variable with the pre-treatment and post-treatment scores. The analyses indicated that subjects in both groups had significant decreases in pain, significant improvement in function, and significant increases in active ROM. The change from pre- to post-treatment means revealed statistically significant patterns of improvement for both groups. Hence, time, exercise, and joint mobilization appeared to influence recovery from shoulder impingement. Significant differences were found between both groups on the dependent variables (Table 3).

Table 3. *Post-treatment means (SD) for the dependent variable for each group*

	EG (n=18)	CG (n=18)	Sig. t (α)
VAS	1.3 (0.89)	2.1 (1.2)	2.19 (α ≤ .05)*
NEER	1.1 (0.68)	1.9 (1.2)	2.63 (α ≤ .05)*
HK	0.9 (0.64)	1.8 (0.9)	3.52 (α ≤ .01)*
Flexion	166.4 (9.67)	161.7 (12)	2.19 (α ≤ .05)*
Scaption	171.9 (8.25)	165.3 (8.48)	2.39 (α ≤ .05)*
SPADI	11.1 (8.49)	21.7 (17.48)	2.30 (α ≤ .05)*

*Abbreviations: VAS = visual analog scale; NEER = Neer impingement test; HK = Hawkins-Kennedy impingement test; SPADI = Shoulder Pain and Disability Index; *Repeated-measures ANOVA.*

Results suggest that the group receiving manual therapy in combination with supervised exercise had a higher level of change on all three of the pain intensity measures (VAS, Neer, and Hawkins-Kennedy) compared to the supervised exercise group. Conroy and Hayes (1998) and Bang and Deyle (2000) found statistically significant reductions in pain measures with subjects who received joint mobilizations in combination with supervised exercise compared to those receiving exercise alone; however, no control group was used in either study. Results also revealed appreciable change differences between groups in scaption and flexion AROM measurements. The group receiving manual therapy in combination with supervised exercise had a higher level of change than the exercise-only group on the SPADI function test (Table 3.). An overview of the activities chosen by the participants that are most difficult indicates that activities involving upward-directed movements are clearly the most disabled, followed by dressing. The final functional results at six weeks of follow-up were statistically verified better in patients treated by exercise and manual therapy ($\alpha \leq .05$) – excellent in 12/18 cases (66.7%), good in 4/18 cases (22.2%), acceptable in 2/18 cases (11.1%), compared to those in exercise-only group – excellent in 7/18 cases (38.9%), good in 5/18 cases (27.8%), acceptable in 5/18 cases (27.8%), and poor in 1/18 case (3.6%). The analysis of the results confirms the positive effect of the physiotherapy to decreases in pain, improved function, and increases in shoulder active range of motion.

These results confirm that therapeutic exercise can play a key role in the improvement of shoulder function in SIS patients. In addition, combining supervised exercise with manual therapy techniques is more effective than a therapeutic exercise alone for improving shoulder function. In this study, shoulder joint mobilization was applied to improve hypomobility in noncontractile tissues. Of the shoulder mobilization techniques performed in this study, anteroposterior (A-P) and inferior mobilization could increase the flexion, scaption, and abduction of the shoulder joint on which manual force was applied. Furthermore, muscle techniques and therapeutic exercise reduce the upper trapezius muscle activity and increases the lower trapezius activity. The muscle techniques can increase the lower trapezius strength by decreasing the upper trapezius muscle tone. Thus, supervised exercise and manual therapy can alter scapular kinematics, improving the upper trapezius and pectoralis major tone, shoulder ROM, and SPADI. The therapeutic exercise was used for contractile tissue flexibility (pectorals, latissimus dorsi, levator scapulae, and lower trapezius) and facilitation (dorsal extension muscles) in this study. Therefore, the mechanism by which combining supervised exercise with manual therapy improves shoulder function appears to be multifactorial. Following passive joint mobilization and active exercise, shoulder joint mobility, pectorals, latissimus dorsi, levator scapulae, lower trapezius muscle stretching, and back muscle strength may have collectively played a role in correcting the thoracic posture and scapular kinetic changes. Such results correspond to study results indicating that joint mobilization and extension exercise is more effective for shoulder function than extension exercise alone (Haider et al., 2018). Additionally, joint capsule and shoulder joint hypomobility is presented, along with muscle imbalances in SIS. Thus, this study has demonstrated the need for the correctional scapular kinematics change to improve shoulder functions in patients with SIS, as well as joint mobilization, manual muscle relaxation/stretching, and therapeutic exercises to improve the noncontractile and contractile tissues.

CONCLUSION

This study aimed to examine the effects of supervised exercise only and a combination intervention of supervised exercise with manual therapy techniques on improving shoulder function in patients with subacromial impingement. Supervised exercise is effective in reducing pain and improving shoulder function. The manual therapy, in combination with a supervised exercise program, resulted in a higher level of change from pre- to post-treatment in all functional measures compared to the supervised exercise only. Manual therapy techniques like joint mobilizations, MWM, and muscle techniques can be an important adjunct to supervised exercise in the treatment of individuals with shoulder impingement syndrome.

REFERENCES

Bang, M., Deyle, G. (2000). Comparison of supervised exercise with and without manual physical therapy for patients with shoulder impingement syndrome. *J Orthop Sports Phys Ther*, Vol. 30, pp. 126–137.

Borstad, J. (2006). Resting position variables at the shoulder: Evidence to support a posture-impairment association. *J Orthop Sports Phys Ther,* Vol. 86, pp. 549–557.

Conroy, D., Hayes, K. (1998). The effect of joint mobilization as a component of comprehensive treatment for primary shoulder impingement syndrome. *J Orthop Sports Phys Ther,* Vol. 28, pp. 3–14.

Desmeules, F., Cote, C., Fremont, P. (2003). Therapeutic exercise and orthopedic manual therapy for impingement syndrome: A systematic review. *Clin J Sport Med*, Vol.13, pp. 176–182.

D'Hespeel, C. (2004). Current concepts: Rehabilitation of patients with shoulder impingement and tight posterior capsule. *Orthop Pract,* Vol. 16, pp. 9–13.

Ganchev, D., Dinova, S., Bogdanova, V. (2007). Optimizirana i intenzificirana kineziterapevtichna metodika pri periartropatii na ramoto. *Sp. Sport i nauka,* 6, 101-105 [Ганчев, Д., Динова, С., Богданова, В. (2007). Оптимизирана и интензифицирана кинезитерапевтична методика при периартропатии на рамото. *Сп. Спорт и наука,* Бр. 6, с. 101-105].

Hawkins, R., Kennedy, J. (1980). Impingement syndrome in athletes. *Am J Sports Med*, Vol. 8, pp. 151–158.

Haider, R., Bashir, M., Adeel, M., Ijaz, M., (2018). Ayub, A. Comparison of conservative exercise therapy with and without Maitland Thoracic Manipulative therapy in patients with subacromial pain: Clinical trial. *J. Pak. Med. Assoc.,* Vol. 68, 381–387.

Hawkins, R., Abrams, J. (1987). Impingement synndrome in the absence of rotator cuff tear (stages 1 and 2). *Orthop Clin North Am,* Vol.18, pp. 373–382.

Ludewig, P., Borstad, J. (2003). Effects of a home exercise program on shoulder pain and functional status in construction workers. *Occup Environ Med,* Vol. 60, pp. 841–849.

McClure, P., Bialker, J., Neff, N., Williams, G., Karduna, A. (2004). Shoulder function and 3-dimensional kinematics in people with shoulder impingement syndrome before and after a 6-week exercise program. *Phys Ther,* Vol. 84, pp. 832-848.

Michener, L., Leggin, B. (2001). A review of self-report scales for the assessment of functional limitation and disability of the shoulder. *J Hand Ther* Vol. 14, pp. 68–76.

Michener, L., Walsworth, M., Burnet, E. (2004). Effectiveness of rehabilitation for patients with subacromial impingement syndrome: A systematic review. *J Hand Ther,* Vol. 17, pp. 152–164.

Millar, A., Jasheway, P., Eaton, W., Christensen, F. (2006). A retrospective, descriptive study of shoulder outcomes in outpatient physical therapy. *J Orthop Sports Phys Ther,* Vol. 36, pp. 403–414.

Mulligan, B. (1999). *Manual Therapy "Nags", "Snags", "Mwm" etc.* 4th ed. Wellington, NZ: Plane View Series Ltd, 1999.

Neer, C. (1983). Impingement lesions. *Clin Orthop*, Vol. 173, pp. 70–77.

Norkin, C., White, D. (2003). *Measurement of Joint Motion: A Guide to Goniometry.* 3rd ed. Philadelphia, PA: F. A. Davis.

Park, H., Yokota, A., Gill, H., El Rassi, G., McFarland, E. (2005). Diagnostic accuracy of clinical tests for the different degrees of subacromial impingement syndrome. *J Bone Joint Surg Am,* Vol. 87, pp. 1446–1455.

Sazdova, L. (2017). Closed Kinetic Chain Exercises for Training of Dynamic Stabilization in Shoulder Impingement Syndrome. International Scientific Congress "Applied Sports Sciences", 2017. *Proceeding book,* pp. 463-469.

Sole, G. (2003). A multi-structural approach to treatment of a patient with sub-acromial impingement: A case report. *J Man Manip Ther,* Vol. 11, pp. 49–55.

Valadie, A., Jobe, C., Pink, M., Ekman, E., Jobe, F. (2000). Anatomy of provocative tests for impingement syndrome of the shoulder. *J Shoulder Elbow Surg,* Vol. 9, pp. 36–46.

Williams, J., Holleman, D., Simel, D. (1995). Measuring shoulder function with the shoulder pain and disability index. *J Rheumatol* Vol. 22, pp. 727–732.

Corresponding author:
Evgeniya Dimitrova, DSc
Department of TMKT,
National Sports Academy "Vassil Levski"
Sofia, Bulgaria
E-mail: janydim@abv.bg

FUNCTIONAL ASSESSMENT ON THE PATIENTS WITH SHOULDER IMPINGEMENT

Faton Daci, Evgeniya Dimitrova
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
Introduction: The aims of our study were to identify the available functional examination tests (FET) and patient-reported outcome measures (PROM) instruments designed for subacromial impingement, to analyze and evaluate them and to develop a methodology for functional assessment of patients with shoulder impingement. Methods: A comprehensive search for all available FET and PROM and published review articles for subacromial impingement was undertaken on PubMed, PEDRO, Google Scholar, and Physiopedia up to June 2021. All full-text articles reporting evaluation, validation, surgical, and non-surgical treatment outcomes of these subacromial impingement FET and PROM were retrieved and analyzed by us, and a methodology for functional assessment of patients with subacromial impingement was developed. The methodology includes the following methods and tests: patient history, observation, palpation, examination of the movements, Visual Analogue Scale (VAS) for pain, examination of muscle balance (muscle length and tonus, isometric test, manual muscle testing), goniometry of the shoulder active range of motion (AROM), special tests (Neer test, Hawkins-Kennedy test), Shoulder Pain and Disability Index (SPADI). Results And Discussion: For a period of 1 year, we accessed 36 subjects diagnosed with primary shoulder impingement. They were randomly assigned to one of two physiotherapy groups: 1) supervised exercise only, and 2) supervised exercise with manual therapy techniques. Physiotherapy protocol involved twelve treatment sessions over a 6-weeks period. The analysis of the results confirms the positive effect of physiotherapy to decreases in pain, improved function, and increases in shoulder active range of motion. Conclusion: A methodology for functional examination of patients with subacromial impingement allows objective monitoring of the results of physiotherapy. Physiotherapy is effective in reducing pain and improving shoulder function in patients with subacromial impingement.

Keywords: *shoulder impingement syndrome, functional assessment.*

INTRODUCTION

Shoulder impingement syndrome is a common musculoskeletal complaint leading to a significant reduction in muscle strength and range of motion (ROM) of the shoulder which adversely affects the patients' quality of life (Millar et al., 2006; Hawkins, Kennedy, 1980; Neer, 1983). Physiotherapy is often the first choice of treatment. Healthcare interventions are under increasing scrutiny regarding effectiveness. Physiotherapy has been found to be effective in reducing pain and disability in patients with shoulder impingement (Bang, Deyle, 2000; Ludewig, Borstad, 2003; Desmeules et al., 2003; Ganchev et al., 2007; Sazdova, 2017; D'Hespeel, 2004; Borstad, 2006; McClure et al., 2004). Very few studies have evaluated the effectiveness of incorporating glenohumeral joint mobilizations (Bang, Deyle, 2000; Conroy, Hayes, 1998; Sole, 2003) and other manual therapy techniques. Functional examination tests (FET) and patient-reported outcome measures (PROM) have revolutionized clinical research facilitating objective interpretation and comparison across different healthcare systems.

The aims of our study were to identify the available functional examination tests and patient-reported outcome measures instruments designed for subacromial impingement, to analyze and evaluate them, and to develop a methodology for functional assessment of patients with shoulder impingement.

In this study, physiotherapy and manual therapy were applied sequentially in patients with subacromial impingement to evaluate their effects on the shoulder pain and on the function.

METHODS

A comprehensive search for all available FET and PROM and published review articles for subacromial impingement was undertaken on PubMed, PEDRO, Google Scholar, and Physiopedia up to June 2021. All full-text articles reporting evaluation, validation, surgical, and non-surgical treatment outcomes of these subacromial impingement FET and PROM were retrieved and analyzed by us, and a methodology for functional assessment of patients with subacromial impingement was developed.

The methodology includes the following methods and tests:

- Patient history (each subject filled out a demographic survey for statistical reporting of gen-

der, age, hand dominance, symptom duration, medications, and the current as well as a history of shoulder dysfunction).
- Observation and palpation (superiolateral shoulder pain).
- Examination of passive and active movements.
- Visual Analogue Scale (VAS) for pain – maximum pain over the preceding 24-hour period graded by a visual analog scale (VAS, 0-10 cm; 0 means no pain, 10 means severe pain).
- Examination of muscle balance (muscle length and tonus, isometric test, manual muscle testing).
- Goniometry – pain-free active ROM measured with a standard goniometer for flexion and scaption according to a standard procedure (Norkin, White, 2003).
- Special tests (Neer test, Hawkins-Kennedy test).

  - *The Neer impingement test* (Neer, 1983), conducted by passive forward elevation and internal rotation of the humerus with the scapula stabilized, is deemed positive if the patient reports pain, usually above 120° of shoulder elevation when the critical zone of the rotator cuff tendon is compressed against the subacromial arch (Hawkins, Abrams, 1987; Valadie et al., 2000).
  - *The Hawkins-Kennedy test* (Hawkins, Kennedy, 1980; Hawkins, Abrams, 1987) is performed by positioning the arm passively at 90° of shoulder flexion followed by the examiner forcibly internally rotating the arm—a maneuver that also directs the critical zone against the coracoacromial ligament. The sensitivity of this maneuver has also been found to be good (Park et al., 2005).

- Functional status was evaluated by using Shoulder Pain and Disability Index (SPADI) – m a self-administered shoulder-specific questionnaire including two subscales; pain and disability. The pain subscale consists of 5 items and the disability subscale consists of 8 items. Patients were asked to answer using 0-100 mm VAS for each item. The score of SPADI was ranged from 0 to 100. Higher scores indicate a high level of disability. The numerically scaled SPADI (Williams et al., 1995), has been shown to have good test-retest reliability, responsiveness, and/or validity (Michener, Leggin, 2001). Overall functional results: excellent (0 to 33 points), good (34 to 66 points), medium (67 to 100 points), and poor (101 points to 130 points).

One physical therapist with 10 years of clinical experience performed the pre- and post-treatment assessment measurements.

RESULTS AND DISCUSSION

For a period of 1 year, we accessed 36 subjects diagnosed with primary shoulder impingement. They were randomly assigned to one of two physiotherapy groups: 1) supervised exercise only, and 2) supervised exercise with manual therapy techniques.

Inclusion criteria included superiolateral shoulder pain and two out of four specified objective signs and symptoms:
- age 18-65
- a positive (painful) Neer impingement test
- a positive (painful) Hawkins-Kennedy impingement test
- painful limitation of active shoulder elevation (flexion, abduction, scaption)
- pain or limitation with the functional movement patterns of hand-behind-back or hand-behind-head.

Exclusion criteria included:
- adhesive capsulitis
- grade III rotator cuff tear
- calcific tendonitis confirmed by radiology
- systemic or neurological disorder
- cervical radiculopathy
- a history of shoulder surgery
- corticosteroid injection within the past month
- subjects who had received physiotherapy treatment for their shoulder within the past three months.

A recent systematic review reveals these inclusion and exclusion criteria have been used in many clinical trials (Michener et al., 2004).
All subjects signed consent forms approved by the Department of Theory and Methods of Physiotherapy, NSA, Sofia, Bulgaria.

Physiotherapy protocol involved twelve treatment sessions over a 6-weeks period.
Participants in *Group 1*, the exercise-only group, performed exercises under the direct one-on-one

supervision of the physiotherapist. Physiotherapy interventions include therapeutic exercises focusing on strengthening the rotator cuff and scapular stabilizing musculature, stretching to decrease capsular tightness, and patient education on proper posture.

Participants in *Group 2*, the exercise + manual therapy group, received the standard exercise protocol as per Group 1 with the addition of joint mobilization techniques, mobilization with movement (MWM), and manual muscle relaxation and stretching techniques.

Patients were instructed to perform a home exercise program once a day mimicking the exercises performed in the clinic. Patients were also educated on the etiology of shoulder impingement syndrome and the importance of proper posture, and they were instructed to modify overhead activities.

The total SPADI score *at baseline* was like the scores found in other studies investigating shoulder complaints. The pain sub-score was markedly higher than the value for functional restriction.

Repeated-measures analyses indicated that *post-treatment* subjects in both groups had significant decreases in pain, significant improvement in function, and significant increases in active ROM. The level of change from pre- to post-treatment revealed statistically significant patterns of improvement for both groups. Hence, time, exercise, and joint mobilization appeared to influence recovery from shoulder impingement. Significant differences were found between both groups on the dependent variables. Results suggest that the group receiving manual therapy in combination with supervised exercise had a higher level of change on all three of the pain intensity measures (VAS, Neer, and Hawkins-Kennedy) compared to the supervised exercise group. Conroy and Hayes (1998) and Bang and Deyle (2000) found statistically significant reductions in pain measures in subjects who received joint mobilizations in combination with supervised exercise compared to those receiving exercise alone; however, no control group was used in either study.

Results revealed appreciable change difference between groups in scaption and flexion AROM measurements.

Results also revealed that the exercise + manual therapy group had a higher level of change than the exercise-only group on the SPADI function test. The final functional results at 6 weeks follow-up were statistically verified better in patients treated by exercise + manual therapy ($p \leq 0.05$) – excellent in 12/18 cases (66.7%), good in 4/18 cases (22.2%), acceptable in 2/18 case (11.1%), compared to those in exercise-only group – excellent in 7/18 cases (38.9%), good in 5/18 cases (27.8%), acceptable in 5/18 cases (27.8%), and poor in 1/18 case (3.6%). The analysis of the results confirms the positive effect of the physiotherapy to decreases in pain, improved function, and increases in shoulder active range of motion. The outcome measures we used were valid and easy to use in daily practice.

CONCLUSION

A methodology for functional examination of patients with subacromial impingement allows objective monitoring of the results of physiotherapy. Physiotherapy is effective in reducing pain and improving shoulder function in patients with subacromial impingement.

REFERENCES

Bang, M., Deyle, G. (2000). Comparison of supervised exercise with and without manual physical therapy for patients with shoulder impingement syndrome. *J Orthop Sports Phys Ther,* Vol. 30, pp. 126–137.

Borstad, J. (2006). Resting position variables at the shoulder: Evidence to support a posture-impairment association. *J Orthop Sports Phys Ther*, Vol. 86, pp. 549–557.

Conroy, D., Hayes, K. (1998). The effect of joint mobilization as a component of comprehensive treatment for primary shoulder impingement syndrome. *J Orthop Sports Phys Ther,* Vol. 28, pp. 3–14.

Desmeules, F., Cote, C., Fremont, P. (2003). Therapeutic exercise and orthopedic manual therapy for impingement syndrome: A systematic review. *Clin J Sport Med*, Vol.13, pp. 176–182.

D'Hespeel, C. (2004). Current concepts: Rehabilitation of patients with shoulder impingement and tight posterior capsule. *Orthop Pract,* Vol. 16, pp. 9–13.

Hawkins, R., Kennedy, J. (1980). Impingement syndrome in athletes. *Am J Sports Med*, Vol. 8, pp. 151–158.

Ganchev, D., Dinova, S., Bogdanova, V. (2007). Optimizirana i intenzificirana kineziterapevtichna metodika pri periartropatii na ramoto. Sp. Sport i nauka, 6, 101-105 [Ганчев, Д., Динова, С., Богданова, В. (2007). Оптимизирана и интензифицирана кинезитерапевтична

методика при периартропатии на рамото. Сп. Спорт и наука, Бр. 6, с. 101-105].

Hawkins, R., Abrams, J. (1987). Impingement synndrome in the absence of rotator cuff tear (stages 1 and 2). *Orthop Clin North Am,* Vol.18, pp. 373–382.

Ludewig, P., Borstad, J. (2003). Effects of a home exercise program on shoulder pain and functional status in construction workers. *Occup Environ Med,* Vol. 60, pp. 841–849.

McClure, P., Bialker, J., Neff, N., Williams, G., Karduna, A. (2004). Shoulder function and 3-dimensional kinematics in people with shoulder impingement syndrome before and after a 6-week exercise program. *Phys Ther,* Vol. 84, pp. 832-848.

Michener, L., Leggin, B. (2001). A review of self-report scales for the assessment of functional limitation and disability of the shoulder. *J Hand Ther* Vol. 14, pp. 68–76.

Michener, L., Walsworth, M., Burnet, E. (2004). Effectiveness of rehabilitation for patients with subacromial impingement syndrome: A systematic review. *J Hand Ther,* Vol. 17, pp. 152–164.

Millar, A., Jasheway, P., Eaton, W., Christensen, F. (2006). A retrospective, descriptive study of shoulder outcomes in outpatient physical therapy. *J Orthop Sports Phys Ther,* Vol. 36, pp. 403–414.

Neer, C. (1983). Impingement lesions. *Clin Orthop*, Vol. 173, pp. 70–77.

Norkin, C., White, D. (2003). *Measurement of Joint Motion: A Guide to Goniometry.* 3rd ed. Philadelphia, PA: F. A. Davis.

Park, H., Yokota, A., Gill, H., El Rassi, G., McFarland, E. (2005). Diagnostic accuracy of clinical tests for the different degrees of subacromial impingement syndrome. *J Bone Joint Surg Am,* Vol. 87, pp. 1446–1455.

Sazdova, L. (2017). Closed Kinetic Chain Exercises for Training of Dynamic Stabilization in Shoulder Impingement Syndrome. International Scientific Congress "Applied Sports Sciences", 2017. *Proceeding book,* pp. 463-469.

Sole, G. (2003). A multi-structural approach to treatment of a patient with sub-acromial impingement: A case report. *J Man Manip Ther,* Vol. 11, pp. 49–55.

Valadie, A., Jobe, C., Pink, M., Ekman, E., Jobe, F. (2000). Anatomy of provocative tests for impingement syndrome of the shoulder. *J Shoulder Elbow Surg,* Vol. 9, pp. 36–46.

Williams, J., Holleman, D., Simel, D. (1995). Measuring shoulder function with the shoulder pain and disability index. *J Rheumatol* Vol. 22, pp. 727–732.

Corresponding author:
Prof. Evgeniya Dimitrova, DSc
Department of TMKT,
National Sports Academy "Vassil Levski"
Sofia, Bulgaria
Email: janydim@abv.bg

FITBALL EXERCISES AS A MEANS OF TRAINING AND PREVENTION OF POSTURAL CONTROL

Penka Mincheva-Bolgurova
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
The purpose of the study is to investigate the use of fitball exercises as a means of training the trunk muscles and stimulating postural control in children and adolescents.
Methods and methodology. Contemporary literature sources and methodologies for training the static strength endurance of the postural muscles and the possibilities for their application as part of a methodology for training to maintain good postural control were studied and analyzed.
Results. Modern research on the possibility of incorporating a variety of therapeutic tools, devices and exercises for training and control of postural muscles stimulates the interest of children and enriches the methodology of physiotherapy. The goal of postural correction is to incorporate exercises from starting positions that stimulate postural reflexes. Postural correction includes exercises that stimulate muscular endurance of the postural muscles, balance, equilibrium and coordination. Fitball exercises are also recommended as exercises that stimulate postural correction and control.
Conclusion. Fitball exercises can be included in the methodology of physiotherapy in the treatment of postural disorders. They provide variety in the complexes by creating a positive emotional stimulus during exercise. They help to improve muscular strength endurance, balance, and postural muscle equilibrium which aids in postural correction and postural control training.

Keywords: *fitball, postural disorders, static-strength endurance, prevention*

INTRODUCTION

There is a tendency to increase the number of cases with incorrect posture and impaired postural control, worldwide. Postural control and posture are determined and maintained by the coordinated action of many muscles through proprioception and balance. Good postural control leads to a stable posture of the head and body against the force of gravity and provides a ba In the long term, posture disorders lead to functional limitations and pain. They are a consequence of various factors of the modern lifestyle. These conditions are a growing public health problem is for maintaining good posture while sitting, standing and while moving. (Forssberg, 1999; Paskaleva et al, 2014, 2015; Prashar et al., 2012; Zeller, 1982).

The correct posture creates the best conditions for the activity of the entire body, ensuring the correct position and functioning of the internal organs, and for its maintenance, the least expenditure of energy is required. It is an indicator of muscle balance and coordination and harmonious physical development. The motor stereotype for posture and postural control is developed and shaped in parallel with the growth of the child and with the development of all body functions. It is formed like any motor habit and must be nurtured during the growth and development of the child in the same way as all other motor habits are developed. (Filkova, 2021)

Posture is often defined as the relative arrangement of body parts. Good posture is the state of muscular and skeletal balance that protects the body structures against injury or progressive deformity independent of the position (erect, lying, stooping, bent) in which these structures are working or resting. Under such conditions, muscles work more efficiently, and ideal positions are allocated to the thoracic and abdominal organs (Kendall et al., 1995). The therapeutic effect of exercises with Swiss balls is expressed in stimulating and increasing the contractile ability, strength and endurance of the skeletal muscles, the mobility of the joints of the limbs and the spine. Performing exercises such as sit-ups, push-ups, chest bridge on an unstable support such as the Swiss ball leads to higher electromyographic activity of the postural muscles and maintenance of balance and coordination. (Clark et al., 2003; Sundstrup et al., 2012; Moore et al., 2004; Stoichevski., 2014). Early inclusion of proprioceptive exercises and in particular Swiss ball exercises after ACL injuries shorten recovery times, impaired proprioception and neuromuscular control. (Beard et al., 1994; Grueva – Pancheva, 2018).

The importance of the postural muscles in providing adequate stability of the spine as well as their

role during various exercises is well known. Swiss balls are often used for training the muscles of the trunk. In fitness centers and rehabilitation centers, Swiss balls are often used as superior to mat exercises in terms of their ability to activate the muscles of the trunk (rectus abdominis, external obliques, internal obliques, erector spinae). Studies have shown that postural strength and endurance exercises and Swiss ball exercises can help develop a good muscular corset by activating and training these muscles, but there is a paucity of literature comparing these two techniques in children and adolescents. Therefore, there is a need to research the effect of applying various postural muscle training exercises and Swiss ball exercises on trunk stability for effective conditioning and prevention of posture and body position so that these exercises can be included in rehabilitation and preventive complexes when working with children and adolescents.

The purpose of the study is to investigate the use of fitball exercises as a means of training the trunk muscles and stimulating postural control in children and adolescents.

METHODOLOGY

Contemporary literature sources and methodologies for training the static strength endurance of the postural muscles and the possibilities for their application as part of a methodology for training to maintain good postural control were studied and analyzed.

Medical databases were searched for descriptors associated with the words: postural control, posture, balance, trauma, proprioception, Swiss/Fit balls, children and adolescents. The search was focused on articles that reflect the application of Swiss balls in various aspects. An extensive number of scientific publications presenting the application of the Fitball for improving mobility, coordination, balance, muscle strength and endurance of postural muscles as well as for pain prevention, proprioceptive training for recovery after trauma and active training were reviewed.

RESULTS

The Fitball is often included in body strengthening programs to rehabilitate after injuries and to improve conditioning performance in athletes. In a pilot study during the training process of 25 athletes who applied three different trunk muscle training programs - Swiss ball exercises for the postural muscle on a mat and those who followed their normal training program used as a control group both exercises on a mat and Fit ball exercises were found to increase muscle activity of the transversus abdominis more than the exercises which were part of the control group routine training (Srivastav, 2016).

When researching the effect of 8 swiss ball exercises (roll-out, pike, knee-up, skier, hip extension right, hip extension left, decline push-up, and sitting march right) and 2 traditional abdominal exercises (crunch and bent-knee sit-up) on activating core (lumbopelvic hip complex), musculature the authors found that the most effective exercises in activating upper and lower rectus abdominis, external and internal obliques, and latissimus dorsi muscles, while minimizing lumbar paraspinals and rectus femoris activity were the roll-out and pike exercises. (Escamilla et al., 2010).

Marshal and Murphy (2005) conducted a research to find out the effect of 4 exercises on and off a Swiss ball: inclined press-up, upper body roll-out, single-leg hold, and quadruped exercise and found that there was a significant increase in the activation of the rectus abdominus with performance of the single-leg hold and at the top of the press-up on the Swiss ball. This led to changes in the relation between the activation levels of the lumbopelvic muscles measured.

Escamilla (2016), conducted an experiment to investigate weather muscle activity would be greater in prone position exercises compared with supine and side position exercises with and without a swiss ball. Electromyography data was collected for the muscle activity of the upper and lower rectus abdominis, external and internal obliques, rectus femoris, latissimus dorsi, and lumbar paraspinals during 5 repetitions of 10 exercises.

The results showed that the upper and lower rectus abdominis activity was generally significantly greater in the crunch, bent-knee sit-up, and prone position exercises compared with side position exercises. External oblique activity was significantly greater in the prone on ball with right hip extension, side crunch on ball, and side bridge (plank) on toes compared with the prone and side bridge (plank) on knees, the crunch, or the bent-knee sit-up positions. Internal oblique activity was significantly greater

in the prone bridge (plank) on ball and prone on ball with left and right hip extension compared with the side crunch on ball and prone and side bridge (plank) on knees positions. Lumbar paraspinal activity was significantly greater in the 3 side position exercises compared with all remaining exercises. Latissimus dorsi activity was significantly greater in the prone on ball with left and right hip extension and prone bridge (plank) on ball and on toes compared with the crunch, bent-knee sit-up, and prone and side bridge (plank) on knees positions. Rectus femoris activity was significantly greater in the prone on ball with left hip extension, bent-knee sit-up, or prone bridge (plank) on toes compared with the remaining exercises. (Escamilla et al., 2016)

The research on whether the addition of a Fitball/Swiss ball to trunk bridging exercises (bridging exercises were performed on the floor as well as on the swiss ball), influences trunk muscle activity. Increased myoelectric activity in the rectus abdominis during the prone bridge and external oblique was found while the internal oblique and erector spinae were not influenced. The addition of a Swiss ball during supine bridging did not influence trunk muscle activity for any muscles studied. (Lehman et al., 2005).

Electromyographic activity of the trunk muscles during stabilization exercises using a Fitball was studied also on subjects with low back pain. The purpose of this study was to compare the electromyographic (EMG) activity of the trunk muscles during seven stabilization exercises using a Swiss ball. Bipolar surface electrodes were attached to the right side of the upper and lower rectus abdominis, the obliquus externus abdominis and the upper and lower back extensor muscles. Push-up exercise, supported with both hands on the ball and toes on the floor in prone position were found to have the highest activity of all abdominal muscles, and the exercise of lifting the swiss ball up, holding it actively between both legs with both knees flexed in supine position had the lowest activity. Lifting up of the pelvis in a bridged position exercise, supporting the head with the ball and with the feet on the floor in supine position, resulted in higher muscle activity of the back extensorc muscles than another exercise. (Mori, 2004).

Fitball/Swiss ball abdominal crunch with added elastic resistance and a crunch on an isotonic training machine lead to high activation of the abdominal muscles. Specifically, crunches on a Fitball with added elastic resistance induces high abdominal activity accompanied by low hip flexor activity, which could be beneficial for individuals with low back pain. Conversely, the lower levels of abdominal activity and higher levels of rectus femoris activity observed in the isotonic machine exercise warrant caution for individuals with lumbar pain. (Sundtrup et al. 2012; Markovska & Dimitrova, 2013).

DISCUSSION

Although there was evidence to suggest that the Swiss ball provides a training stimulus for the rectus abdominus, the relevance of this change to core stability training requires further research because the focus of stabilization training is on minimizing rectus abdominus activity. Prone position exercises are good alternatives to supine position exercises for recruiting core musculature. Side position exercises are better for oblique and lumbar paraspinal recruitment. Because high core muscle activity is associated with high spinal compressive loading, muscle activation patterns should be considered when prescribing trunk exercises to those in which high spinal compressive loading may be deleterious.

Trunk stabilization is very important for the lower back. The use of a Fitball/Swiss ball, the surface of which is labile, is becoming more popular for strengthening the trunk muscles and challenging the motor control system in trunk stabilization exercises. However, little is known about the activity of the trunk muscles during such exercises.

This may be due to the fact that performing a core exercise on an unstable surface such as a Fitball increases the muscle activity of the transversus abdominis and leads to an increase in its muscle contraction. This may also be due to an increased balance needed when on the Swiss ball or more control over the center of gravity with a limited base of support is needed, due to the reduced contact area. Performing activity on the Fitball is more vertical than on the ground, therefore requires the activation of more muscles to achieve spinal stabilization or the subjects may have been highly motivated and found the Fitball/Swiss exercises enjoyable.

Co-activation of several muscles of the body is considered necessary to achieve adequate spinal stability for the prevention and treatment of

post-traumatic and lumbar spine pain. Common exercise recommendations from health professionals include full body exercises to prevent and treat low back pain. Knowledge of the body's muscle activation levels during exercise is important in prescribing and designing exercise programs that aim to increase exercise intensity over time (progressive resistance model). Previous research has documented trunk muscle EMG during various exercises designed to train postural muscles and during functional activities. They found that the abdominal and trunk muscles not only produce torque, but also maintain the position and stability of the spine during axial rotation.

Despite the documented postural muscle activity during various Fitball/Swiss ball exercises, comparisons of muscle activity have not been made with exercise (without the presence of a Swiss ball), therefore the effect of a Swiss ball on trunk muscle activity compared to exercises on the floor needs further research.

Performing curl-ups on labile surfaces changes both the level of muscle activity and the way that the muscles coactivate to stabilize the spine and the whole body. This finding suggests a much higher demand on the motor control system, which may be desirable for specific stages in a rehabilitation program. Differences in trunk muscle activity were observed when a Swiss ball was added to abdominal muscle activation exercises, but it cannot be concluded that these differences were solely due to changes in surface stability due to the different biomechanical demands of the exercises. Future research should control exercise posture to determine how surface stability affects muscle activity.

Numerous Fitball abdominal exercises are employed for core muscle strengthening during training and rehabilitation, but there are minimal data to substantiate the ability of these exercises to recruit core muscles. It is also unknown how core muscle recruitment in many of these Swiss ball exercises compares to core muscle recruitment in traditional abdominal exercises such as the crunch and bent-knee sit-up.

CONCLUSION

From the obtained results, it can be concluded that the basic exercises performed on a Fitball can improve the stability of postural muscles, help to improve athletic performance and can be useful for the prevention of pain and trauma.

Fitball exercises can be included in the methodology of physiotherapy in the treatment of postural disorders. They provide variety in the complexes by creating a positive emotional stimulus during exercise. They help to improve muscular strength endurance, balance, and postural muscle equilibrium which aids in postural correction and postural control training.

REFERENCES

Beard D. J., Dodd, C., Trundle, H., Simpson, A. (1994). Proprioception enhancement for anterior cruciate ligament deficiency, *The journal of Bone and Joint and Joint Surgery*, Volume 76-B(4): pp. 654-659.

Clark, K. C., Holt, L., Sinyard, J. (2003). Electromyografic comparison of the upper and lower rectus abdominis during abdominal exercises, *Journal of Strength and Conditioning Research*, Volume 17(3), pp. 475-483.

Escamilla, R., Lewis, C., Bell, D., Bramblet, G., Daffron, J., Lambert, S., Rercson A., Immamura R., Paulos L., Andrews J. (2010). Core muscle activation during Swiss ball and traditional abdominal exercise. *J Orthop Sports Phys Ther*. May;Volume 40(5): pp. 265-76

Escamilla, R., Lewis, C., Pecson A., Imamura, R., Andrews, J. (2016). Muscle Activation Among Supine, Prone, and Side Position Exercises with and Without a Swiss Ball. *Sports Health*; Volume 8(4): pp. 372-9.

Filkova, S. (2021). *Savremenniyat nachin na jivot I funkcionalnite grabnachni izkrivyavaniya*., Direct services, Sofia.

Forssberg, H. (1999). Neural control of human motor development, *Curropin Neuroboi* 9:Volume 9, Issue 6, pp. 676-682.

Grueva-Pancheva, T. (2018). Dinamichen posturalen control pri pacienti sled rekonstrukciya na predna krystna vrazka – prehod kam sportna nasochenost, *Medicina i sport*, Broi 1-2: pp. 20-25

Kendall, F.P., McCreary, E., Provance, P. (1995). *Músculos provas e funções*. São Paulo: Editora Manole LTDA, pp. 453.

Lehman, G.J., Hoda, W., Oliver, S. (2005). Trunk muscle activity during bridging exercises on and off a Swiss ball. *Chriopr Man Therapy Osteopat.*13:14, available at: https://doi.org/10.1186/1746-1340-13-14

Mori, A. (2004). Electromyographic activity of selected trunk muscles during stabilization exercises using a gym ball Electromyogry. *Clin Neurophysiol.* Jan-Feb;Volume 44(1): pp. 57-64

Markovska, G.& Dimitrova, E. (2013). Kineziterapiya pri posturalni narusheniya na netrenirashti decan a vazrast 7 i 8 godini. *Sbornik s dokladi*, Sofia: NSA, str. 88-94

Marshall, P. & Murphy, B. (2005) Core stability exercises on and off a Swiss ball. *Arch Phys Med Rehabil*; 86(2): pp. 242–49.

Paskaleva, R., Milcheva, H., Mollova, K., Petrova, M., Uzunova, A. (2014). New approach in the practical training of students for prevention of spinal deformities in kindergartens – Trakya University, Stara Zagora in Turkey, Odrin– *9th International Balkan Education Science Congress. 16-18 October 2014.* pp. 959-964.

Paskaleva, R., Uzunova, A., Radev, S. (2015). Early diagnosis and prevention of spinal deformities in kindergarten. *Activities in Physical Education and Sport*, Vol. 5, No. 2, pp. 163-166.

Prashar, A., et al. (2012). Clinical and theoretical contrast of common non-septic causes of bone degeneration. *JPCC*, Volume 6(1): pp.7–9.

Srivastav, P. (2016). Swiss ball versus MAT exercises for core activation of transverse abdominis in recreational athletes. *Journal Of Clinical And Diagnostic Research*. https://doi.org/10.7860/jcdr/2016/23102.8972

Stoichevski, M. (2014). Vazmojnosti za profilaktika I korekciya na grybnachni izkrivyavaniya v chasa po fizichesko vazpitanie I sport. V. *X Studentska nauchna sesiya – 30 godini Pedagogicheski fakultet* , Velikotarnovski universitet; Sv. Sv. Kiril i Metodi, str. 25-32.

Sundstrup, E., Jacobsen, M., Anderson, C., Jay, K., Andersen, L. (2012). Swiss ball abdominal crunch with added elastic resistance is an effective alternative to training machines, *International journal of sports physical therapy*, Aug; Volume 7(4): p.372–380.

Zeller, M. (1982). Postural impairments-a disease of civilization. *Zentralbl Arbeitsmed Arbeitsschutz Prophyl Ergonomie,* Sep: Volume 32(9): pp.324–6.

Corresponding author:
Penka Mincheva-Bolgurova, PhD
Department „Theory and methods of physiotherapy "
National Sports Academy „Vassil Levski",
Sofia, Bulgaria
E-mail: minchevapepi@yahoo.com

IMPROVING AEROBIC CAPACITY AND SPINE FLEXIBILITY THROUGH ADAPTED SWIMMING EXERCISES FOR PUPILS IN PRIMARY SCHOOL

Silvia Shandurkova[1], Martin Stoychevski[2], Stefaniya Belomazheva-Dimitrova[2]

[1]National Sports Academy „Vassil Levski", Sofia, Bulgaria
[2]University of Veliko Tarnovo „St.Cyril and St.Methodius", Veliko Tarnovo, Bulgaria

ABSTRACT

Proper motor development in primary school children is the main goal of physical education. The most common medical problems for pupils are spinal deformities. Our focus was on correcting different types of spinal deformities through an adapted swimming methodology.

This paper discusses the use of specific swimming exercises to improve the aerobic capacity and spinal flexibility in order to acquire good body posture and to prevent further deformities. The contingent of the study were 21 boys and 19 girls, ages 7 - 10, with a medical diagnosis of spinal deformities, which were included in experimental and control groups, doing adapted swimming exercises from our experimental methodology and routine swimming exercises.

The research methods were functional tests for assessing the aerobic capacity – spirometry, Hirz in inhale and exhale and spinal flexibility tests – bending left, right, and forwards. They were conducted in March and September 2020. Descriptive statistics, hypothesis testing, and correlation analysis were used for data analysis.

The research results revealed that the pupils improved their chest mobility, pulmonary function, aerobic capacity, and spine flexibility. Statistically significant differences appeared between the groups in favor of the experimental methodology. The adapted swimming exercises should be used in future practice.

Keywords: *spinal deformities, swimming exercises, aerobic capacity, spinal flexibility*

INTRODUCTION

Spinal disorders are among the most common diseases among children and teenagers. Deformations are due to the increased urbanization, too fast growth and forced hypodynamia, which accompany the contemporary lifestyle (Paskaleva, 2013.) They are also serious medical and social problems that can lead to a number of complications causing pain, discomfort, impaired function of organs, and others (Popova-Dobreva et al., 2013). Almost 60% of children watching television for 1-2 hours daily complain of back pains (Zaharieva et al., 2013, 2014). Postural disorders in primary school children are often linked to a lack of awareness of their body posture (Dobreva et al., 2013). They suffer chest deformities which lead to lung and heart dysfunctions. The volume of aerobic capacity, the flexibility of the spine, and the stability of the muscles are reduced. Bad posture causes abnormal load on the body (Kendail, 1993) and this leads to the shortening of some structures and stretching of their antagonists, resulting in secondary weakness of shortened and lengthened muscles (Houglam, 2005).

Swimming is a cyclic sport that develops all the compounds of physical fitness and leads to an increased body aerobic capacity. It is defined as the sport of greatest importance for human health (Belomazheva, 2020). Already in 1938, F. Lorenz, studying the influence of different types of sports on the body, put swimming in the first place (Platonov, Popov, 1988, 1998). In kinesitherapy, swimming has a prominent therapeutic effect due to posture of the body in the water and the beneficial effects on motor skills. (Zaharieva, Dimitrova, 2020).

For these reasons, we focused on correction of spinal disorders in children in primary school during adapted swimming exercises.

The study aims to evaluate the effect of applying a complex of specific swimming exercises in the swimming lessons of 7-10-year-old children with spinal deformities and to improve their aerobic capacity and spinal stability and flexibility. The tasks of the research were:

1. To study the literature sources on the problem.
2. To develop an adapted swimming methodology with specific swimming exercises to improve

posture, aerobic capacity, spinal stability, and flexibility in primary school children.
3. To evaluate and compare the beneficial effects of the standard swimming training methodology and the adapted swimming methodology.
4. To formulate specific conclusions and recommendations for practice.

METHODS

The research methods were functional tests for assessing the aerobic capacity:

1. Spirometry, measured in millilitres with apparatus, named spirometer. The pupils undress in order to follow the mobility of the chest, then perform a number of deep inhalations and exhalations and evenly, fully exhale the inhaled air into the mouthpiece of the apparatus. The measurement should be done three times, recording the highest value.
2. Hirz in inhale and exhale – the test measures the chest circumference in centimeters when inhaling and exhaling. The difference in the circumferences characterizes the movement of the chest. This gives a general idea of the condition of the chest, the development of the chest and the back muscles, the subcutaneous fat and the development of the respiratory system.
3. Spinal flexibility tests – bending left, right and forwards, measured in centimetres. It is performed on a gymnastic bench and the aim is to touch with hands as low as possible in the respective direction without folding knees.
   The functional tests were conducted in two stages: in March and September 2020.

4. Statistical methods and analysis - descriptive statistics, normality test of Shapiro- Wilk, hypothesis testing (Student's t-tests, Man-Whitney and Wilcoxon tests), Cohens'd effect size measures and correlation analysis were used for data analysis.

The contingent of the study were 40 children, aged 7-10, from the beginners groups of the two swimming clubs in the town of Vratza. An informed consent statement for permission to include the children in the experiment was signed by their parents. The pupils were tested for spinal abnormalities and were divided into experimental and control groups. The experimental group included 20 children (11 boys and 9 girls), trained according to our adapted methodology with specific swimming exercises with a pronounced corrective effect on the spine. The control group included 20 children (10 boys and 10 girls), trained according to standard swimming methodology for beginners (Table 1).

Table 1. *Contingent of the experiment*

Group		gender		total
		girls	boys	
Experimental group	count	11	9	20
	percent	55%	45%	
Control group	count	10	10	20
	percent	50%	50%	
Total	count	21	19	40
	percent	52.5%	47.5%	100%

The experimental methodology was developed especially for the purpose of the study. It involved swimming exercises with rehabilitative effects on the body posture and the spine disorders. A large number of swimming imitative exercises, performed outside the pool and stretching exercises for neck, back and abdominal muscles were included (Figures 1 - 3 – Navaja, 2020). The main goal of the methodology was for the pupils to learn the correct swimming technique along with performing exercises that mainly strain the back and abdominal muscles. The exercises imitate the technique of crawl and backstroke styles, which train the relevant muscle groups involved in maintaining correct body posture.

Figure 1. *Stretching back muscles*

Figure 2. *Stretching lateral abdominal muscles*

Figure 3. *Stretching lateral abdominal muscles*

Figure 4. *Stretching lateral back muscles*

RESULTS

The descriptive statistics analysis displayed the average values, the minimum, and maximum values, the range, the standard deviation, the coefficients of variation, and the coefficients of normality – asymmetry and skewness for each of the functional tests in the two research stages – 1 and 2 (Table 2). The Shapiro-Wilk test for normality of the distribution was applied and non-parametric tests were used for hypothesis testing, where the distribution of values differs from normal. The variability coefficients varied between 13 and 21%, which indicates medium variations in the groups.

Table 2. *Descriptive statistics of the functional tests*

group		Descriptive Statistics								
		N	R	Xmin	Xmax	Mean	STD	V%	As	Ex
Experimental	Spirometry 1	20	1000	1000	2000	1517.5	260.200	17.1	-.374	.269
	Spirometry 2	20	1000	1100	2100	1662.5	250.723	15.1	-.047	.241
	Hirz – inhale 1	20	38	62	100	73.15	10.535	14.4	1.707*	2.239*
	Hirz – inhale 2	20	38	64	102	75.10	10.321	13.7	1.721*	2.311*
	Hirz – exhale 1	20	38	57	95	69.00	10.508	15.2	1.641*	2.030*
	Hirz – exhale 2	20	37	59	96	70.70	10.178	14.4	1.667*	2.075*
	Bending left 1	20	20	20	40	30.80	5.053	16.4	-.267	-.166
	Bending left 2	20	18	18	36	27.85	4.923	17.7	-.297	-.488
	Bending right 1	20	17	23	40	31.35	4.848	15.5	.335	-.407
	Bending right 2	20	20	20	40	28.40	5.305	18.7	.795	.215
	Bending forward 1	20	37	-27	10	-1.80	11.256	int	1.176	.028
	Bending forward 2	20	32	-19	13	2.10	8.717	int	1.060	.253
Control	Spirometry 1	20	700	1100	1800	1420.0	198.945	14.0	.273	-.917
	Spirometry 2	20	700	1200	1900	1495.0	184.177	12.3	.552	-.244
	Hirz – inhale 1	20	33	66	99	72.85	7.555	10.4	2.417*	7.115*
	Hirz – inhale 2	20	35	65	100	74.40	7.742	10.4	2.096*	5.617*
	Hirz – exhale 1	20	31	63	94	69.25	7.405	10.7	2.208*	5.829*
	Hirz – exhale 2	20	35	60	95	70.15	7.788	11.1	1.880*	4.542*
	Bending left 1	20	25	19	44	31.90	6.504	20.4	-.260	-.662
	Bending left 2	20	21	21	42	31.20	6.534	20.9	-.147	-1.081
	Bending right 1	20	29	21	50	31.85	8.273	26.0	1.058	.221
	Bending right 2	20	28	22	50	30.15	7.856	26.1	1.484	1.383
	Bending forward 1	20	31	-20	11	-1.80	9.578	int	-.555	-.804
	Bending Forward 2	20	30	-18	12	.85	8.536	int	-.958	.380

**indicates that distribution differs from normality and non-parametric tests and coefficients were used*

Correlation analysis was used to analyze the strength of association between the tests. Pearson product-moment correlation coefficient and Spearman's Rho coefficient were used for parametric and non-parametric tests respectively (Tables 3-6). The results showed that there were strong (> 0.700) and very strong (> 0.900) correlations between spirometry and Hirz in inhale and exhale – they both measured aerobic capacity in both groups and in both studies. The other significant correlations were between flexibility tests – bending left, right and forward, except in the second study of the control group, where the correlation was not significant. There was no correlation between aerobic tests and flexibility tests.

Table 3. *Correlations between functional tests, experimental group, first study*

Correlations Experimental group	Spirometry1	Hirz - inhale1	Hirz- ex. 1	Bending L1	Bending R 1	Bending F 1
Spirometry 1	1					
Hirz - inhale.1	.711**	1				
Hirz - exhale 1	.688**	.994**	1			
Bending left 1	-.387	.060	.059	1		
Bending right 1	-.506*	-.113	-.097	.679**	1	
Bending for. 1	.379	.260	.278	-.403	-.524*	1

***. Correlation is significant at 0.01 level, * Correlation is significant at 0.05 level*

Table 4. *Correlations between functional tests, control group, first study*

Correlations Control group	Spirometry 1	Hirz – in1	Hirz - ex1	Bending L 1	Bending R1	Bending F 1
Spirometry 1	1					
Hirz - inhale.1	.586**	1				
Hirz - exhale 1	.575**	.911**	1			
Bending left 1	.192	-.065	-.161	1		
Bending right 1	-.285	-.001	-.071	.254	1	
Bending for. 1	.379	.260	.278	-.403	-.524*	1

***. Correlation is significant at 0.01 level, * Correlation is significant at 0.05 level*

Table 5. *Correlations between functional tests, experimental group, second study*

Correlations Experimental group	Spirometry 2	Hirz – inhale2	Hirz - exhale 2	Bending left 2	Bending right1	Bending for. 2
Spirometry 2	1					
Hirz – inhale 2	.687**	1				
Hirz - exhale 2	.638**	.978**	1			
Bending left 2	.371	-.058	-.104	1		
Bending right 2	-.428	-.042	-.009	.509*	1	
Bending for. 2	.334	.309	.311	-.450*	-.482*	1

***. Correlation is significant at 0.01 level, * Correlation is significant at 0.05 level*

Table 6. *Correlations between functional tests, control group, second study*

Correlations Control group	Spirometry 2	Hirz – in. 2	Hirz – ex. 2	Bending L 2	Bending R1	Bending F 2
Spirometry 2	1					
Hirz – inhale 2	.606**	1				
Hirz - exhale 2	.737**	.877**	1			
Bending left 2	.151	-.008	.010	1		
Bending right 2	-.457	-.012	-.207	.373	1	
Bending for. 2	.415	.383	.471	-.076	-.189	1

***. Correlation is significant at 0.01 level, * Correlation is significant at 0.05 level*

Hypothesis testing included Student's t-tests, Cohens'd effect size measures, Man-Whitney and Wilcoxon tests for independent (Table 7) and related samples (Table 8). Table 7 displayed significant differences between experimental and control groups in the second study of spirometry (p=.021) with a medium size effect (Cohen's d = 0.720) and bending left (p=.045) with a small size effect (Cohen'd = 0.562). The differences in the other tests were not significant (p > .05).

Table 7. *Statistical differences between experimental and control group*

Functional tests	test (t ,U)	Sig (2-tailed)	Diff	Cohen's d	CI-lb	CI-ub
Spirometry 1	1.331	.191	97.500	.420	-50.767	245.767
Spirometry 2	2.408	.021*	167.500	.720	26.675	308.325
Hirz - inhale.1	.103	.918	.300	.033	-5.568	6.168
Hirz - inhale.2	.243	.810	.700	.078	-5.140	6.540
Hirz - exhale 1	-.087	.931	-.250	.028	-6.069	5.569
Hirz - exhale 2	.192	.849	.550	.061	-5.251	6.351
bending left 1	-.597	.554	-1.100	.190	-4.828	2.628
bending left 2	-1.831	.045*	-3.350	.562	-7.053	.353
bending right 1	-.233	.817	-.500	.075	-4.841	3.841
bending right 2	-.826	.414	-1.750	.262	-6.041	2.541
bending forward 1	.010	.900	.000	.000	-6.690	6.690
bending forward 2	.875	.649	1.250	.146	-4.273	6.773

**Significant diff. (p < .05), Cohen'd > 0.03 – small size effect > 0.05 – medium size effect*

Comparing the two studies significant differences were found in both experimental and control groups in all the tests, except bending left in the control group (Table 8). In both groups the pupils have improved their aerobic capacity and spine flexibility. Still, the experimental group had a bigger size effect (Cohen's d > 0.8), compared to the control group (Cohen's d > 0.5). In three of the tests (spirometry, p = .01, Hirz in exhale, p = .04, and bending left, p = .01) there were significant differences between the two groups in their profits in favor of the experimental group.

Table 8. *Statistical differences between the first and second study in the experimental and control group*

Related samples	Functional tests	test (t , Z)	Sig (2-tailed)	Diff	Cohen's d	CI-lb	CI-ub
Experimental group	Spirometry 1 -2	7.855	.000	145.500	1.76	-183.64	-106.36
	Hirz – inhale 1-2	9.233	.000	1.950	1.84	-2.39	-1.51
	Hirz - exhale 1-2	8.233	.000	1.700	2.06	-2.13	-1.27
	bending left 1-2	-6.472	.000	-2.950	1.45	2.00	3.90
	bending right 1-2	-6.314	.000	-2.950	0.41	1.97	3.93
	bending for. 1-2	5.352	.000	3.900	1.20	-5.43	-2.37
Control group	Spirometry 1 -2	4.016	.001	75.000	0.9	-114.08	-35.92
	Hirz – inhale 1-2	6.049	.000	1.550	0.62	-2.09	-1.01
	Hirz - exhale 1-2	2.781	.012	.900	1.35	-1.58	-0.22
	bending left 1-2	-1.926	.069	-.700	0.43	-0.06	1.46
	bending right 1-2	-2.950	.008	-1.700	0.66	0.49	2.91
	bending forward 2	2.001	.060	2.650	0.45	-5.42	0.12

**Significant diff. (p < 0.05), Cohen'd > 0.03 – small size effect > 0.05 – medium size effect, > 0.08 – large size effect*

DISCUSSION

Swimming exercises and trainings with children in primary school proved to be highly effective in order to correct bad posture and spinal disorders.

The experimental methodology with specific swimming exercises helped to improve the aerobic capacity, spinal stability, and flexibility. The larger size effects established in the experimental group compared to the control group led to the conclusion of greater efficiency of the experimental methodology. The functional tests spirometry, Hirz in exhale, and bending left had statistically significant differences between the two groups in favor of the experimental group.

The adapted swimming methodology had a beneficial effect on the health of primary school children and should be used in further practices.

REFERENCES

Belomazheva-Dimitrova, S. (2020). Prouchvane mnenieto na roditeli na 11-12 godishni uchenitsi otnosno

problemat grabnachni izkrivyavaniya. *Godishnik na Shumenskiya universitet „Episkop Konstantin Preslavski*, Pedagogicheski fakultet, „Episkop Konstantin Preslavski",Shumen, pp. 949-957

Houglam, P. (2005). *Therapeutic Exercise for Musculoskeletal Injuries*, Vol. 838, Human Kinetics.

Kendall, F.P., Provance, P.G., et al. (1993). *Muscles: Testing and Function*, Lippincott, Williams and Wilkins, Philadelphia

Kutincheva, P. & Dilova-Neikova, Ts. (2008). *Pluvane*. Ai and Bi, Veliko Tarnovo

Navaja, A. (2020). Massage box and therapy, available at https://alexnavajas.com/tronco, (accessed 15 August 2022).

Paskaleva, R. (2013). *Prakticheskо rakovodstvo po kineziterapiya pri sotsialnoznachimi zabolyavaniya v detska vazrast,* Eks-press, Gabrovo.

Platonov, M. & Vaitsekhovski, S. (1988). Trenirovka na visoko-kvalifitsirani pluvtsi, Meditsina i Fizkultura, Sofia.

Popov, I. (1998). Pluvane – uchebnik za studentite ot NSA. NSA – PRES, Sofiya

Popova–Dobreva, D., Gencheva, N., & Markovska G. (2013). Dinamika na razprostranenie na posturalni narusheniya i ploskostapie pri dvugodishno prosledyavane na detsa ot nachalna uchilishtna stepen. *Sbornik s dokladi ot Kineziterapiya pri grabnachni izkrivyavaniya i vrazkata im s drugi riskovi faktori za razvitieto na zabolyavaniya v detska vazrast*, Sofiya, 11th December 2013, pp. 34.

Zakharieva, D. & Angelcheva, M. (2013). Ergonomichnost na uchilishtnata sreda za nasarchavane na dobrata stoika pri 7-8 godishni detsa. *Sbornik s dokladi ot Kineziterapiya pri grabnachni izkrivyavaniya i vrŭzkata im s drugi riskovi faktori za razvitieto na zabolyavaniya v detska vazrast*, Sofiya, 11th December 2013, pp. 41.

Zakharieva, D. & Belomazheva-Dimitrova, S. (2015). Otsenkata na stoikata na detsata v minaloto i dnes. *Sbornik dokladi ot nauchna konferentsiya na tema "Evropeiski standarti v* sportnoto obrazovanie", 1st June, 2015, Vratsa, pp. 30-36.

Zakharieva, D. & Belomazheva-Dimitrova, S. (2014). Dobrata stoika pri malkite detsa. *Sbornik trudove ot Yubileina mezhdunarodna nauchna konferentsiya "30 godini Pedagogicheski fakultet"*, VTU "Sv. sv. Kiril i Metodii", 21st November, 2014, pp. 491-498.

Zakharieva, D. (2015). Metodi za otsenka na stoikata pri detsata. *Nauchni trudove na Rusenskiya universitet*, tom 54, series 8.1, pp.34

Corresponding author:
Silvia Shandurkova, PhD
"Theory of Sport" Department
National Sports Academy "Vassil Levski",
Sofia, Bulgaria
21, Acad. Stefan Mladenov, str.
E-mail: shandurkova@nsa.bg

TRADITIONAL CHINESE MASSAGE (TUINA) FOR CHRONIC NECK PAIN

Denka Marinova
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
Chronic neck pain is something common which can be hard to treat. There is limited evidence for the efficiency of different alternative therapies. This research aimed to assess the efficiency of the traditional Chinese massage on the range of motion and intensity of pain in the cervical area of the spinal column. Objects and methods: 38 patients with chronic neck pain were randomly divided into experimental and control groups. The control group performed only controlled therapeutic exercises. The patients from the experimental group were subjected to ten Chinese therapeutic massages and therapeutic exercises twice a week. The range of motion in the neck was assessed with a universal goniometer for flexion, potations, and lateral flexion. The intensity of the pain was assessed with the visual-analogical scale. At the end of the research, we found statistically significant, better results in the EG in the left rotation (58,4° ± 2°), right rotation (54,4° ± 2,1°), right lateral flexion (32,6° ± 4,7°), and left lateral flexion (37,2° ± 5,6°), with a statistical significance level (p < .05). Tracing the dynamics in the pain symptoms showed a reduction in the pain in both groups of patients, with a significant downward trend in the experimental group. Conclusion: Traditional Chinese massage alleviates pain symptoms and relaxes the increased muscle tone, which leads to an increase in the range of motion in the neck area. Compared to routine physiotherapy, the Chinese massage methods has a proven effect on the traced indicators.

Keywords: *traditional Chinese massage, neck pain, therapy*

INTRODUCTION

The neck pain syndrome is a multi-factor syndrome disease of a complex character. Chronic neck pain (CNP) can negatively influence patients' social, family, and professional environment and can affect the health system and aggravate its financial state (Kazeminasab et al., 2022). It has been determined that in a different period of life, 22% and 70% of the population experience pain in the cervical area (Milanov, 2009). The insufficient motor activity, the lack of psychological support, and the financial difficulties for adequate treatment are crucial (Cohenm, 2015).

A leading symptom among the patients is subjectively registered pain, defined as an unpleasant sensory and emotional experience (Quratulain et al., 2017). In most cases, besides the pain, there are a lot of other symptoms, such as restricted mobility and reduced muscle strength in the cervical area, muscle dysfunction, headaches, vestibular disturbances, and pain and functional disturbances in the upper limb (Liu et al., 2017). The clinical picture of chronic neck pain could result from many factors and nosologies which can appear simultaneously or consecutively, making the diagnostics and therapy rather challenging (Borenstein, 2007).

Alternative medicine, Chinese traditional medicine in particular, perceives the problem from a holistic point of view as a disrupted balance in the structural, biochemical, psycho-emotional, and energy aspects of the organism (Ivanova, 2018; Angelcheva, Petkova, 2019). It provides possibilities for etiopathogenetic treatment, while conventional therapeutic methods are guided by clinical diagnosis (Cheng, 1987). Chinese traditional massage (tuina) attracts the attention of specialists all over the world, which is why we can argue that it deserves its place among the modern methods for prophylactics and treatment (Goranova, 2018; Cheng, Huang, 2014). There are a lot of surveys on the benefit of this ancient therapy, but there are still no proven explanations for its effects in the context of Western medicine, and it is perceived as an alternative treatment system (Hui et al., 2017; Wei et al., 2017).

The aim of this study was to assess the therapeutic influence of traditional Chinese massage therapy on patients with chronic neck pain. On the basis of the research of the available literary sources, some critical analysis, and our own practical experience, we formulated the tasks of the research: to select suitable patients and tests for assessment of their functional condition according to the aim of the research; to apply in practice specialized traditional Chinese massage therapy and to compare its effect with that of the conventional physiotherapeutic treatment, to analyze the obtained results and to assess the effect of the specialized massage method.

MATERIALS AND METHODS

The research was conducted over two years (2020-2021) at the clinical facilities for practical training of kinesitherapy students – 8th diagnostic and consultancy center in Sofia. The research was done among 38 patients with CNP. The patients were randomly divided into an experimental group (EG) and a control group (CG). The experimental group included nineteen patients with a mean age of 46.65 (SD ± 11.23). This group was subjected to a ten-day course of Chinese massage therapy for the neck area and controlled therapeutic exercises. The control group also included nineteen patients with a mean age of 44.25 (SD ± 14.6) years, treated routinely with the usual methods and means of physiotherapy. They were not subjected to traditional Chinese massage therapy, unlike those from the experimental group. We purposefully excluded the patients with general contra-indications for total physical therapy, patients who had undergone surgeries of discal hernia in the cervical area, surgeries of the thyroid gland or the shoulder joint within a year prior to the research; neurological deficit of the upper limb, and an acute neck pain which was not influenced by analgesics. The common thing among all patients was their continuous work in a static position (at a desk, in front of a computer, etc.) and their motor activity reduced to minimum, a written informed agreement for participation in the research.

The aim of the therapy with both groups was a maximal reduction of the pain symptoms and a functional recovery of the neck area. The method of Chinese massage therapy includes ten procedures carried out twice a week over 5 weeks. The procedure lasts for 45-50 min and is applied along the energy channels, collaterals, and active points according to the patients' individual condition. The methodological requirements are observed, and patients' condition is monitored. This suggests a great variability during the procedures. The physiotherapeutic behavior is relevant to the characteristics of the pathological process, the degree of the damage, and the functional capacity of the neuro-muscular system. Different massage techniques are applied - Mo, Ca, Rou, and Gun. The procedure ends with passive and active movements in the neck area. The choice of a specific massage technique and dosage depends on the clinical condition, the functional limitation, and the patient's physiological response. Still, very often, different techniques are combined, and the dosage is individually chosen. The massage techniques used are performed with slight and medium pressure. The controlled therapeutic exercises with the patients from both groups include active exercises for the cervical area, breathing exercises, and active exercises for the upper limbs.

To fulfill the aims of the research, we assessed (at the beginning and the end of the treatment) the changes in the intensity of neck pain with a Visual Analog Scale (VAS). The range of motion in the neck was assessed with a universal goniometer for flexion, extension, and lateral flexion. We used an international SFTR method for measuring and recording joint movements.

RESULTS

The collected data were statistically processed with software SPSS, version 19.0. To compare the results between the two groups before and after the treatment, we performed the Student's t-test for a pair and unpaired samples. It is considered that a value smaller than 0.05 shows a statistically significant difference.

The results from the research on the subjective perception of pain with VAS are presented in Table 1 (for the patients from the control and experimental groups).

Table 1. *Changes in the intensity of pain in the experimental and control groups during the study*

Pain assessment	Group	Pre $X_1 \pm SD_1$	Post $X_2 \pm SD_2$
Visual Analog Scale	EG	6.79±1.41	3.52±1.66***
	CG	7.04±1.39	5.53±1.35
	p	0.718	0.001

*X_1, X_2 - mean values of the indexes for the two surveys; $SD_{1,2}$ – standard deviations of the indexes for the two surveys; EG – experimental group (n=26); CG – control group(n=26); ***p < .001 – significant differences in comparison to initial values determined with Student t-test for dependent and independent samples; P- significance of differences between the two groups*

The changes having taken place as a result of the conducted Chinese massage therapy to patients with CNP laid down in Table 2.

Table 2. *Changes in the average values and standard deviations of cervical range motion level measured at the beginning and the end of treatment with SFTR.*

Cervical range motion	Participants	Pre $X_1 \pm SD_1$	Post $X_2 \pm SD_2$
Left rotation	EG	36.4° ± 4.9°	58.4°±2.6°***
	CG	36.9°±°3.6	38.4°±°3.2
	p	.432	.003
Right rotation	EG	37.1° ± 1.6°	54.4°±°2.1***
	CG	37.5° ± 2.5°	38.9° ± 4.6
	p	.942	.001
Right lateral flexion	EG	23.6° ± 3.5°	32.6° ± 4.7°
	CG	23.9° ± 5.2°	25.3°± °2.5
	p	.824	.003
Left lateral flexion	EG	23.88° ± 3.6°	37.2 ± 5.6***
	CG	24.1 ± 3.7	25.3° ± 3.6°
	p	.707	.005
Flexion	EG	23.4°± °3.5	27.4° ± 6.9°
	CG	23.1° ± 3.3°	25.7° ± 5.2°
	p	.934	.426
Extension	EG	23.2° ± 6.4°	28.6° ± 3.4°
	CG	23.85°± °6.5	25.1°± °4.1
	p	.438	.502

*X_1, X_2 - mean values of the indexes for the two surveys; $SD_{1,2}$ – standard deviations of the indexes for the two surveys; ***p < .001 – significant differences in comparison to initial values determined with Student t-test for dependent and independent samples; P- significance of differences between the two groups*

DISCUSSION

The reduction of pain intensity is a main criterion for evaluating the effectiveness of applied massage therapy. The initial examination revealed the presence of severe pain in both groups. Tracking the dynamics of pain symptoms shows the presence of severe pain at the beginning of therapy, with a tendency to decrease after the start of treatment for EG. When comparing the results at the beginning and at the end of the study, a statistically significant difference in the average values of the results is established. Maximum pain intensity at baseline was 6.79 (±1.41), at the end of therapy it was 3.27±1.66 (p<.001) for EG. The mean value reached 3.38 (SD≤1.15). The presented results (Table 1) show that at the end of the treatment course, as a result of the therapy, a statistically significant reduction in neck pain was found in EG. As shown in Table 2, the observed improvement in functional scores for EG was associated with the application of massage techniques combined with therapeutic neck exercises.

The comparative assessment between the two groups in the course of the research showed a significantly better condition of the patients from the experimental group regarding the reduction in pain and the increase in functional mobility in the neck area in all directions. It is evident that traditional Chinese massage therapy positively influences CNP. The patients from the experimental group reported they felt livelier, had more power, and had weaker pain and stiffness in the cervical area.

In our opinion, traditional Chinese massage helps conduct nerve impulses along the central motor neuron, enhancing the proprioceptive central field. By applying specific massage techniques along the energy channels and active points, we can stimulate proprioception along the nerve endings, muscles, and ligaments (Zhang et al., 2015). We can reach the sensorimotor zone of the central nervous system and the cerebral cortex. Through the pyramid and extra-pyramid motor paths, the signals of the cerebral cortex reach each intervertebral segment (Roberts, 2011; Milanov, 2014).

Although the mechanisms for these positive results have not been studied enough in the scientific lit-

erature, there are a few theories. According to the theory of Weerapong et al., (2005), the muscle spasm can cause local ischemia and pain by activating the pain receptors in the muscles. It is clear that the application of techniques aimed at treating the active point (AP) and the rubbing technique are in the basis of muscle relaxation. The use of these techniques provokes relaxation reactions in the muscles and connective tissue, and the irritation of the receptors is overcome. As a result, circulation gets normal (Iliü, et al., 2012). Practice shows that the techniques tui and mo provide an analgetic effect by activating subcutaneous receptors. Once activated with massage therapy, these receptors block the signals of the pain receptors coming from the spinal column, which contributes to pain reduction and improves the psycho-emotional state (Meng, 2010). A lot of surveys have proven that Chinese massage methods are the most effective in treating diseases characterized with pain symptoms. The stimulation of the active points activates one or several mechanisms for pain control and some adaptation mechanisms with the participation of some hypothalamus-pituitary, core, subcortical, and limbic structures. It inhibits the post-capillary sphincters, which leads to an improvement in local circulation. This can explain the quick effect on pain symptoms and the positive influence on the muscles with an increased muscle tone. Another theory explains that the slight touch during the therapeutic massage temporarily enhances the existing discomfort and thus provokes a greater release of natural opiates, such as β-endorphins. This would add to the feeling of happiness and joy and would suppress pain, which in turn, would help the easiness of movements (Tsao, 2007).

Norrbrink and Lundeberg (2011) proved the efficiency of Chinese massage therapy as a means of reducing neuropathic pain in patients with spinal cord injury. In another survey with such patients, Roberts L. (2011) also found that acupressure improved the nervous conductivity of the limbs and significantly reduced pain. The good thing is that both surveys did not find any short-term or long-term negative effects. The authors believed that massage therapy decreases muscle hypertonia and improves trophic and circulation, contributing to the reduction in pain symptoms. These conclusions allow us to accept the thesis that Chinese therapeutic massage has its place in pain reduction in CNP. An important aspect of massage for pain relief is a reduction in muscle tension, which in turn leads to improved movement (Tao et al., 2015; Wei et al., 2017), but it should always be kept in mind that for in some patients, increased muscle tone in the neck area compensates for the muscle weakness so characteristic of a herniated disc.

Supportive to our reasoning are the conclusions made by Cook et al. (2015), who also emphasized the leading role of therapeutic massage for relaxation and decreased stress. If we look at the conclusions mentioned above in detail, we will sum up that Chinese massage therapy is a means which effectively influences functional conditions and affects neck pain.
We believe that applying traditional Chinese massage and specialized exercises will lead to significant results. Zhang et al., in a survey conducted in 2015, found an improvement in the emotional, cognitive, and executive brain dysfunction due to pain by eliminating the influence of afferent pain on the default mode networks, which proved the beneficial influence of Chinese massage. In another survey, Wei et al., (2017) came to the conclusion that massage therapy, added to manual therapy, affects the feeling of pain and stiffness in the neck area and as a result, improves the health status (Wei et al., 2017). We can sum up that in future research of a longer duration and a bigger sample, it would be desirable that other tests should be included for assessment of the pain and the volume of movement, which will further prove the influence of traditional Chinese massage therapy on physical and mental health.

CONCLUSION

Traditional Chinese massage alleviate pain symptoms and relax the increased muscle tone, which increases the range of motion in the neck area. Compared to routine therapy, Chinese massage methods have a proven effect on the researched indicators. Based on the results of the analysis, we offer the following suggestions. To make a plan to integrate traditional Chinese massage into clinical practice and conduct training courses in Tuina massage for physiotherapists.

REFERENCES

Angelcheva, M, Petkova, S. (2019). Effects of combination between relax massage and Bach flover remedies on everyday stress, *Proceedings book, International Scientific Congress "Applied Sports Sciences",* Balkan Scientific Congress" Physical Edukation, Sport, Health", 15-16 November 2019, Sofia, Bulgaria, 348-352.

Borenstein, D. (2007). Chronic neck pain: how to approach treatment, *Current Pain Headache,* Vol. 11, 6, pp. 436-9.

Cheng, Y., Huang, G. (2014). Efficacy of massage therapy on pain and dysfunction in patients with neck pain: a systematic review and meta-analysis. available at: https://www.hindawi.com/journals/ecam/2014/204360/ (accessed 15 April 2022).

Cheng, X. (1987) Chinese *Acupuncture and Moxibustion.* Foreign Languages Press, Beijing, China, 30-35.

Cohenm, P. (2015). Epidemiology, diagnosis, and treatment of neck pain. *Mayo Clinic Proceeding,* Vol. 90, 2, pp. 284–99.

Cook, A., Wellman, R., Cherkin, D., Kahn, J., Sherman, K. (2015). Randomized clinical trial assessing whether additional massage treatments for chronic neck pain improve 12- and 26-week outcomes. *Spine Journal,* Vol. 15, 10, pp. 2206–2215.

Field, T., Hernandez-Reif, M., Diego, M., Schanberg, S., Kuhn, C. (2005). Cortisol decreases and serotonin and dopamine increase following massage therapy. *International Journal of Neuroscience,* Vol. 115, 10:1397–1413.

Goranova, Z. (2018). *Bi-sindrom v tradizionna kitaiska medizina.* Kitaiski tradizionni metodi za lechenie, Sbornik statii, NSA PRES, Sofia, pp. 184-194.

Hui, T., Loma, L., Parth, T., Patel, C., Bernardo-Filho, M., Urbaczek, A., Yu-Ching, Hsu. (2017). TuiNa Massage: A Minireview of Pertinent Literature. *Journal of Complementary and Alternative Medical Research,* Vol. 3, 1, pp. 1-14.

Iliü, D., Djuroviü, A., Brdareski, Z., Vukomanoviü, A., Pejoviü, V., Grajiü, E. (2012). The position of Chinese massage (Tuina) in clinical medicine. *Vojnosanit Pregled*, Vol. 69. 11, pp. 999–1004.

Ivanova, S. (2018). *Abdominalen masaj za profilaktika i lechenie.* Kitaiski tradizionni metodi za lechenie, Sbornik statii, NSA Pres, Sofia, 174-178.

Kazeminasab, S., Nejadghaderi, S., Amiri, P., Pourfathi, H., ArajKhodaei, M., Sullman, M., Kolahi, A., Safri, S. (2022). Neck pain: global epidemiology, trends and risk factors BMC Musculoskeletal Disorders, available at: https://bmcmusculoskeletdisord.biomedcentral.com/articles/10.1186/s12891-021-04957-4/ (accessed 6 July 2022).

Liu, R., Kurihara, C., Tsai, H., Silvestri, P., Bennett, M., Pasquina, P., Cohen, P. (2017). Classification and Treatment of Chronic Neck Pain: A Longitudinal Cohort Study. *Regional Anesthesia&Pain Medicine,* Vol. 42, 1, pp. 52-61.

Meng, A. (2013). L*ehrbuch der Tuina Therapie: Die Traditionelle Chinesische Massage.* Verlag, Stuttgart, pp. 117-130.

Milanov, I. (2009). *Bolkata v nevrologichnata praktika.* Medizina i fizkultura, Sofia, pp. 17-20.

Milanov, I. (2014). Savremenni sxvashtania za bolkata. *Cephalgia*, Vol. 16, 2, pp. 31-40.

Norrbrink, C., Lundeberg, T. (2011). Acupuncture and massage therapy for neuropathic pain following spinal cord injury: an exploratory study. *Acupuncture in Medicine,* Vol. 29, №2, pp. 108–115.

Quratulain, G., Afzal., Manzoor, S. (2017). Chronic Neck Pain and how to Prevent Chronic Neck Pain in Bankers by Using Ergonomics. available at: https://www.researchgate.net/publication/320843567/(accessed 22 February 2022).

Tao, W., Jiang, H., Tao, X., Jiang, P., Sha, L., Sun, X. (2016). Effects of Acupuncture, Tuina, Tai Chi, Qigong, and Traditional Chinese medicine five-element music therapy on symptom management and quality of life for cancer patients: A meta-analysis. *Journal Pain Symptom Management,* Vol. 51, 4, pp. 728-47.

Tsao, J. (2007). Effectiveness of massage therapy for chronic, nonmalignant pain: a review. *Evidence-based Complementary and Alternative Medecine*, Vol.4, 2, pp. 165-79.

Roberts, L. (2011). Effects of patterns of pressure on resting electromyography. *International Journal of Therapeutic Massage&Bodywork,* Vol. 4, 1, pp. 4-12.

Weerapong, P., Hume, A., Kolt, G. (2005). The mechanisms of massage and effects on performance, muscle recovery and injury prevention, *Sports Medicine*, Vol. 35, 3, pp. 235–256.

Wei, X., Wang, S., Li, L., Zhu, L. (2017). Clinical Evidence of Chinese Massage Therapy (Tui Na) for Cervical Radiculopathy: A Systematic Review and Meta-Analysis. available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5337873/ (accessed 08 May 2022).

Yang, M., Feng, Y., Hong Pei., Deng, S., Wang, M., Xiao, X., Zheng, H., Zhenhong, L, Chen, J., Li, X., Liang, F. (2014). Effectiveness of Chinese massage therapy (Tui Na) for chronic low back pain: study protocol for a randomized controlled trial. available at: https://pubmed.ncbi.nlm.nih.gov/25352050/ (accessed 23 March 2022).

Zhang, H., Chen, C., Wang, H., Li, D., Jia, B., Tan, Z., Zheng, B., Weng, W. (2015). Effect of Chinese tuina massage therapy on resting state brain functional network of patients with chronic neck pain. *Journal of Traditional Chinese Medical Sciences,* Vol. 2, 1, pp. 60-68.

Corresponding author:
Denka Marinova, PhD
National Sports Academy "Vassil Levski"
Department "Physiotherapy"
Sofia, Bulgaria
E-mail: denka_marinova@abv.bg

ASSESSMENT OF BODY POSTURE OF 6-7 YEARS OLD CHILDREN IN RELATION TO THE BMI

Daniela Sadikova
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
Introduction: Increased weight in childhood is a determining factor in developing several diseases in adulthood. The poor posture of the child might be a result of the rapidly growing musculoskeletal system, the increased BMI, or a combination of both. This study aims to investigate the relation between BMI and poor posture in 7-6 years old children.
Material and Methodology: The study included 2 kindergartens in Sofia and was held in September 2018. The New York Posture Rating Chart was used to evaluate the posture. The anthropometric data were assessed and the BMI was calculated by BMI-for-age (5-19) years. The screening covered 112 children with a mean age of 6.14 years.
Results: Poor posture was identified in 32 (28.5%) of the subjects. Abnormal BMI was amounted to 22 (19.6%) of the children: 4 (3.5%) underweight, 16 (14.3%) overweight and 2 (1.7 %) obese. The increase in BMI correlated with a higher chance of poor posture was identified by almost 11.6 % of the pupils.

Keywords: *posture screening, preschool children*

INTRODUCTION

Poor posture and overweight in children are becoming increasingly serious medico-social problems affecting our society. The modern way of life and reduced motor activity are the reasons that provoke the appearance of incorrect posture (Paskaeva, 2015). Kendall F. et al. (1993) define poor posture as causing an unusual load on the body, associated with an increase in the body's needs. This can be attributed mainly to the period of growth in children, where phases with an increased risk of the appearance of postural disorders stand out (Milosevic & Obradovic, 2008; Sabo, 2006). Therefore, it is highly important to detect postural problems at an early stage and keep them under strict kinesiological control (Auxter et al., 1989).

Around the world, the seriousness of the problem and the attention given to it vary widely. For example in some states in USA postural screening is mandatory in grades 5-9, and body mass index (BMI) checks for students in grades 1, 4, 7, and 10. In recent years, more and more attention has been paid to the etiology of spinal curvatures and their interrelationship with lifestyle. Overweight (BMI over 25 kg/m2) and obesity (BMI over 30 kg/m2) represent a significant medico-social problems worldwide (Karnik, 2012) and is considered a likely cause of impaired posture. In overweight children are observed: impaired gait, impaired postural control, and reduced bone mineralization, which can cause subsequently lead to injuries and fractures (Tsiros, 2011). The analysis of the 8-year-old participants revealed that body posture abnormalities are correlated with body composition and in particular with fat mass percentage (Zieteck, 2022).

There are a few studies regarding the correlation between postural disorders and BMI. Zaharieva (2016) touches on the topic and establishes a weak relationship between BMI and the studied postural indicators. Some foreign authors establish a link between being overweight and the development of asymmetry during growth (Wojciech R. et al., 2019). According to Rusek et al. (2019) children with overweight and obesity tended to have an incorrect position of the shoulders and pelvis in comparison to children with normal body weight. They found that greater body mass (higher BMI) coincided with a larger distance of the scapulae from the frontal plane (p=.009)

The purpose of the study is to present and analyze the results of a screening test for poor posture and overweight in preschool children, as well as the interrelationship between these two indicators.

METHODS

In September 2018, we conducted a screening study for postural disorders and overweight in two kindergartens in the city of Sofia. The studies were conducted in 84 Kindergarten "Detelina" and 35 Kindergarten "Shtastlivo detstvo" after written consent of the parents. Each child was examined, and the results were recorded in a report which was given to the parents. 112 children aged 5-7 years (children from the third and preschool groups) were examined. The average age of the children was 6.14 years. Of them, 66 (58.9%) were boys and 46

(41.1%) were girls. In practice, a number of tests, methods and functional assessments are used to establish postural disorders. Different authors select and form a test battery preferred for the particular contingent. In the present study, the following research methods were used to record deviations in posture and BMI:

- NYPR - New York Posture Rating Scale
- BMI, calculated by the formula BMI-for-age (5-19) years (WHO, 2007)

Posture assessment was done by the 10-segment New York Posture Rating Scale (NYPR) - modification of the original NYPR (Howley, Franks., 1992) scoring 10,5,0 in order to assess 10 segments (head, shoulders, spine, hips, ankles, neck, upper back, trunk, abdomen, lower back). Each subject was assessed barefoot in standing position on the base of a platform and assumed a comfortable, erect posture with the body weight distributed between both feet. Scoring was done as 10, 5, 0 for no deviation, some deviation and marked deviation respectively for each 10 criteria in the rating scale.

BMI was assessed with the metric system calculated by the formula: *weight in kilograms divided by height in meters squared* with interpretation of cut-off's:

- Overweight: >+1SD (equivalent to BMI 25 kg/m2 at 19 years)
- Obesity: >+2SD (equivalent to BMI 30 kg/m2 at 19 years)
- Thinness: <-2sd>

RESULTS

From the tested 112 children with no deviations in posture and weight were 71 children (63.3 %). The rest, who are also the subject of the study, 41 children (36.7%) had poor posture and/or deviations from the BMI norm. Of these, in 32 children (28.5 %) we reported poor posture, and in 22 children (19.6 %) deviations from the norm for BMI. A combination of both indicators was measured in 13 children (11.6%). As a percentage distribution of children with deviations in posture and BMI between boys and girls, there is a predominant number of girls 25 (60.9%), at the expense of 16 (39.9%) boys.

Table 1. *Baseline demographic criteria and distribution*

Contingent of the study	Percentage	Av. age	Bad posture	BMI	BP + BMI
Girls, n= 25	60.9 %	6.1	n = 20	n =13	n =7
Boys, n=16	39.1 %	6.2	n = 12	n=9	n=6
Total, n= 112	100%	6.14	n=32(28.5%)	n =22(19.6%)	n =13

The NYPR results showed a moderate preponderance of the total number of deviations of those registered in the frontal plane 17 (53.1%) versus 15 (46.9%) of those in the sagittal plane. As the most significant deviation, we measured as the uneven shoulders - 15 (46.9%), followed by kyphotic posture reported in 10 (31.2%) and lordotic posture reported in 5 (15.6%).

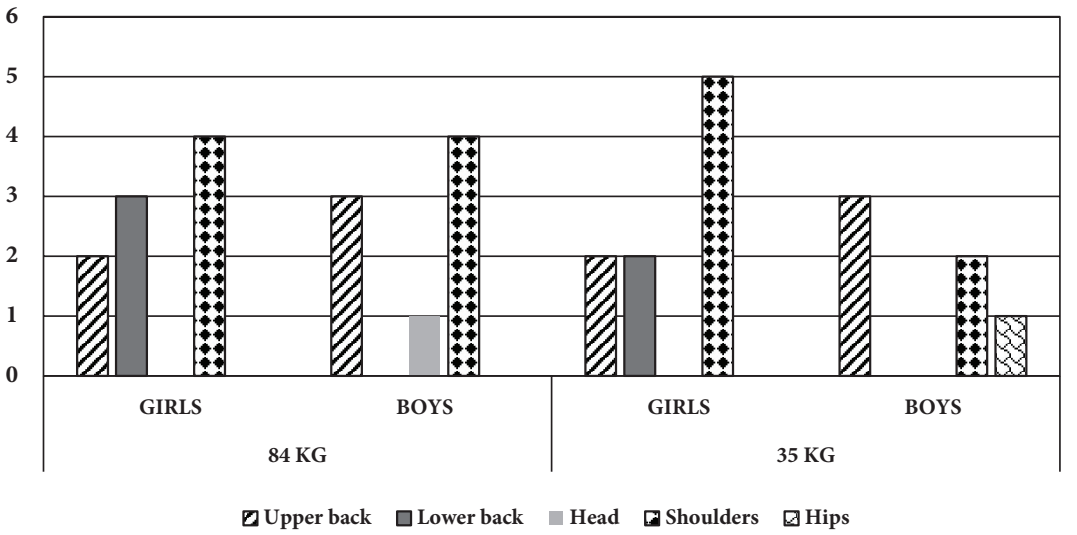


Figure 1. *Results from the NYPR chart*

BMI measurement showed 10 (62.5%) overweight girls and 6 (37.5%) boys, respectively. Children with reported incorrect posture and deviation in BMI were 13 (24.07%) of the total number of children with deviations or 11.6% of all tested children.

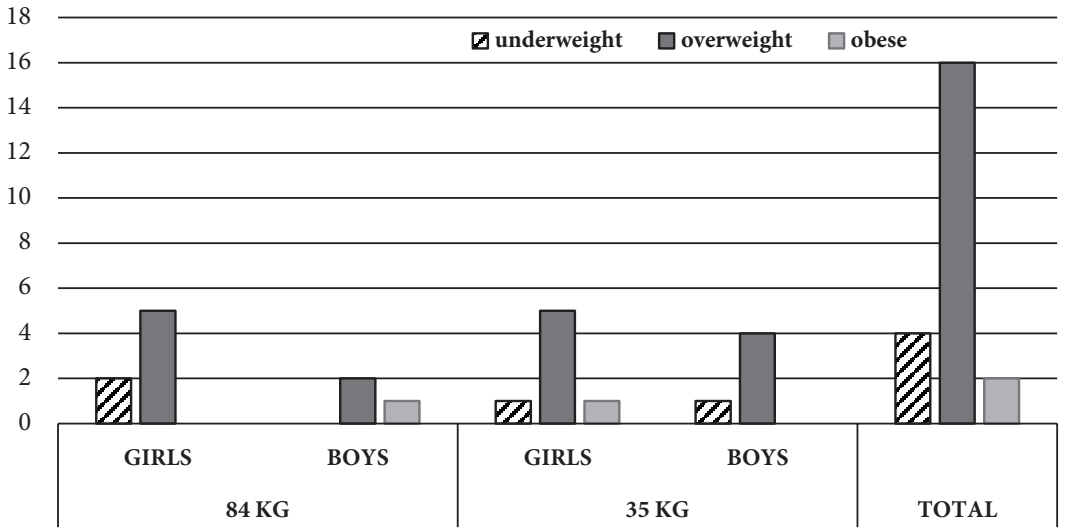


Figure 2. *BMI results*

DISCUSSION

Conducting screening tests for spinal curvatures and overweight in different countries is organized in different ways, by different specialists, without specific compliance with regulations. Paskaleva et al., (2017) published a study of 2029 children aged 5-6 years from 25 kindergartens in Stara Zagora, whose results are slightly higher compared to the data we obtained, namely 970 (65.4%) have impaired posture, and 181 (12.2%) are overweight. In her study with a contingent of 209 children between the ages of 6 and 11, Sazdova, (2019) found postural disorders in 107 (51.19%) children. This result is close in value to the study of Dimitrova et al. (2013), where out of 190 children, 50 (26%) had postural disorders. Popova-Dobreva et al. (2013-2014) made a comparison between the screening of 95 children in first grade 29 (31%) and the same contingent in second grade 47 (55%). The results of this study show a tendency for a sharp increase in the number of children with postural disorders with increasing age, which also explains the lower percentage of their prevalence in preschool age. The same opinion is shared by Spasov (1980), who found out that the lowest percentage of poor posture and spinal deformities is observed in preschool age, gradually increases in the primary course, the peak is in the middle grades and then the curve trades down again.

The significant differences in the data from the different studies are due to the fact that the screening is carried out in different conditions and without a specific test battery. This, in turn, makes the analysis and comparison of the results of different authors very imprecise and difficult to compare. The authors themselves have different points of view regarding deviations from normal posture, as according to Chernogorova, Kaimakchiev, (1969) it is normal and pathological, Popov, (2002) defines it as good and disturbed, and Markova-Stareyshinska, (1971) divides it into very good, good, average and bad.

According to data from an analysis of The Sofia Regional Health Inspectorate for 2018-2019 and an individual assessment of 42,426 children of 215 childcare facilities, 88.0% from the measured 40,839 children (96.3%) were in the normal weight range, and 9.1% in the risk group. 1.2% of children were reported underweight, and 1.8% obese. The data specifically for the children from the preschool groups were similar. Body mass was measured in 2793 (95.1%). Of them, 84.0% were normal, and 11.4% were in the risk group. The relative share of underweight children was 1.9%, and of those with obesity - 2.7%.

In a study of the relationship between poor posture and BMI in 511 boys between 7 and 15 years of age in Poland, Lubkowska, (2017) concluded that reduced/increased BMI in children is a pre-

requisite for the development of postural disorders. Children with excessive body fat had less slope of the thoracic-lumbar spine according to Wyszyńska, (2016).

CONCLUSION

The results of the study provide information about the prevalence of poor posture and weight deviations in preschool children. Many studies on poor posture or overweight are described in the literature, but there is a lack of serious research on their relationship. The data point to the need to introduce regular screening programs at an early age, as well as the creation of a standardized test battery, tailored to the children's age.

REFERENCES

Auxter, D., Pyfer, J., Huettig C. (1989). *Principles and Methods of Adapted Physical Education and recreation. Appendix a: Posture and Body Mechanics,* WCB/Mc Graw-Hill, 517-558

Dimitrova, E. (2013*). Analiz na rezultatite ot skrining za posturalni narushenia I ploskostupie pri deca ot podgotvitelnite klasove*, Sb. reports. NSA, ISBN 987-954-718-374-2, NSA press, 24-32

Garn, Marion, S. (1952). Physical growth and development, *American Journal of Physical Anthropology*, 10.2: 169-192.

Gencheva, N. et. al (2010). Prosledyavane na razprostranenieto na nepravilno telodurjane sred uchenitsi ot I-IV klas - nachalna uchilishtna stepen. *Sport & Science,* issue part 2, 2010;484-487

Karnik S, Kanekar A. (2012). Childhood obesity: a global public health crisis. *Int J Prev Med*. 2012 Jan; 3(1):1-7. PMID: 22506094; PMCID: PMC3278864.

Kendall, F.P., McCreary, E.K. and Provance, P.G. (1993). *Muscle Testing and Function, 4th Edition*, Lippincott, Williams and Wilkins, Philadelphia.

Obradović, B., Milošević, Z. (2008). Posture of preschool boys and girls at the age of 6. *Glasnik Antropološkog društva Srbije,* 43, 310-318.

Paskaleva, R., Ivanova, V., Pavlova, V. (2019). Izsledvane na fizicheskoto razvitie pri deca v preduchilishtna vuzrast v obshtina Stara Zagora – Bylgaria. *Collection of reports from a round table "Functional study, organization and prevention of incorrect posture"*, NSA, 26-48

Rusek W. et al. (2019). Role of body mass category in the development of faulty postures in school-age children from a rural area in south-eastern Poland': a cross-sectional study *BMJ Open* 2019;9: e030610. doi: 10.1136/bmjopen-2019-030610

Sazdova., L. (2019). Funkcionalno sustoyanie I razprostranenie na epravilnata stoika pri uchenitsi ot nachalna uchilishtna vuzrast., *Collection of reports from a round table "Functional research, organization and prevention of incorrect posture"*, NSA, 49-69

SRZI (2019). *Analiz na fizicheskoto razvitie, zdravoslovnoto sustoyanie I dispanserno nabludenie na decata ot detskite zavedenia I uchenitsite ot grad Sofia za uchebnata 2018/2019 godina.*, available at: https://srzi.bg/uploads//pages/Promociq_i_profilaktika/2.Deca_do_7g/Analiz_deca_2018_19.pdf

Usheva, N. (2015). A study of the posture of preschool children, *Social Medicine* 1.3: 16-18.

Wyszyńska J. et al. (2016). Analysis of relationship between the body mass composition and physical activity with body posture in children. *BioMed Research International* 2016; Article ID 1851670, DOI: http://dx.doi.org/

Ziętek, M. et al. (2022). The Incidence of Body Posture Abnormalities in Relation to the Segmental Body Composition in Early School-Aged Children. *Int. J. Environ. Res. Public Health* 2022, 19, 10815. https://doi.org/10.3390/ijerph191710815

Corresponding author:
Daniela Sadikova,
Ph.D. student,
Department "Theory and methodics of physiotherapy"
National Sports Academy "Vassil Levski",
Sofia, Bulgaria
E-mail: danielasadikova@gmail.com

A COMPARATIVE STUDY ON THE EFFECT OF EXTRACORPOREAL SHOCK WAVE THERAPY AND INTERFERENTIAL ELECTROTHERAPY IN PERIARTHRITIS HUMEROSCAPULARIS

Diana Stefanova, Mariana Angelcheva & Simona Bogdanova
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
Introduction: Periarthritis humeroscapularis is one of the most common causes of pain in the shoulder joint. The most applied treatment is conservative. Physical therapy and therapeutic modalities are effective, but there is uncertainty about their optimal combination.
Objective: To examine whether the addition of either extracorporeal shock wave therapy or interferential electrotherapy to physical therapy of shoulder would be more effective in the management of periarthritis humeroscapularis.
Materials and Methods: A total of 35 subjects with periarthritis humeroscapularis were divided into Group-A and Group-B. Both groups received 10 sessions of shoulder exercises and either extracorporeal shock wave therapy (Group-A) or interferential electrotherapy (Group-B).
The outcome measures represent the American Shoulder and Elbow Surgeons Shoulder Score - the patient self-evaluation section (pain and activities of daily living) and the clinical assessment section (active and passive range of motion, strength, and stability).
Results: Subjects showed statistically significant differences in reducing pain, improving range of motion and functional disability in the pre and post values of both the extracorporeal shock wave therapy and interferential electrotherapy groups. Group A was superior in improving external rotation ROM from abduction and flexion and Group B in alleviating pain.
Conclusion: Either extracorporeal shock wave therapy or interferential electrotherapy in combination with physical therapy seemed to be significantly effective in the management of patients of periarthritis humeroscapularis. However, the group who received interferential electrotherapy showed higher improvement in pain, and the group with extracorporeal shock wave therapy demonstrated higher improvement in range of motion.

Keywords: *extracorporeal shock wave therapy, interferential electrotherapy, physical therapy*

INTRODUCTION

One of the most common causes of pain in the shoulder joint is shoulder periarthritis (Aleksiev, 1999; Page et al., 2016). A wide range of pathophysiological conditions are included in the term of shoulder periarthritis. Shoulder periarthritis unites lesions of both muscles and the joint capsule itself. In clinical practice periarticular lesions are differentiated by rotator cuff disease and adhesive capsulitis (Isaikin, Ivanova, 2017).

The most applied treatment is conservative. A wide range of therapeutic interventions are commonly used to manage shoulder periarthritis including kinesitherapy and passive physical modalities to decrease pain and accelerate healing. Physical therapy and therapeutic modalities are effective, but there is uncertainty about their optimal combination (Matsanova-Simova, Radeva, Aleksiev, 2022).

Extracorporeal shockwave therapy (ESWT) is a non-invasive conservative treatment method. This physical modality has been applied in the management for several painful musculoskeletal disorders including rotator cuff diseases (tendinopathies and enthesopathies), myofascial pain, joint injuries, and fractures (Klüter, 2018; Speed, 2014; Cheng et al., 2019; Zhang et al., 2020; Luan et al., 2019). Interferential Therapy (IFT) is a passive physical modality involving the crossing of two medium frequency currents to generate a low-frequency beating effect in the deep tissues (Beatti et al., 2010).

Findings from trials and systematic reviews suggest it is unclear whether kinesitherapy combined with different types of passive physical modalities are effective in the management of shoulder periarthritis.

The aim of the present study was to compare the effects of extracorporeal shock wave therapy or interferential electrotherapy, both in combination with kinesitherapy in the management of shoulder periarthritis

METHODS

Thirty-five patients with shoulder periarthritis referred and/or registered for physiotherapy services were examined. Participants were divided into Group-A (n=17, mean age: 53.47 ± 10.92) and Group-B (n=18, mean age: 55.5 ± 10.71). Group-A received the extracorporeal shock wave therapy plus kinesitherapy and Group-B interferential electrotherapy plus kinesitherapy.

At the beginning and at the end of the two-week treatment course the American Shoulder and Elbow Surgeons (ASES) (Richards et al., 1994) methodology was performed to evaluate the results from the study. The ASES has been validated and is reliable for many shoulder conditions (Tashjian, 2010; Angst et al., 2011).

The measures included were a) a visual analogue scale (VAS) which provides pain score, b) goniometric shoulder range of motion (ROM) and point scale for internal rotation, c) shoulder manual muscle testing. Secondary measures were subjective instability (yes/no) and objective instability (on a scale from 0 to 5 where 5 is normal and 0 is luxation of the shoulder joint).

The patient score consists of subscale for pain, symptoms of instability and activities of daily living (ADL). Pain is measured with 10-point visual analogue scales (VAS). The ADL subscale contains 10 functional items that are shoulder specific. The range for pain and functional subscales is from 0 (worse pain and functional loss) to 50 (no pain and excellent condition). Total ASES is the combination of the VAS score for pain (50%) and cumulative ADL index (50%) (Richards et al., 1994).

The clinical assessment evaluates active and passive ROM, strength, and stability. Passive and active shoulder ROM are assessed using a goniometer for forward flexion, external rotation (at side and 90° abduction) measured in degrees. The internal rotation (highest segment reach of the hand behind the back) is measured with point scale ranging from 1-lowest to 21-highest. Strength was measured with shoulder manual muscle testing (grade of 0 to 5, with 0 as no contraction, 1 as flicker, 2 as movement with gravity eliminated, 3 as movement against gravity, 4 as movement against some resistance, and 5 as normal power).

Both groups received 10 sessions of shoulder exercises and either extracorporeal shock wave therapy (Group-A) or interferential electrotherapy (Group-B) for two weeks.

Extracorporeal shockwave therapy (ESWT) was applied twice a week for two weeks in total. Participants were treated with a ESWT device (Chattanooga Intellect RPW). Each treatment consisted of 1st phase transmitter D 20 mm and 2nd phase R 15mm, frequency of 10 Hz, 2200 pulses, pressure 2-4 Bar). The intensity of energy was adjusted according to participant's tolerance of pain.

Group-B was received interferential electrotherapy (IFT) and kinesitherapy. IFT was administered using the two channel, quadripolar technique with electrodes placed around the affected shoulder, 10 times for 2 weeks. A 15-min IFT was administered with application of alternating medium-frequency current (4,000 Hz) and an amplitude-modulated low frequency (beat frequency 90-100 Hz for the first 5 procedures and 1-100 Hz for the following sessions. IFT was delivered at a medium to high level of non-painful intensity, adapted to individual tolerance without evoking visible muscle twitches.

Both groups received the same kinesitherapy of proprioceptive neuromuscular facilitation (PNF) techniques for relieving pain (Hold-Relax) and for improving muscle strength and muscle endurance (Contract-Relax), Post isometric relaxation (PIR) techniques for the shortened muscles, active exercises (against elastic resistance and with Fit Ball). Kinesitherapy program was aimed at pain reduction, muscles shoulder function improvement and mobility restoration.

The inclusion criteria were a history of shoulder pain for at least 3 months and VAS pain score of 4 or above, and restriction in range of motion, no treatment other than analgesics within the past 3 months, medical diagnosis of shoulder periarthritis. Patients were excluded from the study if they had had lack of stability, cervical radiculopathy, neurological abnormalities, autoimmune mediated arthritis, corticosteroid joint injection on the affected shoulder, malignancy, or if they had other contraindications to shock wave therapy. We excluded patients who did not sined informed consent.

Statistical Package for Social Science (SPSS) version

19.0 (IBM) for Windows was used for data analysis. Data were examined using explorative statistics and the distributions were inspected for violations of normality using the Kolmogorov-Smirnov Test. The normally distributed samples were analysed using the One Sample T-Test and those which were not normally distributed with the Wilcoxon Signed-Rank test to compare the variables in pre and post intervention. To assess the difference between the groups, the Paired Sample T-Test was used for normally distributed samples, while the Mann-Whitney U test was used for those who violated the assumption of normality. A p value lower than 0.05 was considered statistically significant.

RESULTS

The participants' demographic and clinical baseline characteristics were given in Table 1. There was no statistically significant difference regarding age, gender, side of involvement, and medical comorbidities between the groups at baseline (p>0.05).

Table 1. *Demographic characteristics of group A and group B*

Characteristics	**Group A (n = 17) Mean ± SD**		**Group B (n = 18) Mean ± SD**		**p**
Age (years)	53.47 ± 10.92		55.5 ± 10.71		.582
Gender	n	%	n	%	
Male	4	23.5	9	50	.111
Female	13	76.5	9	50	.111
Side of involvement	n	%	n	%	
Right	7	41.18	7	38.89	.894
Left	10	58.82	11	61.11	.894
Medical comorbidities	1 woman, 2 men	17.6	2 women, 1 man	16.70	

*Medical comorbidities: group A (high blood pressure, kidney stones); group B (high blood pressure, cholecystitis). * Significant p value (<.05).*

Subjects showed statistically significant differences in reducing pain and improving performance in ADL in the pre and post values for both the extracorporeal shock wave therapy and interferential electrotherapy groups (Table 2).

Table 2. *Pre-treatment and post-treatment ASES score – patient self-reported section results*

Assessment	**Groups**						
	Group A (ESWT)			**Group B (IFT)**			
ASES patient (sections)	Initial Mean ± SD	Final Mean ± SD	P (Intragroup comparisons)	Initial Mean ± SD	Final Mean ± SD	P (Intragroup comparisons)	P (Intergroup comparisons)
Pain (0–50)	22.94 (6.39)	33.82 (6.74)	.000*	24.44 (8.20)	37.50 (5.49)	.000*	.042*
ADL (0–50)	24.18 (8.48)	36.18 (10.04)	.000*	19.78 (11.33)	31.44 (10.31)	.000*	.184
ASES total (0–100)	47.06 (12.83)	69.94 (14.71)	.000*	44.22 (15.11)	66.72 (14.07)	.000*	.513

*ADL: Activities of Daily Living, ASES score: American Shoulder & Elbow Surgeons standardized shoulder form, ASES patient: patient self-reported section, ASES total (Pain +ADL), ESWT: extracorporeal shock wave therapy, IFT: interferential electrotherapy. * Significant p value (<.05).*

However, the mean pain score in IFT group (37.50 ±5.49) was significantly higher than the mean of ESWT group (33.82±6.74). In intergroup comparisons, no significant difference was found between the groups in total ASES score and the ADL domain scores. Minimal clinically important differences (MCID) were considered ≥12 (a 12 to 17-point change) for ASES score of patients with rotator cuff disease who are treated without surgery (Tashjian, et al., 2010). Improvement on the ASES score was by

22.9 points (from 47.06 to 69.9) for Group A (ESWT) and 22.6 points (from 44.1 to 66.7) for group B (IFT).

Table 3 demonstrates clinical ASES score before and after the intervention and their changes between groups. In intragroup comparisons, a significant difference between pre- and post-treatment results was found in active, and in passive ROM of shoulder and of strength.

Table 3. *Pre-treatment and post-treatment clinical ASES score section results*

Assessment	Groups						
	Group A (ESWT)			Group B (IFT)			
ASES clinical (sections)	Initial Mean ± SD	Final Mean ± SD	P (Intragroup comparisons)	Initial Mean ± SD	Final Mean ± SD	P (Intragroup comparisons)	P (Intergroup comparisons)
Range of motion (Affected side)							
Forward flection							
Active	131.47 (21.85)	148.24 (18.20)	.000*	116.67 (28.95)	132.78 (25.51)	.000*	.048*
Passive	135.00 (36.01)	160.59 (13.10)	.007*	128.61 (27.80)	142.50 (25.68)	.000*	.014*
External rotation							
Active	49.82 (15.97)	61.18 (15.57)	.000*	42.33 (18.18)	52.22 (19.42)	.000*	.279
90^0 Active	52.6471 (33.17)	72.06 (21.44)	.017*	27.78 (36.35)	46.94 (34.73)	.001*	.028*
Internal rotation							
Passive	9.76 (2.17)	11.53 (2.72)	.000*	8.83 (2.77)	11.11 (2.72)	.000*	.960
Abduction	80.00 (21.29)	130.88 (30.83)	.000*	91.11 (34.96)	113.89 (32.20)	.000*	.080
Strength							
Forward flection	3.18 (0.81)	3.53 (0.87)	.014*	3.056 (0.73)	3.22 (0.81)	.083	.198
Abduction	2.76 (0.75)	3.0588 (0.83)	.020*	2.278 (0.46)	2.83 (0.71)	.002*	.448
External rotation	2.94 (0.75)	3.47 (0.72)	.001*	2.83 (0.79)	3.17 (0.79)	.001*	.242
Internal rotation at side	3.29 (0.77)	3.53 (0.87)	.041*	2.89 (0.68)	3.17 (0.79)	.020*	.205

*ASES: American Shoulder and Elbow Surgeons score, c ASES: clinical component, ESWT: extracorporeal shockwave therapy, IFT: interferential current therapy, VAS: Visual analogue scale for pain; * Significant p value (<0.05).*

Although the ROM of shoulder and strength were improved significantly in both groups, ESWT group had a statistically significant improvement in forward flection and external rotation (90^0 active) ($p<.05$). The strength was not significantly different between the two groups.

DISCUSSION

The present study was conducted to compare the effects of extracorporeal shock wave therapy and interferential electrotherapy and both in combination of kinesitherapy for subjects with shoulder periarthritis.

The findings of our study demonstrated that the addition of ESWT or IFT to kinesitherapy successfully improved shoulder pain and improved shoulder function for people with shoulder periarthritis.

The results regarding pain measurement using a patient self-reported ASES show there was significant improvement in ESWT and IFT groups. Both treatments were effective in reducing shoulder pain. We observed in both groups pain was significantly reduced following interventions (Group A, 10.9 points and Group in B, respectively 13.0 points). This improvement exceeded the threshold of the

MDC for ASES pain score of 7.2 points (Michener, McClure and Sennett, 2002).

Results of the present study also confirmed that pain reduction in both groups surpassed MCID in patients with rotator cuff disease who are treated without surgery (Tashjian et al., 2010), and thus are clinically relevant.

Several studies have confirmed the analgesic effect of extracorporeal shock wave therapy and interferential electrotherapy.

The result of present study for Group A (ESWT) showed improvement in term of ASES pain score. This result was in accordance with similar study by Ilieva (2014) which stated the short-term pain-relieving effect of ESWT in a non-homogeneous group of patients with chronic shoulder periarthritis with and without calcium deposits.

ESWT has reported to treat a variety of pain conditions effectively and increasingly used for rotator cuff pain, but evidence of its efficacy remains unclear, with studies reporting conflicting results (Muthukrishnan, Rashid, Al-Alkharji, 2019; Vahdatpour et al., 2014). Extracorporeal shock wave therapy is an effective treatment modality that relieves pain, increases function, and restores movement of the shoulder in symptomatic rotator cuff disease (calcific and non-calcific rotator cuff tendinitis) (Ozturk, Savcı, Gelecek, 2014; Surace et al., 2020). Several studies suggested that ESWT might have analgesic effect in various tendinopathies (Vallance, Malliaras, 2019; Maemichi et al., 2021).

ESWT mechanism of analgetic effect is probably assumed to be due to the lowering the concentration of substance-P that reduces the stimulation of afferent nociceptive fibres and thus reduces the pain (Rola et al., 2022; Hausdorf et al., 2004), overstimulation of pain nerve fibre endings (Melzack, 1975; Rompe, 1996), or disruption of the tendon tissue by the physical effects of the sound waves (or radial shock wave) resulting in induction of a healing process of the tendon (Loew, 1997).

However, in inter-group comparison, the subjects of group B (IFT) showed better improvements in terms of decreasing the ASES pain score.

Evidence from various literatures support use of IFT as a sole intervention for shoulder pain management (Yu et al., 2015; Page et al., 2016). However, results of the present study were in accordance with several other studies, which demonstrated that IFT, as a supplement to other interventions, has advantages over placebo and control treatments for reducing musculoskeletal pain (Fuentes et al., 2010; Matsanova-Simova, Radeva and Aleksiev, 2022).

The analgesic effect of the interferential current electrotherapy may be due to central-level inhibition through the pain gate control mechanism, inhibition of the triggering pain threshold by hyperpolarisation of semi permeable membrane receptors, lowering the concentration of substance-P, and the stimulation of beta-endorphin production (Fuentes et al., 2010).

Our results show IFT therapy is more effective in reducing pain than ESWT therapy. One possible reason for superiority of IFT may have been that we delivered IFT using quadripolar technique with electrodes placed around the affected shoulder with application of an amplitude-modulated low frequency (beat frequency 90-100 Hz and 1-100 Hz). Some authors attributed the pain-relieving ability of the IFC to its amplitude modulated frequency characteristics (Johnson, Tabasam, 2003; Watson, 2000; Sluka, 2009). Stimulation with the higher frequencies of about 100 Hz to stimulate the pain gate mechanisms, with lower frequencies up to 10 Hz at motor level intensities can be used to activate the opioid mechanism (De Domenico, 1990). IFT can also improve blood micro perfusion and reduce muscle spasms although evidence for these effects is not consistent (Johnson, 2014).

Statistically significant changes were seen within both groups for strength and ASES ADL domain, and total ASES score. These results would be attributed to pain reduction, and increased ROM thus enabling individuals to participate in activities of daily living.

In our study both groups treated by passive physical modalities showed increased muscle strength and shoulder mobility. Over the two-week therapeutic follow-up statistically insignificant changes were observed between groups for all the ROM apart from flexion and external rotation in favour of Group A. These results confirmed that addition of kinesitherapy to extracorporeal shock wave ther-

apy or interferential electrotherapy would be effective in shoulder pain reduction and function in subjects with shoulder periarthritis. Kinesitherapy have an additional pathogenetic effect on the joint function (Kelle, Kozanoglu, 2014; Page et al., 2016; Matsanova-Simova, Radeva, Aleksiev, 2022).

In conclusion, EWST and IFT are both effective in alleviating pain and improving shoulder functionality, motion, and strength. However, IFT is more effective than EWST for reducing pain. EWST is more effective for improving ROM in terms of flexion and external rotation. There is need for further studies to confirm these results with larger sample size, control group and longer follow-up.

REFERENCES

Aleksiev, A. A. (1999). Traumatologic diseases. In: *Practical Physiotherapy* (ed. M. Ryazkova), Sofia, Znanie, 81–103 (in Bulgarian).

Angst, F., Schwyzer, H. K., Aeschlimann, A., Simmen, B. R., & Goldhahn, J. (2011). Measures of adult shoulder function: Disabilities of the Arm, Shoulder, and Hand Questionnaire (DASH) and its short version (QuickDASH), Shoulder Pain and Disability Index (SPADI), American Shoulder and Elbow Surgeons (ASES) Society standardized shoulder assessment form, Constant (Murley) Score (CS), Simple Shoulder Test (SST), Oxford Shoulder Score (OSS), Shoulder Disability Questionnaire (SDQ), and Western Ontario Shoulder Instability Index (WOSI). *Arthritis care & research*, *63 Suppl 11*, S174–S188.

Beatti A., Rayner A., Souvlis T., Chipchase L. (2010). The analgesic effect of interferential therapy on clinical and experimentally induced pain. *Phys. Ther. Rev*. 15 (4), pp. 243-252.

Cheng, L., Chang, S., Qian, L., Wang, Y., & Yang, M. (2019). Extracorporeal shock wave therapy for isokinetic muscle strength around the knee joint in athletes with patellar tendinopathy. *The Journal of sports medicine and physical fitness, 59 5*, 822-827.

Domenico, G.D. (1982). Pain relief with interferential therapy. *The Australian journal of physiotherapy, 28*, 14-18.

Fuentes, J. P., Armijo Olivo, S., Magee, D. J., & Gross, D. P. (2010). Effectiveness of interferential current therapy in the management of musculoskeletal pain: a systematic review and meta-analysis. *Physical therapy*, *90*(9), 1219–1238.

Hausdorf, J., Schmitz, C., Averbeck, B., & Maier, M. (2003). Molekulare Grundlagen zur schmerzvermittelnden Wirkung extrakorporaler Stoßwellen. *Der Schmerz, 18*, 492-497.

Ilieva E. M. (2014) *Modern approach in rehabilitation in osteoarthrosis. Extracorporeal shock wave therapy.* Published: Plovdiv, Medical Publishing House LAX Book ISBN 978-954-8326-69-8 (in Bulgarian) pp. 54

Isaikin AI, Ivanova MA. (2017). Scapulohumeral periarthritis. Nevrologiya, neiropsikhiatriya, psikhosomatika. *Neurology, neuropsychiatry, psychosomatics,* 9(1):4–10.

Johnson MI. (2014) *Transcutaneous Electrical Nerve Stimulation (TENS). Research to support clinical practice.* Oxford University Press

Johnson, M. I., & Tabasam, G. (2003). A single-blind investigation into the hypoalgesic effects of different swing patterns of interferential currents on cold-induced pain in healthy volunteers. *Archives of physical medicine and rehabilitation*, *84*(3), 350–357.

Johnson, M. I., Paley, C. A., Howe, T. E., & Sluka, K. A. (2015). Transcutaneous electrical nerve stimulation for acute pain. *The Cochrane database of systematic reviews*, *2015*(6), CD006142.

Kelle, B., & Kozanoğlu, E. (2014). Low-level laser and local corticosteroid injection in the treatment of subacromial impingement syndrome: a controlled clinical trial. *Clinical Rehabilitation, 28*, 762 - 771.

Klüter, T., Krath, A., Stukenberg, M., Gollwitzer, H., Harrasser, N., Knobloch, K., Maffulli, N., Hausdorf, J., & Gerdesmeyer, L. (2018). Electromagnetic transduction therapy and shockwave therapy in 86 patients with rotator cuff tendinopathy: A prospective randomized controlled trial. *Electromagnetic biology and medicine*, *37*(4), 175–183.

Loew, M., Daecke, W., Kusnierczak, D., Rahmanzadeh, M., & Ewerbeck, V. (1999). Shock-wave therapy is effective for chronic calcifying tendinitis of the shoulder. *Journal of Bone and Joint Surgery, American Volume, 81*, 863-867.

Luan, S., Zhu, Z. M., Ruan, J. L., Lin, C. N., Ke, S. J., Xin, W. J., Liu, C. C., Wu, S. L., & Ma, C. (2019). Randomized Trial on Comparison of the Efficacy of Extracorporeal Shock Wave Therapy and Dry Needling in Myofascial Trigger Points. *American journal of physical medicine & rehabilitation*, *98*(8), 677–684.

Maemichi T., Tsutsui T., Okunuki T., Hoshiba T., Kumai T. (2021). Pain Relief after Extracorporeal Shock Wave Therapy for Patellar Tendinopathy: An Ultrasound Evaluation of Morphology and Blood Flow. *Appl. Sci,* 11:8748.

Matsanova-Simova V, Radeva S, Aleksiev A. (2022). Upgrading, and prophylactic effect of exercise in shoulder periarthritis. *C. R. Acad. Bulg. Sci*., 75, No 2, pp. 266-274

Melzack R. (1975). Prolonged relief of pain by brief, intense transcutaneous somatic stimulation. *Pain*, *1*(4), 357–373.

Michener, L. A., McClure, P. W., & Sennett, B. J. (2002). American Shoulder and Elbow Surgeons Standardized Shoulder Assessment Form, patient self-report section: reliability, validity, and responsiveness. *Journal of shoulder and elbow surgery*, *11*(6), 587–594.

Muthukrishnan, R., Rashid, A. A., & Al-Alkharji, F. (2019). The effectiveness of extracorporeal shockwave therapy for frozen shoulder in patients with diabetes: randomized control trial. *Journal of physical therapy science*, *31*(7), 493–497.

Ozturk NS, Savcı S, Gelecek N. (2014). Effects of extracorporeal shock wave therapy on subacromial impingement syndrome. *Orthop J Sports Med.* 2(Suppl 3):11–11.

Page, M. J., Green, S., Mrocki, M. A., Surace, S. J., Deitch, J., McBain, B., Lyttle, N., & Buchbinder, R. (2016). Electrotherapy modalities for rotator cuff disease. *The Cochrane database of systematic reviews*, *2016*(6), CD012225.

Richards, R. R., An, K. N., Bigliani, L. U., Friedman, R. J., Gartsman, G. M., Gristina, A. G., Iannotti, J. P., Mow, V. C., Sidles, J. A., & Zuckerman, J. D. (1994). A standardized method for the assessment of shoulder function. *Journal of shoulder and elbow surgery*, *3*(6), 347–352.

Rola, P., Włodarczak, A., Barycki, M., & Doroszko, A. (2022). Use of the Shock Wave Therapy in Basic Research and Clinical Applications-From Bench to Bedsite. *Biomedicines*, *10*(3), 568.

Rompe, J.D., Hopf, C., Kullmer, K., Heine, J. and Burger, R. (1996) Analgesic Effect of Extracorporeal Shock Wave Therapy on Chronic Tennis Elbow. *The Journal of Bone & Joint Surgery*, 78, 233-237.

Speed C. (2014). A systematic review of shockwave therapies in soft tissue conditions: focusing on the evidence. *British journal of sports medicine*, *48*(21), 1538–1542.

Surace, S. J., Deitch, J., Johnston, R. V., & Buchbinder, R. (2020). Shock wave therapy for rotator cuff disease with or without calcification. *The Cochrane database of systematic reviews*, *3*(3), CD008962.

Tashjian, R. Z., Deloach, J., Green, A., Porucznik, C. A., & Powell, A. P. (2010). Minimal clinically important differences in ASES and simple shoulder test scores after nonoperative treatment of rotator cuff disease. *The Journal of bone and joint surgery. American volume*, *92*(2), 296–303.

Vahdatpour B, Taheri P, Zade AZ, et al. (2014). Efficacy of extracorporeal shockwave therapy in frozen shoulder. *Int J Prev Med,* 5:875–81.

Vallance, P., & Malliaras, P. (2019). Extracorporeal Shockwave Therapy of Healthy Achilles Tendons Results in a Conditioned Pain Modulation Effect: A Randomised Exploratory Cross-Over Trial. *Muscle Ligaments and Tendons Journal*.

Walsh, D. M., Howe, T. E., Johnson, M. I., & Sluka, K. A. (2009). Transcutaneous electrical nerve stimulation for acute pain. *The Cochrane database of systematic reviews*, (2), CD006142.

Watson T. (2000). The role of electrotherapy in contemporary physiotherapy practice. *Manual therapy*, *5*(3), 132–141.

Yu H., Côté P., Shearer H.M., Wong J.J., Sutton D.A., Randhawa K.A., Varatharajan S., Southerst D., Mior S.A., Ameis A., et al. (2015). Effectiveness of passive physical modalities for shoulder pain: Systematic review by the Ontario protocol for traffic injury management collaboration. *Phys. Ther.* 95:306–318.

Zhang Q, Fu C, Huang L, et al. (2020). Efficacy of extracorporeal shockwave therapy on pain and function in myofascial pain syndrome of the trapezius: a systematic review and meta-analysis. *Arch Phys Med Rehabil.* 101:1437–46.

Corresponding author:
Diana Stefanova MD, PhD
National Sports Academy "Vassil Levski"
1 Gurguljat Str.
Sofia, Bulgaria
E-mail: dn_stefanova@yahoo.com

APPLICATION OF AN INCLINOMETER IN THE FUNCTIONAL DIAGNOSIS OF CHILDREN SPORTING FOOTBALL

Rumiana Tasheva
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
The aim of the study was to apply for the first time in Bulgaria a Digital Pelvic Inclinometer in the functional diagnostic of children playing football.
Material and methods. During the period March-August 2020, 107 boys aged 6-10 years (mean age 8.63 ±.115) from soccer clubs Baroko, Vitosha 13, Talant, Tsarsko Selo were assessed. Players train an average of 1.91 ±0.866 years with a frequency of 2.70 ±0.461 times a week.
All children were tested for pelvic inclination using a Digital Pelvic Inclinometer (DPI) based on Sub-4 Technologies. Pelvic angle data is calculated electronically and digitally displayed on an LCD.
The anterior superior iliac spine (ASIS) and posterior superior iliac spine (PSIS) levels were measured bilaterally and the difference between the two values was determined as pelvic torsion.
Results: Data were analyzed with SPSS 25.0. Pearson's coefficient demonstrates a correlation of 0.813 between the inclinometer data on the left and right. There is also a 0.357 correlation between the inclinometer data on pelvic torsion and the isometric test for static strength endurance of the lower paravertebral muscles.
Test of Normality Koplmogorov-Smirnov shows other than normal distribution – on the left 0,101 (Sig. .013) and on the right 0,134 (Sig. .000). These results determine applying of the nonparametric test Kruskal Wallis. The data demonstrate statistically significant differences between teams, in the inclinometer on the right x^2=7.86 (Sig. .049) and pelvis torsio x^2=10.506 (Sig. .015). In addition also the data of the pelvis torsio shows statistically significant differences between groups according to age (first 6-7, second 8-9, and third 10-11 years) x^2=8.432 (Sig. .015).
Conclusion: The application of Digital Pelvic Inclinometer provides an accurate diagnosis of pelvic inclination and the presence of torsion, which is essential for the timely treatment of functional dysfunctions and for the prevention of complications.

Keywords: *children, football, inclinometer*

INTRODUCTION

The publication presents the results of a scientific research project at the National Sports Academy "Vasil Levski" on the topic: "FUNCTIONAL DIAGNOSTICS OF CHILDREN FROM PRIMARY COURSE PLAYING FOOTBALL SPORTS". The students from the "Physiotherapy" specialty - II year as volunteers and lecturers from the departments of Physiotherapy and Football participated in the project.

Soccer is the most popular sport in the world, with most players under the age of 18 (Faude, Rößler, Junge, 2013; Prieto-González et al., 2021.). Playing soccer has a beneficial effect on children's health and development, but there is also a high risk of injury. In this aspect, injury prevention is paramount. In a number of studies, injury prevention in youth soccer players has focused primarily on the knee and the anterior cruciate ligament (Alentorn-Geli et al., 2009; Di Paolo et al., 2021; García-Luna et al., 2020; Padua et al., 2015; Thompson et al., 2017; Waldén et al., 2012;). In recent years, studies investigating gender differences in anthropometric characteristics, balance and range of motion in elite youth soccer players have been conducted (Llurda-Almuzara et al., 2022). In fact, physiotherapy has a leading role in injury prevention. Effective prevention is based on precise functional diagnostics. The inclusion of innovative methods in functional diagnostics contributes to the improvement and expansion of the research process.

The aim of the study was to apply for the first time in Bulgaria a Digital Pelvic Inclinometer in the functional diagnostic of children playing football.

MATERIAL AND METHODS

During the period March-August 2020, 107 boys aged 6-11 years (mean age 8.63 ±0.115) from soccer clubs Baroko, Vitosha 13, Talant, Tsarsko Selo were assessed. In order to be included in the study, the coaches in the clubs obtained informed consent from the children's parents. Players train an average of 1.91 ±0.866 years with a frequency of 2.70 ±0.461 times a week.

Twenty-eight indicators were tracked, including anthropometric - height, weight, absolute and relative lengths of the lower limbs, Hirtz (1, 2, 3), and BMI. In the present article, we follow up on the study of pelvic tilt using a digital pelvic inclinometer (DPI) and the static force endurance test for the lower paravertebral musculature (LPM). DPI is based on Sub-4 Technologies to precisely measure and quantify innominate bone inclination. Data is captured by the DPI via a small three-axis accelerometer, calculated electronically, and displayed digitally on the LCD. The examination begins with inspection and palpation bilaterally at the level of the anterior and posterior superior iliac spines (ASIS and PSIS). Subsequently, anterior superior iliac spine (ASIS) and posterior superior iliac spine (PSIS) levels were measured bilaterally in degrees with DPI, and the difference between the two values was defined as pelvic torsion (Figure 1). Data from the lumbar spine only were tracked.

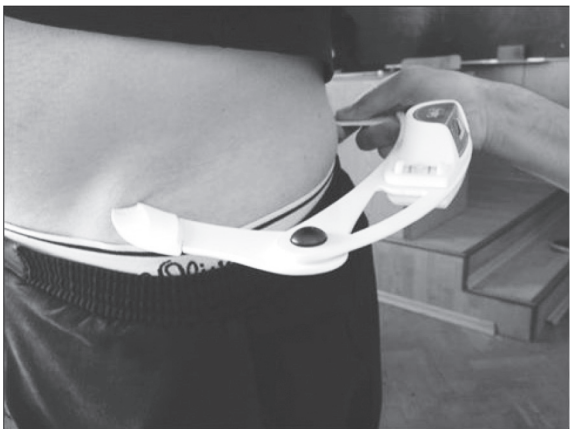


Figure 1. *Measurement with DPI*

Figure 2. *LPM test*

The test for the lower paravertebral muscles is performed from the prone starting position with the lower part of the body off the couch. The lower limbs are raised to the level of the body and held for 30 seconds (Figure 2).

RESULTS

Data were analyzed with SPSS 25.0 (Gigova, 2019). The results of the descriptive statistics are presented in Table 1.

Table 1. *Descriptive statistics*

Indicators	N	Range	Min	Max	Mean	Std Dev	V	Skewness	Kurtosis
Age	129	4	6	10	8.63	1.31	15.17	-.336	-.330
Career	129	5	0	5	1.91	.866	45.02	.386	.353
Weekly	129	1	2	3	2.70	.461	17.03	-.871	-1.261
Incl left	107	21.0	3.0	24.0	12.111	4.1076	33.85	.436	-.037
Incl right	107	23.2	.5	23.7	11.607	4.4776	38.53	.016	.064
Incl torsion	107	8.0	.0	8.0	2.122	1.6933	79.71	1.209	1.559
Paravertebral m - lower part	130	43	5	48	24.45	8.029	32.80	-.379	.121
Valid N (listwise)	105								

The results presented in Table 1 show that the studied children train a minimum of 2 times a week and a maximum of 3 times. In fact, there is a big difference in the career indicator, as there are children who started training less than a year ago and others for 5 years. Regarding the inclinometer data, it is found that the average values are close, which on the left are =12.111° ±4.1076 and on the right =11.607° ±4.4776. On the other hand, the range between the minimum and maximum values is large - left =21.0° and right =23.2°. This is indicative of a significantly increased pelvic inclination, and only on the right there are children with a minimum value in the norm of 0.5°. Therefore, the presence of torsion is established

with an average of =2.122° ±1.6933, with the minimum value being 0°, but the maximum being 8° and showing pronounced asymmetry in some children. In the results of the isometric test for the lower part of the paravertebral musculature, an average value of =24.45 sec ± 8.029, is established, close to the norm of 30 sec. In fact, the minimum values of 5 sec indicate significantly poor static strength endurance in some of the children, while the maximum of 48 sec is significantly above the norm.

In addition, the coefficients of skewness and kurtosis (Table 1) are above the critical values, and the Kolmogorov-Smirnov normality test shows other than normal distribution - on the left 0.101 (Sig. .013) and on the right 0.134 (Sig. .000).

Correlation tracking by Pearson's coefficient shows the presence of one between inclinometer left and right with a value of 0.813. There is also a -0.357 correlation between the inclinometer data on pelvic torsion and the isometric test for static strength endurance of the lower paravertebral muscles.

Based on the analyzes made, the Kruskal Wallis nonparametric test was applied to establish statistically significant differences in the measured indicators. The data demonstrate statistically significant differences between teams, emphasized in the inclinometer on the right H=7.86° (Sig. .049) and pelvis torsion H=10.506° (Sig. .015). Left, right, and torsion inclinometer data by the team are presented in Figure 3.

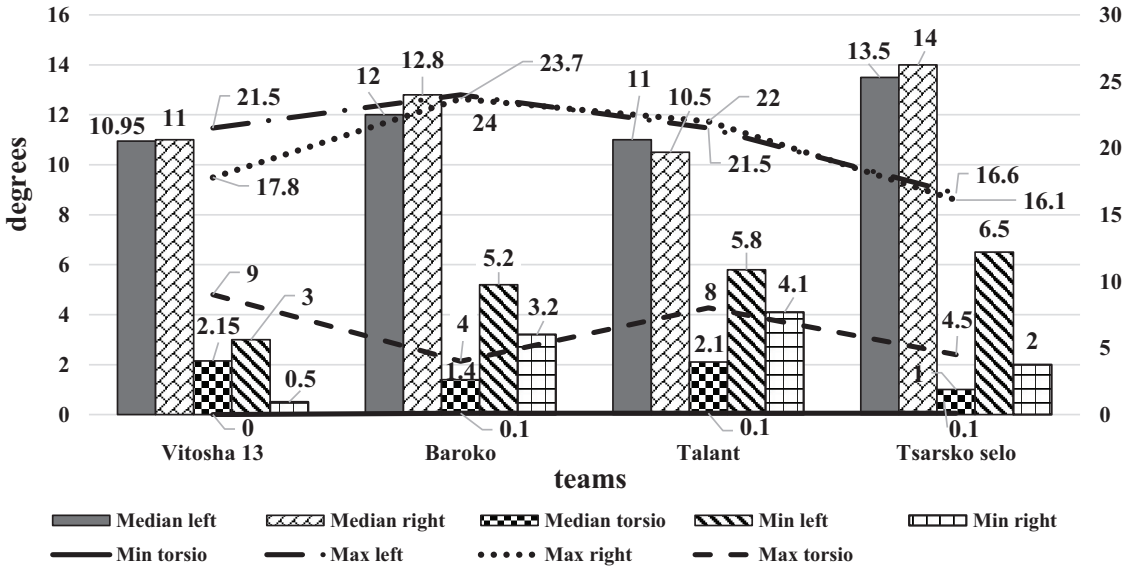


Figure 3. *Inclinometer results by team*

Tracking the medians from the inclinometer to the left of the team shows the highest results of 13.5° for the children from Tsarsko Selo, while the other three teams have similar values with the lowest for Vitosha 13. Regarding the minimum values from the inclinometer on the left, again the highest 6.5° are for the children from Tsarsko Selo and the lowest 3° for Vitosha 13 (H = 4.792, Sig. = .188). On the other hand, the children from Tsarsko Selo have the lowest maximum values of 16.6° from the inclinometer on the left, while the other three teams have similar data with the highest results for Baroko with 24° (Figure 3).

The medians from the inclinometer on the right are similar, with the highest being 14° again for the children from Tsarsko Selo and the other three teams having similar values with the lowest with 10,5° for Talant. However, the minimum values from the inclinometer on the right are the highest with 14° for Talant and the lowest of 0.5° for Vitosha 13 (H = 7.867, Sig. = .049). Regarding the maximum values from the inclinometer on the right, the lowest result of 16.1° is for the children from Tsarsko Selo and Vitosha 13 of 17.8° (Figure 3).

The data from the inclinometer torsion are essential, with the median being the lowest 1° for the children from Tsarsko Selo and 1.4° for

Baroko. Greater pelvic torsion is reported for Vitosha 13 of 2.15° and for Talant 2.1°. Encouraging is the data from the inclinometer regarding minimum values of the pelvis torsion, which are 0° or 0.1° in all four teams. However, the results of the inclinometer are different regarding the maximum values of pelvic torsion, which are highest in the children from Vitosha 13 with a value of 9° and Talant with 8° (H = 10.506, Sig = .015). The values are also high at Tsarsko selo 4.5° and Baroko 4° (Figure 3).

In addition, also the data of the pelvis torsion shows statistically significant differences between groups according to age (first 6-7, second 8-9, and third 10-11 years) H = 8.432 (Sig. .015) (Figure 4).

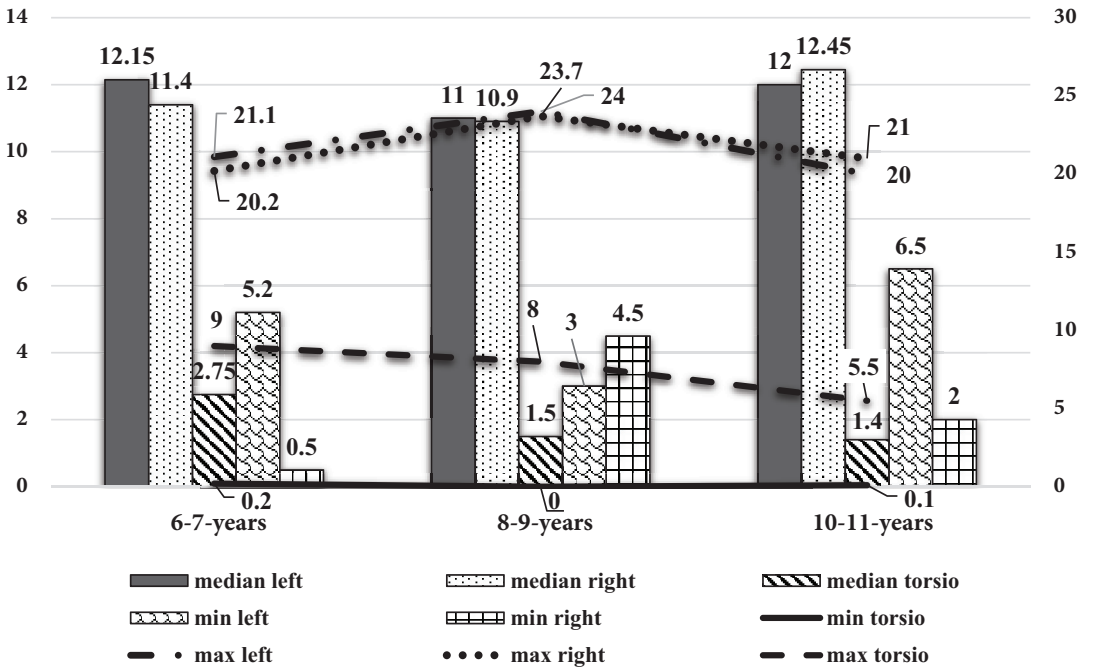


Figure 4. *Inclinometer results by age*

It is clear from Figure 4 that the 10-11-year-old group has the highest medians regarding the left 12° (H = 1.064, Sig. = .587) and 12.45° (H = 1.234, Sig. = .540) right inclinometer. On the other hand, pelvic torsion has the highest median 2.75° of in the youngest soccer players, 6-7 years old (H = 8.432, Sig. = .015). Subsequently, in the case of older children, the medians drop to 1.5° in the 8–9-year-olds and retain their lower values of 1.4° in the oldest examined at 10-11 years old (Figure 4).

Worryingly, the minimum values from the inclinometer on the left are high in all three age groups, with the highest in 10-11-year-old footballers with a value of 6.5°. The minimum values of the inclinometer on the right are lower than those on the left, with the highest values 4.5° for football players aged 8-9 years. The minimum values of the inclinometer on the right are lower than those on the left, being highest 4, 5° in the 8-9 year-old footballers and dropping to 2° in the 10-11 year olds. An important result is that for pelvic torsion the minimum values are close to the norm or close to it in all three age groups (Figure 4).

The maximum values of the inclinometer are highest in the 8-9-year-olds, with 24° on the left and 23.7° on the right. Significantly high medians are also found for pelvic torsio, which are the highest 9° in 6-7-year-olds and decrease in 8-9-year-olds to 8° and reach 5.5° in 10-11-year-olds (Figure 4).

As a result of the established correlation between the torsion of the pelvis and the static-force endurance test (SFET) of the lower paravertebral muscles (LPM), the results of the Kruskal Wallis test are presented in Figure 5.

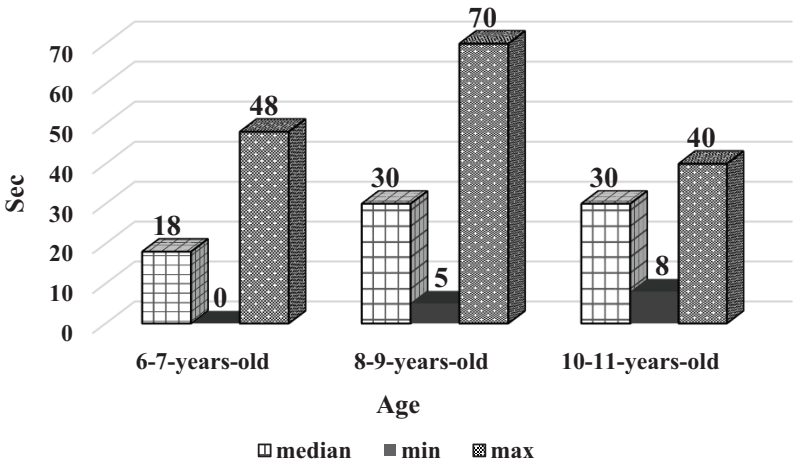


Figure 5. *SFET' results of the lower paravertebral muscles*

From Figure 5 it is clear that the median value of 18 sec is the lowest and is below the norm for 6-7-year-oldchildren playing soccer (H = 11.923, Sig. = .003). This result, as well as the presence of minimum values of 0 sec, is indicative that some children cannot complete the test. On the other hand, it is found that in this age group there are also children with results of 48 sec, which are above the norm. In the other two age groups 8-9 and 10-11, the annual medians are 30 seconds and are equivalent to the norm, with no minimum values of 0 seconds and the maximum reaching 70 seconds (Figure 5).

DISCUSSION

In our previous studies, we have applied DPI for functional diagnostics in the prevention of spinal deformities in 6-10-year-old children (Tasheva, Kolev, 2014). The efficiency of the method and the obtained results justified the inclusion of DPI in the prevention of injuries in children playing football. From the analysis, it is clear that there is a correlation between the results of the DPI and the LPM test. These results demonstrate the relationship between the static strength endurance of the lower paravertebral musculature and pelvic torsion. The data are indicative of the greatest degrees of pelvic torsion in the youngest 6-7-year-old children examined, while it decreases in the 8-9-year-olds and remains in the 10-11-year-olds. On the other hand, the data showed statistically significant differences between the teams and groups according to age regarding pelvic torsion and inclinometer on the right, necessitating analysis of the reasons for this. Inclinometer data for minimum pelvic torsion values were close to normal in all four teams, but maximum values were high. The obtained results determine the need to apply physiotherapy to reduce the inclination and torsion of the pelvis.

CONCLUSION

The application of Digital Pelvic Inclinometer provides an accurate diagnosis of pelvic inclination and the presence of torsion, which is essential for the timely treatment of functional dysfunctions and for the prevention of complications.

REFERENCES

Alentorn-Geli, E., Myer, G.D., Silvers, H.J., Samitier, G., Romero, D., Lázaro-Haro, C., Cugat, R. (2009). Prevention of non-contact anterior cruciate ligament injuries in soccer players. Part 2: a review of prevention programs aimed to modify risk factors and to reduce injury rates. *Knee Surg Sports Traumatol Arthrosc.* Vol. 17(8), pp. 859-79. doi: 10.1007/s00167-009-0823-z.

Di Paolo, S., Zaffagnini, S., Pizza, N., Grassi, A., Bragonzoni, L. (2021). Poor Motor Coordination Elicits Altered Lower Limb Biomechanics in Young Football (Soccer) Players: Implications for Injury Prevention through Wearable Sensors. *Sensors (Basel),* Vol. 21(13), pp. 4371. doi: 10.3390/s21134371.

Faude, O., Rößler, R., Junge, A. (2013). Footbaal inyuries in children and adolescent players: are there clues for prevention? *Sports Med.*, Vol. 43(9), pp. 819-37. doi: 10.1007/s40279-013-0061-x

García-Luna, M.A., Cortell-Tormo, J.M., García-Jaén, M., Ortega-Navarro, M., Tortosa-Martínez, J. (2020). Acute Effects of ACL Injury-Prevention Warm-Up

and Soccer-Specific Fatigue Protocol on Dynamic Knee Valgus in Youth Male Soccer Players. *Int J Environ Res Public Health.,* Vol. 17(15), pp. 5608. doi: 10.3390/ijerph17155608.

Gigova, V. (2019). *Statistical methods with SPSS 19.* Guide for students of the Master's and PhD programs of the National Sports Academy "Vasil Levski", Sofia. ISBN 978-954-718-596-8

Llurda-Almuzara, .L, Pérez-Bellmunt, A., Labata-Lezaun, N., López-de-Celis, C., Moran, J., Clark, N.C. (2022). Sex Differences in Pre-Season Anthropometric, Balance and Range-of-Motion Characteristics in Elite Youth Soccer Players. *Healthcare (Basel),* Vol. 10(5), pp. 819. doi: 10.3390/healthcare10050819.

Padua, D.A., DiStefano, L.J., Beutler, A.I., de la Motte, S.J., DiStefano, M.J., Marshall, S.W. (2015). The Landing Error Scoring System as a Screening Tool for an Anterior Cruciate Ligament Injury-Prevention Program in Elite-Youth Soccer Athletes. *J Athl Train.* Vol. 50(6), pp. 589-95. doi: 10.4085/1062-6050-50.1.10.

Prieto-González, P., Martínez-Castillo, J.L., Fernández-Galván, L.M., Casado, A., Soporki, S., Sánchez-Infante, J. (2021). Epidemiology of Sports-Related Injuries and Associated Risk Factors in Adolescent Athletes: An Injury Surveillance. *Int J Environ Res Public Health,* Vol. 18(9), pp. 4857. doi: 10.3390/ijerph18094857.

Tasheva, R., Kolev, K. (2014). Detailed functional diagnostic in lumbar lordosis through Hamstring length test. *Congress Proceedings 9th FIEP European Congress, 7th International Scientific Congress "Sport, Stress, Adaptation",* NSA "Vassil Levski", Sofia, 9-12 October, pp. 122-126.

Thompson, J.A., Tran, A.A., Gatewood, C.T., Shultz, R., Silder, A., Delp, S.L., Dragoo, J.L. (2017). Biomechanical Effects of an Injury Prevention Program in Preadolescent Female Soccer Athletes. *Am J Sports Med.,* Vol. 45(2), pp. 294-301. doi: 10.1177/0363546516669326.

Waldén, M., Atroshi, I., Magnusson, H., Wagner, P., Hägglund, M. (2012). Prevention of acute knee injuries in adolescent female football players: cluster randomised controlled trial. *BMJ,* May 3, No. 344, ep. 3042. doi: 10.1136/bmj.e3042.

Corresponding author:
Prof. Rumiana Tasheva, PhD
National Sports Academy "Vassil Levski"
1, Gurgulyat Str.
1000 Sofia, Bulgaria
E-mail: rumiana_tasheva@yahoo.com

THE USE OF SPECIALIZED KINESITHERAPY IN PATIENTS WITH ISCHEMIC STROKE WHO ARE TREATED WITH TISSUE PLASMINOGEN ACTIVATOR

Mariela Filipova[1], Daniela Popova[2] & Christyan Stoychev[1]
[1]SWU "Neofit Rilski", Faculty of Public Health,
Health Care and Sport, Department Kinesitherapy
[2]Medical university-Sofia, Faculty of Public Health, Department Kinesitherapy

ABSTRACT
Introduction: In kinesitherapy practice, the challenge is the use of venous thrombolysis with tissue plasminogen activator, due to the relatively severe general condition and the need for kinesitherapy in the first 12 hours of application of tissue plasminogen activator. In our methodology, we introduce the application of passive and active exercises, PNF method, mirror therapy, kinesiotape, etc.
Aim and objective: The aim of the study is to compare the methodology proposed by us with standard ones. The subject of the study were 15 patients with ischemic stroke who were treated with venous thrombolysis. Their advantages and disadvantages in the application will be highlighted
Methods: The study was conducted in the period from 2008-2014 in the Neurology Department at the Hospital in Blagoevgrad. The use of specialized kinesitherapy in 15 patients with ischemic stroke treated with venous thrombolysis (experimental group) was compared with the use of standard methods in non-thrombolized (control group) patients. In our study, we used the Barthel Index to verify the data. Statistically significant difference is reported using nonparametric statistics and Mann-Whitney tests.
Results: In our study, we examined the activities of daily living using the Barthel index scale. All patients were tested on the day of hospitalization, on the 5th day, and on the 30th day. Of the experimental group, there was a statistically significant difference Asymp. Sig. ≤ .001, which proves that there was a change in the activities of daily living. No statistically significant difference was registered in the control group.
Discussion: Through intravenous thrombolysis, a specialized kinesitherapy program, including passive, active movements in the uninjured limbs, in mirror therapy and kinesiotaping patients have a better quality of life and faster recovery occurs.

Keywords: *kinesitherapy, venous thrombolysis, tissue plasminogen activator, ischemic stroke*

INTRODUCTION

In kinesitherapy practice, the challenge is the use of venous thrombolysis with tissue plasminogen activator, due to the relatively severe general condition and the need for kinesitherapy in the first 12 hours of application of tissue plasminogen activator. In our methodology, we introduce the application of passive and active exercises, PNF method, mirror therapy, early verticalisation and mobilization, etc. Arnold et al., (2015) looked at options for very early mobilization (within 24 hours) of stroke patients after intravenous recombinant tissue plasminogen activator (IV rt PA) as a safe and feasible activity. Eighteen patients were included in the study and were assessed with a pre-mobilization safety checklist; 72.2% (13 of 18) were verticalized without complaints or deterioration. The research team reported that one patient had an orthostatic response and one patient had a transient worsening of hemiparesis. No patient had an intracranial hemorrhage or persistent worsening of neurologic deficits. Ifejika-Jones et al., (2011) performed a retrospective analysis of all ischemic stroke patients who sought (within the initial three-hour window for intravenous thrombolysis) care and were admitted to the Houston School of Medicine's Stroke units at The University of Texas at Memorial Hermann Hospital - Texas Medical Center. The study was conducted between January 2004 and October 2009. The authors used baseline demographic data and the National Institutes of Health Stroke Scale (NIHSS scale) results: Of 2,225 patients with acute ischemic stroke, 1,019 were discharged home, 719 for inpatient rehabilitation, 371 for qualified medical assistance, and 116 patients for sub-acute care. From the resulting data, the research team concluded that patients who received recombinant tissue plasminogen activator therapy were more likely to be discharged home compared to other levels of care (P < .0001; OR, 1.945; 95% CI, 1.538 to 2.459). Given inpatient rehabilitation rather than physiotherapy in a physiotherapy and rehabilita-

tion unit. In conclusion, from the published article, the author team concluded that patients who receive intravenous recombinant tissue plasminogen activator as a treatment for acute ischemic stroke are more likely to be discharged directly to home after hospitalization without transfer to a physical therapy unit. A team of authors report in their publication that limited information is available on the possibilities of conducting kinesitherapeutic procedures provided in hospitals for the emergency treatment of people who have survived a stroke. Of the studied contingent, 61% of patients with ischemic stroke received kinesitherapy and occupational therapy in the acute period of the disease (Kumar et al., 2019). Another team of scientists conducted a study on the effect of the application of kinesitherapy (mirror therapy) and speech therapy during the first 2 weeks after an acute cerebrovascular accident, claiming that due to the spontaneous onset of recovery, it is difficult to measure the effect of kinesitherapy and aphasia recovery. According to the authors, the optimal time to initiate rehabilitation after stroke remains undetermined, although there is increasing evidence that, for at least some deficits, initiation of rehabilitation strategies within the first 2 weeks of stroke is beneficial (Coleman et al., 2017). Another researcher in her dissertation offers an author's methodology for the recovery of patients with ischemic stroke treated with venous thrombolysis (Filipova, 2015). It combines elements of various methods to support the rehabilitation potential of patients in the first 12-24 hours after a cerebrovascular accident, including passive exercises, active exercises (if possible), PNF, mirror therapy, joint mobilization, and early verticalization. A team of researchers offers opportunities to influence the gait of patients who have experienced a stroke through kinesitherapy (Vasileva et al., 2015a). The same team also developed a kinesitherapy program for restoring balance disorders in patients with ischemic stroke (Vasileva et al., 2015b). Madhoun et al., (2020) conducted a randomized controlled trial on the effects of mirror therapy applied to stroke-damaged upper limbs, and is still one of the challenges of neurorehabilitation. However, the effectiveness of this type of therapy and patients with moderate and severe damage to the upper limbs has not been deeply studied. The authors compared the efficacy of mirror therapy and ergotherapy, and the reporting of the results was carried out by comparing motor function and daily activities in patients with subacute stroke (in a rehabilitation hospital). All 35 patients with moderate and severe subacute stroke were divided into two groups (experimental and control). Convection therapy, mirror therapy, and ergotherapy were used in the experimental group. No mirror therapy was used in the control group. The research team included the following test battery: the Fugl-Meyer Score (FMA), the Brunnstrom Score (BRS), the Modified Barthel Index (MBI), and the Modified Ashworth Scale (MAS). After 25 procedures, patients in both groups showed improvement in activities of daily living, motor recovery, and motor function. No significant differences were observed between the two groups on BRS and MBI. However, interestingly, the results of the group of patients who received mirror therapy were significantly better than the control group in FMA ($P < .05$), and some aspects of MAS (elbow flexion, wrist flexion, wrist extension, and finger extension with $P < .05$). In conclusion, this study shows that the combination of conventional rehabilitation treatment and mirror therapy is an effective way to improve functional recovery in upper extremity stroke patients. Lubenova & Lubenov (2021) offer an innovative approach to recovery after a stroke by using interactive games as an element of neurorehabilitation and proven positive results from the applied methodology.

Aim *and objective.* The aim of the study is to compare the methodology proposed by us with standard ones. The subject of the study were 15 patients with ischemic stroke who were treated with venous thrombolysis. Their advantages and disadvantages in the application will be highlighted

METHODS

The study was conducted in the period from 2008-2014 in the Neurology Department at the Hospital in Blagoevgrad. The use of specialized kinesitherapy in 15 patients with ischemic stroke treated with venous thrombolysis (experimental group- EG) was compared with the use of standard methods in non-thrombolized (control group - CG- 15 patients). All patients signed an informed consent. In our study, we used the Barthel Index to verify the data. Statistically significant difference is reported using nonparametric statistics and Mann-Whitney tests (Table 1). Prism 3.0 statistical package was used for the graphical processing of their graphical representation.

Table 1. *Data with Barthel index results in the EG on the 5-th and 30-th day of discharge*

Table Analyzed	**Data Table-1 Columns A and B**
Mann Whitney test	
P value	P < .0001
Exact or approximate P value?	Gaussian Approximation
P value summary	***
Are medians sig. different? (P < .05)	Yes
One- or two-tailed P value?	One-tailed

No statistically significant difference was observed in the Barthel index results (p < .097) of patients from the control group (Table 2). Regarding the activities of daily life in EG, we report a statistically significant difference in the period up to the 30th day. In the control group, retention of the results was observed, without statistically significant differences.

Table 2. *Data with Barthel index results in CG on the 5th and 30th day of discharge*

Table Analyzed	**Data Table-1 Columns C and D**
Mann Whitney test	
P value	.0977
Exact or approximate P value?	Gaussian Approximation
P value summary	ns
Are medians sig. different? (P < .05)	No
One- or two-tailed P value?	One-tailed

From the results presented (Table 3), a trend towards faster recovery of motor capabilities and correspondingly performing activities of daily living (ANOVA) was observed.

Table 3. *Dynamics of Barthel index results in EG and CG on the 5th and 30th day of discharge*

Table Analyzed	
One-way analysis of variance	
P value	P < .0001
P value summary	***
Are means sig. different? (P < .05)	Yes
Number of groups	4
F	95.22
R squared	0.8361
Bartlett‘s test for equal variances	
Bartlett‘s statistic (corrected)	15.44
P value	.0015
P value summary	**
Do the variances differ sig. (P < .05)	Yes

RESULTS

In our study, we examined the activities of daily living using the Barthel index scale. All patients were tested on the day of hospitalization, on the 5th day, and on the 30th day. Of the experimental group, there was a statistically significant difference Asymp. Sig. ≤ .001, which proves that there was a change in the activities of daily living. No statistically significant difference was registered in the control group.

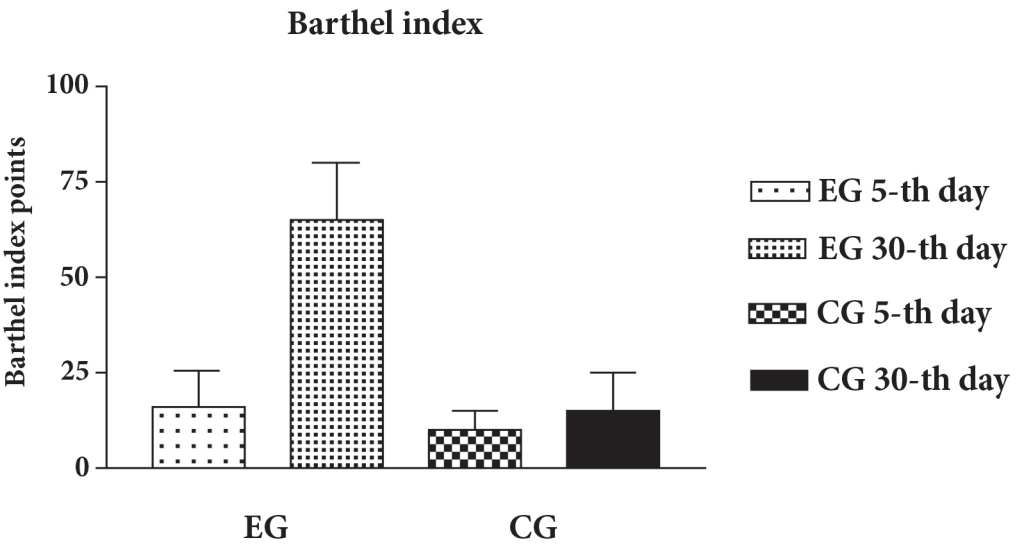


Figure 1. *Data from Barthel index results in EG and CG on the 5th and 30th day of discharge*

DISCUSSION

In the present study, statistically reliable results were obtained, which allow to claim that the innovative, combined kinesitherapeutic methodology supports the full recovery of the patient. Through intravenous thrombolysis, a specialized kinesitherapy program, including passive, active movements in the uninjured limbs, in mirror therapy, and kinesiotaping patients have a better quality of life and faster recovery occurs. The application of intravenous thrombolysis is extremely important because it significantly shortens the stay of patients in the hospital ward, significantly reduces motor deficits, and this is a good basis for the full and rapid recovery of patients after applied combined kinesitherapy.

REFERENCES

Arnold, S.M. Dinkins, M. Mooney, L.H. Freeman, W.D. Rawal, B. Heckman, MG. Davis, O.A. (2015). Very early mobilization in stroke patients treated with intravenous recombinant tissue plasminogen activator, *J Stroke Cerebrovasc Dis.,* Vol. 24 No. 6, pp. 1168-73.

Ifejika-Jones, N.L. Harun, N. Mohammed-Rajput, N.A. Noser, E.A. Grotta, J.C. (2011). Thrombolysis with intravenous tissue plasminogen activator predicts a favorable discharge disposition in patients with acute ischemic stroke. *Stroke,* Vol.42 No. 3, pp. 700-704.

Filipova, M. (2015). Kinesitherapy for patients with ischemic stroke, treated with intravein thrombolysis [dissertation]. Blagoevgrad (Bulgaria): South West university; 2015, 191p. [In Bulgarian].

Kumar, A. Adhikari, D. Karmarkar, A. Freburger, J. Gozalo, P. Mor, V. Resnik, L. Variation in Hospital-Based Rehabilitation Services Among Patients With Ischemic Stroke in the United States. *Phys Ther.,* Vol. 99 No.5, pp. 494-506.

Coleman, E.R. Moudgal, R. Lang, K. Hyacinth, H.I. Awosika, O.O. Kissela, B.M. Feng, W. (2017). Early Rehabilitation After Stroke: a Narrative Review. *Curr Atheroscler Rep.,* Vol. 19 No. 12, pp. 59.

Madhoun, H.Y. Tan, B. Feng, Y. Zhou, Y. Zhou, C. Yu, L. (2020). Task-based mirror therapy enhances the upper limb motor function in subacute stroke patients: a randomized control trial. *Eur J Phys Rehabil Med. 2020, Vol. 56 No. 3, pp. 265-271.*

Lubenova, D. & Lubenov, N. (2021). Optimizing video games in neurorehabilitation*, Neurosonology and cerebral hemodynamics,* Vol. 17 No. 2, pp. 1-13.

Vasileva, D. Lubenova, D. Mihova, M. Dimitrova, A. Grigorova-Petrova, K. (2015a). Influence of kinesitherapy on gait in patients with ischemic stroke in the chronic period, *Open Access Macedonian Journal of Medical Sciences*, Vol.3 No. 4, pp. 619–623.

Vasileva, D. Lubenova, D. Mihova, M. Dimitrova, A. Grigorova-Petrova, K. (2015b). Influence of kinesitherapy on balance reactions in patients with ischemic stroke in the chronic period, *Open Access Macedonian Journal of Medical Sciences,* Vol.3 No. 4, pp. 601–606.

Corresponding author:
Mariela Filipova, PhD
Departament „Kinsitherapy“,
SWU „Neofit Rilski“,
Blagoevgrad 2700, Bulgaria
Email: mariela_filipova@swu.bg

ALTERED MOBILITY IN THE SPINE AS A PREREQUISITE FOR CHRONIC NON-SPECIFIC LOW BACK PAIN

Vesela Dimitrova & Lyubomira Sazdova
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
Chronic low back pain is a common pathology, both in everyday life and in sports also. It impairs daily comfort, quality of life, and physical activity - for amateurs, and professionals. Doctors, physiotherapists, fitness trainers, psychologists, and others see into this issue. The causes of chronic low back pain can be mechanical, biochemical, and psycho-emotional. In 95% of cases, the cause is myofascial structures (Malanga, Cruz, Colon, 2010). A meta-analysis that looks through the treatment of this type of pain indicates exercise as a mandatory tool to address this problem. Specifying the type of motor activity is a condition for managing the pain. (Shipton, 2018)
The aim of the study was to establish characteristic pathobiomechanical patterns in the mobility of the spine in patients with chronic nonspecific low back pain.
Methodology: A cohort study of 60 patients who complained of chronic nonspecific low back pain was performed. The indicators on which they were studied are the measurement of the mobility of the thoracic spine according to Ott, and the measurement of the mobility of the lumbar spine according to Schober. The relationship between the change in mobility in the different parts of the spine and the presence of chronic pain was studied.
Conclusion: The results of the study showed statistically significant data that the change(alternate) in the mobility of each of the sections in the spinal column leads to an increase or decrease in mobility in the adjacent parts. In this study, in 2/3 of cases with chronic non-specific low back pain, there is an increase in the mobility of the lumbar region, which leads to instability and overwhelming of soft tissues in the area, and this leads to pain.

Keywords: *spine, chronic non-specific pain, mobility*

INTRODUCTION

Gravity is a constant force acting on the human body. Upright posture and movement of the body in space require the optimal conditions of the musculoskeletal system. Stability is the ability of the body to maintain postural equilibrium and support joints during the movements. Deficiency of strength and endurance due to immobility, trauma, or a sedentary lifestyle, leads to compensatory mechanisms of the musculoskeletal system. The stabilizing function is outrun by the mobility one. (Fransson et al., 2000; Solberg, 2008)

Mobility can be defined as the ability of a joint to move freely without significant physical obstacles. In contrast, stability may be simply defined as resistance to movement. Though these concepts appear diametrically opposed, a complex synergistic relationship exists between these two qualities. In order to produce efficient movements at the joints, there must be a base of stability (i.e., anchor point) that allows the appendages to travel through their intended ranges of motion, at the required velocities, without undue restriction. (Sciascia, Cromwell, 2012)

When the joints are looked at individually, each joint can be classified by its main responsibility. Of course, every joint will have some overlap in roles, but each has a primary function for the upright position. The stable joints are the foot, knee, lumbar spine, cervical spine, and elbow. (Figure 1) The mobility joints are the ankle, hip, thoracic spine, shoulder, and wrist. A clear pattern emerges in that the kinetic chain is a series of joints stacked on top of each other in an alternating pattern of stability and then mobility. This sequence creates the ideal platform for dynamic human movement. (Sciascia, Cromwell, 2012)

Segmental stability is dependent on muscular strength and endurance and CNS. It is the ability of the muscular system to efficiently execute and control movement patterns. The golf swing, for example, requires certain parts of the kinetic chain to be moving while additional segments are stationary. In order for the kinetic chain to execute these movement patterns in an efficient manner requires the muscular system to have specified levels of strength and endurance to both maintain postural positions and perform every day or athletic actions.

The Mobility/Stability Pattern of Human Movement Principle was created by noted physical therapist Gray Cook and strength coach Mike Boyle. The Mobility/Stability Pattern of Human Movement states efficient movement within the kinetic chain occurs in an alternating pattern of mobile joints and stable body segments (Figure 1). If this pattern is altered, dysfunction in movement patterns will occur and compensations in these movement patterns will be the result. (Sciascia, Cromwell, 2012)

Unfortunately, a disruption in this pattern can occur, creating movement dysfunctions. The most common causes of this alternating pattern disruption include previous injury, chronic pattern overload, muscle imbalances, or bony misalignments. When issues like these occur, they can affect the normal function of the joint. If the dysfunction is severe enough, the joint, or in many cases joints, will then begin to lose the ability to maintain its primary stability or mobility function. Quite often the joints that are stability-based become more mobile, and the joints that are mobility-based become more stable.

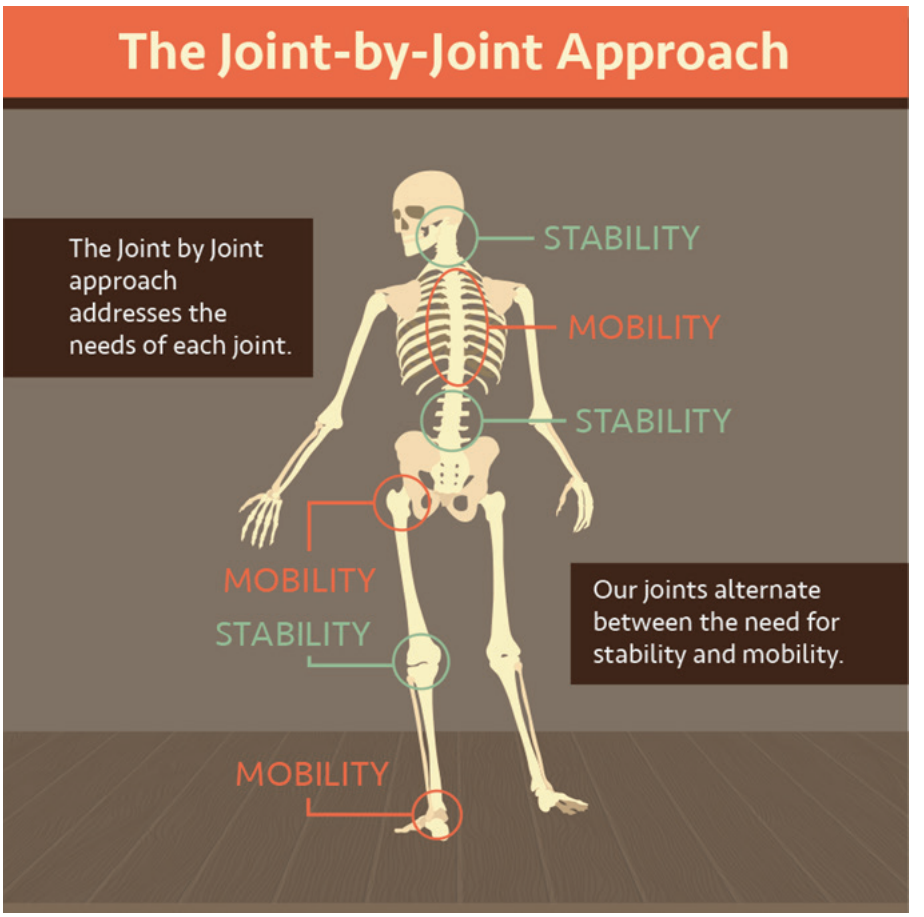


Figure 1. *Movements pattern of the body according to axial load (Cook, 2010)*

When the joints within the kinetic chain lose their primary role due to dysfunction and change roles, human movement becomes compromised and the chance of injury increases significantly.

These compensations lead to hyperactivity of the dynamic muscles and subsequently to reduced mobility and flexibility, which leads to a pathological chain of reactions in the system. (Key, 2010) Most often the compensatory mechanisms are associated with changes in the sagittal plane, i.e., the presence of upper and lower cross syndrome in order to maintain balance and upright position of the spine and body (Figure 2). (Key, 2010; Solberg, 2008) This requires changes in the center of the gravity of each segment of the spine to hold close to the center of the gravity of the body. The human system tries to work economically and one part of the load goes from muscles through ligaments and facet joints and disks. (Fransson, 2000; Janda, 1987)

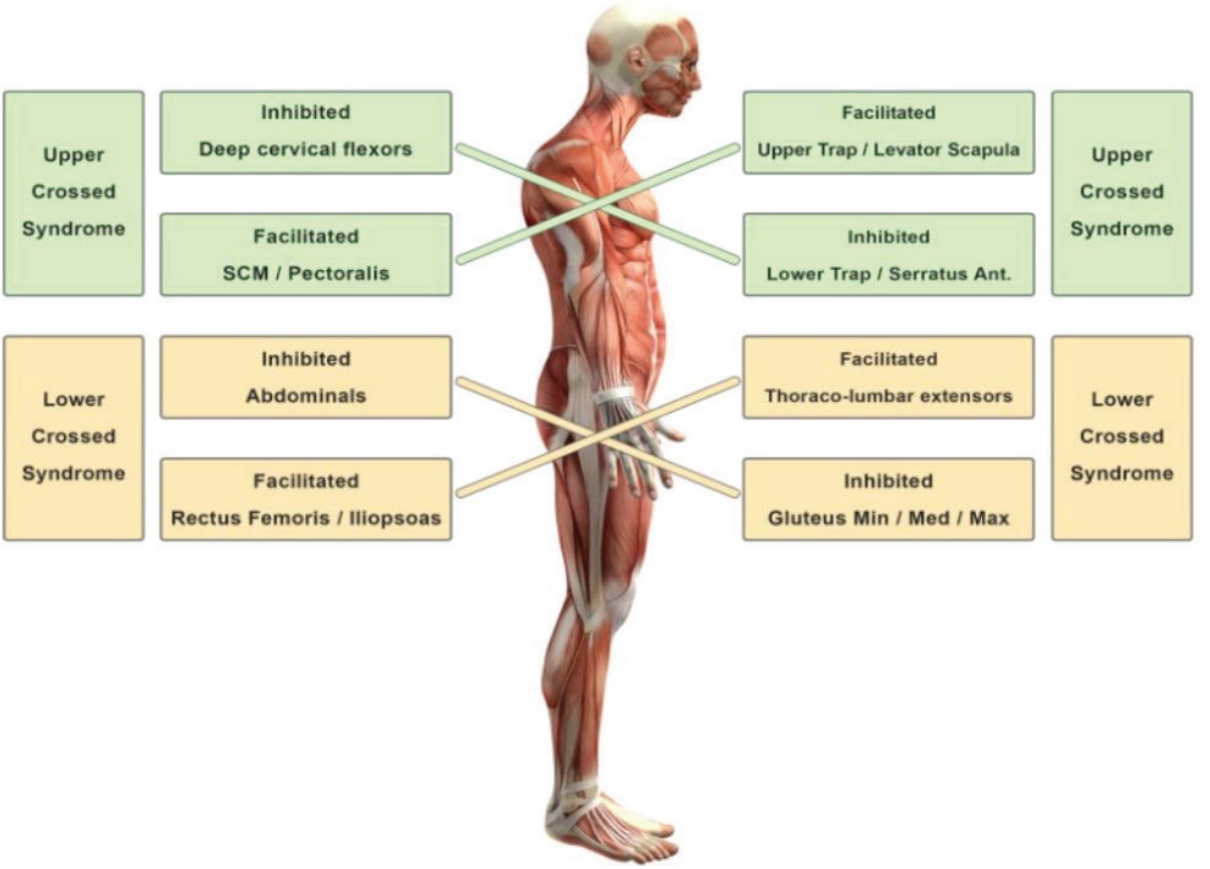


Figure 2. *The Janda's model of upper and lower crossed syndrome*

Upright posture is a challenge for the body and nervous system. Disruption of the mechanisms and structures that support it leads to pain and dysfunction. One of the most common problems is low back pain.

Studies related to chronic non-specific low back pain show that in 85% of cases the pain is caused by muscle imbalance and muscle weakness in the area of the spine. (Zheng, 2018) Most studies have highlighted the weakness of the abdominal muscles and in particular the impaired coordination in the work of m. transversus abdominis and mm. multifidus, as well as the reduced strength in m. gluteus maximus. (Fortin, Macedo, 2013; Truchon, 2001)

To deal with the problem, an exercise program is recommended, which strengthens the weakened muscles and strengthens the problem area. This would be more efficient if adjacent areas were influenced beforehand.

The aim of the study was to monitor the mobility of the thoracic and lumbar spine in patients with chronic nonspecific low back pain.

METHODOLOGY

In the study were included 60 patients who had complaints of nonspecific chronic low back pain for more than 3 months. 48 women and 12 men were studied. Patients with neurological symptoms were excluded from the study. A description of the purpose and methods of the study was provided to all the participants, and the experiments were conducted after the participants had read and signed an informed consent form. The study used the methods of Ott and Schober for mobility of the thoracic and lumbar spine. The results were processed by statistical analysis.

RESULTS

The results show reduced mobility in the thoracic region and increased mobility in the lumbar spine. Test Ott is represented at Table 1, Figure 3. Test Schober is shown at Table 2, Figure 4.

From the processing of the results, it can be seen that 81.67% of the studied contingent are women.

The results of the Ott test showed that only 11.67% of the participants were within the norm. (Table 1, Figure 3)

In Schober's test, only 8.33% of the contingent are in the norm. (Table 2, Figure 4)

These results show statistically significant differences regarding the hypothesis that chronic low back pain is likely to be associated with altered mobility in the different parts of the thoracic and lumbar spine.

Probably normalizing the mobility in the different parts of the spine would improve the functional state of the whole spine.

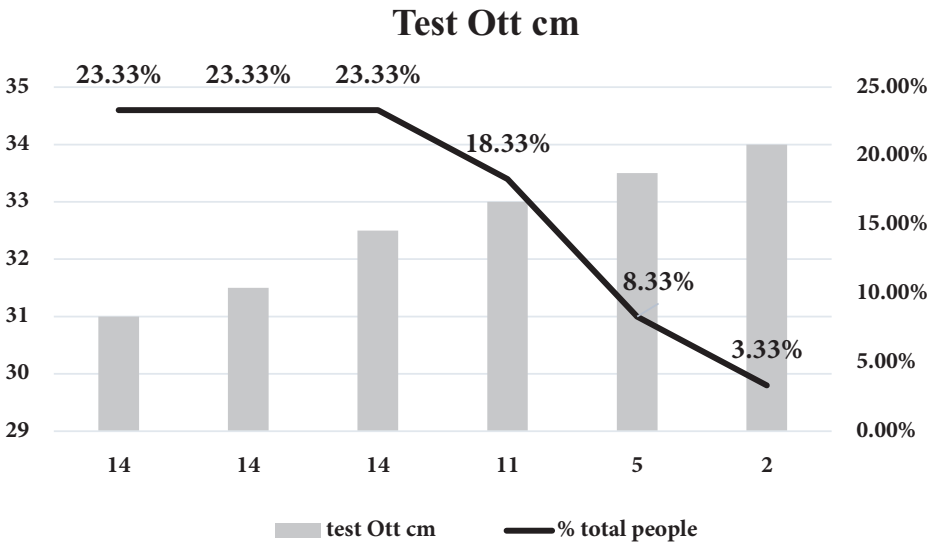


Figure 3. *The proportion of people according to the mobility of the thoracic spine*

Table 1. *Ratio Ott in centimeters/people*

man	14	14	14	11	5	2
test Ott cm	31	31.5	32	32.5	33	34
% Of total people	23.33%	23.33%	23.33%	18.33%	8.33%	3.33%

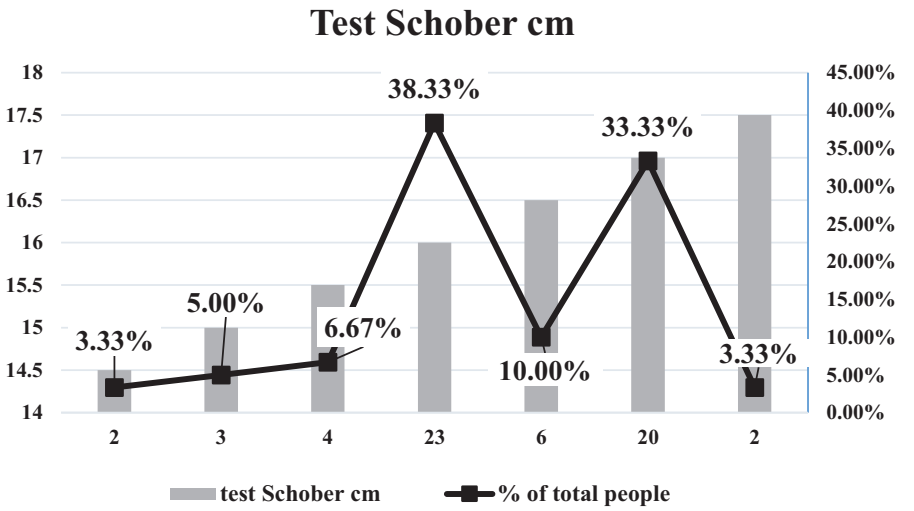


Figure 4. *The proportion of people according to the mobility of the lumbar spine.*

Table 2. *Ratio Schober in centimeters/people*

man	2	3	4	23	6	20	2
test Schober cm	14.5	15	15.5	16	16.5	17	17.5
% Of total people	3.33%	5.00%	6.67%	38.33%	10.00%	33.33%	3.33%

DISCUSSION

Increased thoracic and lumbar curvature as well as increased pelvic inclination were observed in the participants. These signs suggest the existence of upper and lower cross syndrome, which leads to deterioration of the function of the individual parts of the spine, as well as its overall function. (Janda, 1987; Key, 2010; Kang et al., 2013)

Activation of some muscles leads to the inhibition of others, which leads to the establishment of pathological patterns of movement. When continued for a long period of time they lead to inflammation, pain, and structural changes.

In addition, patterns of motion in the body can be considered in closed and open kinetic chains. (Solberg, 2008). In a modern technological society, the upper limbs, which work in an open kinetic chain, are more loaded, but in order to work optimally, stabilization by the thoracic part of the spine is needed. The lower limbs work in a closed kinetic chain and this requires stabilization by the pelvis. In this way, two rigid segments are formed in the spine.

Knowing the biomechanics of the human body, we can expect that stiffness in one part will lead to hypermobility in an adjacent area, which we observe in this case in patients with nonspecific chronic low back pain. This assumption may change the approach to working out the standard physiotherapy program.

CONCLUSION

The results of the study showed statistically significant data that the alternate in the mobility of each of the sections in the spinal column leads to an increase or decrease in mobility in the adjacent parts. In this study, in 2/3 of cases with chronic non-specific low back pain, there is an increase in the mobility of the lumbar region, which leads to instability and overwhelming of soft tissues in the area, and this leads to pain.

An increase in thoracic kyphosis and lumbar lordosis was observed in patients. This is a compensatory adaptive mechanism of the body in order to maintain a stable equilibrium position of the body.

Reduced mobility in the adjacent parts of the lumbar region leads to over-mobility in this region and is a prerequisite for an excessive strain on the muscles in the region that maintain stability and be More extensive studies investigating the relationship between chronic pain and altered biomechanical movement patterns of the spine and musculoskeletal system are needed come to understand the source of pain.

REFERENCES

Fortin, M., Macedo, L. (2013). Multifidus and paraspinal muscle group cross-sectional areas of patients with low back pain and control patients: a systematic review with a focus on blinding., *Phys Ther*. 2013 Jul;93(7):873-88. doi: 10.2522/ptj.20120457.

Fransson, P., Johansson, R., Hafström, A., Magnusson, M. (2000). Methods for evaluation of postural control adaptation. *Gait Posture*, Sep;12(1):14-24. doi: 10.1016/s0966-6362(00)00052-7.

Janda, V. (1987). *Muscles and motor control in low back pain: Assessment and management. In: Twomey Lt. Physical therapy of the low back*. New York, Edinburgh, London: Churchill Livingston, 1987;253-87.

Kang, M., Jung, D., An, D., Yoo, W., Oh, J. (2013). Acute effects of hamstring-stretching exercises on the kinematics of the lumbar spine and hip during stoop lifting., *J Back Musculoskeletal Rehabil.*;26(3):329-36. doi: 10.3233/BMR-13038.

Key, J. (2010). The Pelvic Crossed Syndromes: A reflection of imbalanced function in the myofascial envelope; a further exploration of Janda's work. *Journal of bodywork and movement therapies*. 2010 July; 14:299-30

Malanga, G., Cruz, C. (2010). Myofascial low back pain: a review. *Phys Med Rehabil Clin N Am.* Nov; 21(4):711-24, available at: https:// doi: 10.1016/j.pmr.2010.07.003.

Sciascia, A., Cromwell, R. (2012). *Kinetic Chain Rehabilitation: A Theoretical Framework*, PMCID: PMC3361354, PMID: 22666599, Published online 2012 May 14. doi: 10.1155/2012/853037

Shipton, E.A., (2018). Physical therapy approaches in

the treatment of low back pain. *Pain and therapy*, 7(2), pp.127-137.

Solberg, G. (2008). *Postural Disorders and Musculoskeletal Dysfunction: Diagnosis, Prevention and Treatment*. Book, Second Edition.

Truchon, M. (2001). Determinants of chronic disability related to low back pain: towards an integrative biopsychosocial model. *Disabil Rehabil.* 2001 Nov 20;23(17):758-67.

Zheng, Y, Ke, S., Lin, C., Li, X., Liu, C, Wu, Y., Xin, W., Ma, C., Wu, S. (2019). Effect of Core Stability Training Monitored by Rehabilitative Ultrasound Image and Surface Electromyogram in Local Core Muscles of Healthy People. *Pain Research and Management*.

Corresponding address:
Vesela Dimitorova
PhD student
Department of Theory and Methods of Kinesitherapy
National Sports Academy "Vassil Levski"
Sofia, Bulgaria
e-mail: vvvesi_bg@yahoo.com

COMPLEX SPEECH THERAPY AND KINESITHERAPEUTIC ASSESSMENT IN PERSONS WITH ACQUIRED NEUROLOGICAL DISEASES

Miglena Simonska[1], Mariela Filipova[2] & Anna Andreeva[1]
[1] SWU "Neofit Rilski", Faculty of Public Health, Health Care and Sport, Department of Logopedics; [2] SWU "Neofit Rilski", Faculty of Public Health, Health Care and Sport, Department Kinesitherapy

ABSTRACT
Introduction: The complex speech-language and kinesitherapeutic assessment in persons with acquired neurological diseases require a very specific and accurate assessment. It requires the use of a number of tests and full knowledge of the possibilities of disability.
Aim and objective: The aim of the research is to create a methodology for general assessment in neurologically diseased patients, using specialized equipment-device for digital assessment and analysis of the bite and analysis of dynamic and static muscle gait activity and random muscle groups.
Methods: The study was conducted in 2022 in the Center of Logopedics at the Faculty of Public Health, Health Care and Sport, SWU "Neofit Rilski" in Blagoevgrad. Specialized assessment was applied to 25 patients with neurological diseases. They were divided into two groups - experimental (15 patients) and control - 10 patients. In our study, we used the Barthel Index and The Gugging Swallowing Screen to verify the data. Statistically significant difference was reported using nonparametric statistics and Mann-Whitney tests. The statistical package we used was Prism 3,0.
Results: In our study, we examined the activities of daily living using the Barthel index scale and the swallowing screen test. All patients were tested after the hospitalization and on the 30th day of it. There was a statistically significant difference Asymp. Sig. ≤ 0.01, which proves that there were changes in the activities of daily living and swallowing.
Discussion: Proper selection of a test battery and application of specialized complex therapy (speech therapy and kinesitherapy) can increase the quality of life of patients.

Keywords: *speech therapy, kinesitherapy, swallowing disorders, complex assessment, neurological diseases*

INTRODUCTION

The complex speech therapeutic and kinesitherapeutic assessment in persons with acquired neurological diseases requires a very specific and accurate assessment. It requires the use of a number of tests and full knowledge of the possibilities of disability. The motor control of speech refers to the systems and strategies that regulate speech production, including the planning and preparation of movements (sometimes called motor programming) and the execution of movement plans that result in muscle contractions and structural displacements/shifts.

Traditionally, speech motor control has been distinguished from phonological operations, but in some recent phonological theories, there is a deliberate blurring of the boundaries between phonological representation and motor functions (Kent, 2000). The author, in his scientific work, examines problems in the control of motor speech and a class of communication disorders known as motor speech disorders. In addition, the author explores the literature where discussion of the nature of motor speech disorder (particularly apraxia of speech and stuttering) is available, whether phonological level, motor level, or both. Motor speech disorders considered by the author are dysarthria, apraxia of speech, developmental apraxia of speech, developmental stuttering, and acquired (neurogenic and psychogenic) stuttering (Kent, 2000). An author team found speech disorders as frequent consequences of acquired brain damage or neurodegenerative damage (Basilakos, Fridriksson, 2022). In their paper, they describe that although sudden speech difficulties may signal acute pathological conditions such as cerebrovascular accidents, determining the etiology of motor speech communication disorders may be somewhat easier.

Identifying a speech-motor impairment independent of language difficulties can be helpful for diagnosis, as there are subtle, albeit distinct, patterns of speech impairments associated with different neurological conditions.

Basilakos, Fridriksson (2022) also add that the identification of impairments specific to speech

processing may help to clarify supposed pathological mechanisms or even determine the topic of compromised neuroanatomical structures. During the routine clinical assessment, early warning signs of a motor speech impairment may go unnoticed if the clinician is without experience in assessing motor speech or is not aware of its clinical manifestations.

Another researcher makes an interesting connection between acquired psychogenic or functional speech disorders as a subtype of functional neurological disorders that can mimic organic speech disorders and manifest most often as dysphonia, stuttering, or fluency disorders. The diagnosis of the speech disorder as functional can be supported by the sometimes rapidly achieved positive results of symptomatic speech therapy (Duffy, 2016). A researcher points out that stroke is one of the most common conditions, often leading to death or permanent limitation of body functions and limitations in the quality of life, due to disorders such as dysarthria, aphasia, apraxia, and dysphagia. The author draws attention to the fact that post-stroke conditions are also characterized by a number of other disabilities, such as paresis and paralysis of the motor apparatus, cognitive disorders, and damage to the general state of health of the individual, accompanied by some of them by chronic diseases, which requires a team approach in assessment and therapy (Simonska, 2020; Mitova, 2016b).

According to other authors, the assessment of the condition of patients after a cerebrovascular accident is complex. They draw the attention of the evaluators that in the methodology for determining the kinesitherapeutic potential in the test battery, it should be appropriate to include a study of speech disorders (Filipova, Popova, 2019). The examination and restoration of gait in patients with acquired neurological diseases are also of fundamental importance for improving the quality of life and fully conducted kinesitherapeutic procedures. In their paper, a research team conducted a meta-analysis of all 33 randomized controlled trials investigating the use of exoskeletons or end-effector devices in adult stroke patients. Data from publications in databases (Medline, Embase, Central, Cinahl, Opengrey, Opensigle, Pedro, Web of science, clinical trials, and conference proceedings) from inception to November 2019 were reviewed.

Literature of previous metadata analyzes of patients who underwent kinesitherapy were also examined (before and after the rehabilitation program). The gait speed, gait endurance, Berg Balance Scale (BBS), Functional Ambulation Classification (FAC), and Timed Up and Go scores were reported in the reviewed publications. From the meta-analysis performed, the authors concluded that robot-assisted gait training combined with kinesitherapy and weight-bearing training appears to be an effective intervention for gait recovery after stroke (Moucheboeuf et al., 2020). Another team of authors - through a meta-analysis and a systematic review, looked for approaches to the recovery of stroke survivors through the use of virtual reality for limb motor function, the balance, the gait, cognition, and a daily function of stroke patients (Zhang, 2021).

A researcher is conducting a study on the treatment of patients with acquired neurological diseases in the elderly before hospice care (Mitova, 2016a). The authors Lyubenova, Lyubenov (2021) propose the use of video games as an element of the kinesitherapeutic program for patients in need of neurorehabilitation. Another collective of authors provides an opportunity to improve the quality of life by restoring gait in patients in a chronic recovery period (Vasileva et al., 2015). It is important to pay attention to the recommendations of the National Consensus on Prevention, Diagnosis, and Treatment of Cerebrovascular Diseases of the Bulgarian Society of Neurology from 2018 in item „…*2.2.1.3. Symptomatic treatment of the consequences of stroke*“, where it is written that “multidisciplinary care, motor and speech rehabilitation of patients with cerebral stroke” is recommended, a systemic approach (speech and kinesitherapy) is sought as an important part of the full recovery of patients with acquired neurological damage (Milanov et al., 2018).

Aim and objective: The present study aims to create a working protocol for the study of this type of patient and to create a methodology for complex speech therapy and kinesitherapy assessment, which can be used not only for diagnosis but also for monitoring the progress of therapy.

METHODS

The study is conducted in 2022 in the Center of Logopedics at the Faculty of Public Health,

Health Care and Sport, SWU "Neofit Rilski" in Blagoevgrad. 25 patients with neurological diseases were examined with specialized tests. They were divided into two groups - experimental (15 patients) and control - 10 patients. All patients signed an informed consent. In our study, we used the Barthel Index and The Gugging Swallowing Screen to verify the data. The statistical package Prism 3,0. was applied. Statistically significant difference was reported using nonparametric statistics and Mann-Whitney tests.

RESULTS

In our study, we examined the activities of daily living using the Barthel index scale and the swallowing screen test. All patients were tested after the hospitalization and on the 30th day of it. There was a statistically significant difference Asymp. Sig. ≤ 0.01, which proves that there were changes in the activities of daily living and swallowing. In addition, we supplemented the results with the use of the NIHSS scale, which considers motor deficits and the presence of speech disorders.

Table 1. *Statistics of NIHSS scale results for EG.*

Table Analyzed	**Data Table-1 Columns A and B**
Unpaired t-test	
P value	P < .0001
P value summary	***
Are means signif. different? (P < .05)	Yes
One- or two-tailed P value?	Two-tailed
t, df	t=14.34 df=28
How big is the difference?	
Mean ± SEM of column A	18.33 ± 0.4543 N=15
Mean ± SEM of column B	7.533 ± 0.6005 N=15
Difference between means	10.80 ± 0.7530
t, df	t=14.34 df=28

When comparing the data from the experimental and control groups, by ANOVA one way - Barthlet test proves that the groups are homogeneous and comparable p < .0091. When comparing the data in the experimental group, there is a statistically significant difference p < .0001 and data from the mean values after discharge (Mean ± SEM of column A-18.33 ± 0.4543 at N=15) and on the 30th day after hospitalization. (Table 1).

No statistically significant difference was found in the patients after discharge and on the 30th day after discharge (p < .0672). (Table 2).

Table 2. *Statistics of the results of the NIHSS scale for CG*

Table Analyzed	**Data Table-1 Columns C and D**
Unpaired t-test	
P value	.0672
P value summary	Ns
Are means sig. different? (P < 0.05)	No
One- or two-tailed P value?	Two-tailed
How big is the difference?	
Mean ± SEM of column C	18.00 ± 1.054 N=10
Mean ± SEM of column D	14.50 ± 1.455 N=10
Difference between means	3.500 ± 1.797

The results of the NIHSS scale values, after discharge, showed significantly limited motor abilities, present speech disorders (dysarthria), language disorders (aphasia), and dysphagia in EG and CG.

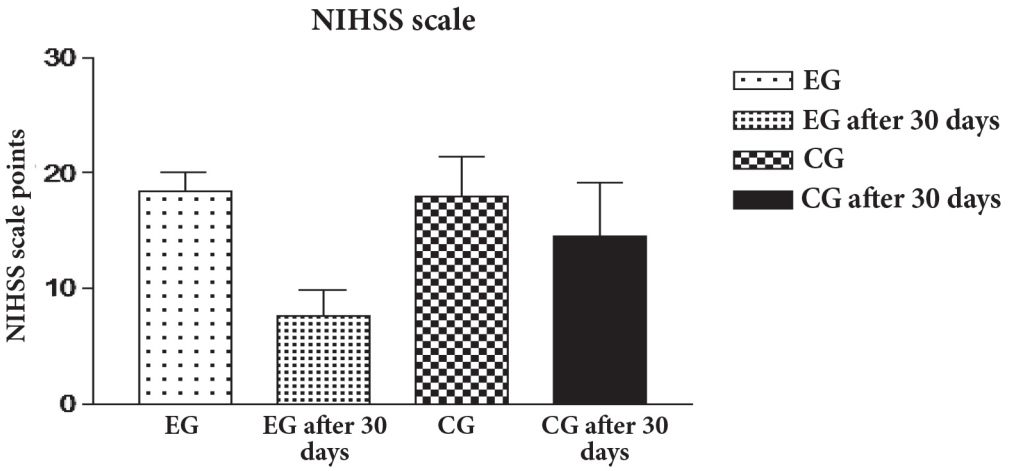


Figure 1. *NIHSS scale data for the experimental and control groups*

After the 30th day of discharge, a reduction of the motor deficit, and improvement of chewing and swallowing functions were reported. Although some of the subjects also had a manifestation of persistent motor aphasia, significant progress in a speech in terms of motor realization was found in both groups, more pronounced in the experimental group (Figure 1).

DISCUSSION

Proper selection of a test battery and application of specialized complex therapy (speech therapy and kinesitherapy) could increase the quality of life of patients. The team approach allows to apply specialized tests to evaluate more functions related to motor activity, such as gait, fine motor skills of the hands, chewing and swallowing, and speech. Progress is dependent on individual assessment and individualized symptomatic therapy, based on the professional competencies and joint activity of speech therapists and kinesitherapists, supported by the expert assessment and treatment of the treating neurologist.

The obtained results give reason to confirm that the comprehensive assessment should include the use of tests to assess:

- chewing and swallowing functions;
- language functions;
- speech and manual praxis functions;
- speech production (mobility of articulatory, phonatory, and respiratory muscles);
- level of speech intelligibility;
- cranial nerves;
- degree of gait recovery;
- activities of daily living.

The period of follow-up of the results is not limiting for the reliability of the study. The obtained results are positive and provide an opportunity for future studies with a larger contingent of patients.

CONCLUSION

As a result of the applied complex therapy, faster recovery of speech skills, balance, normalization of muscle tone, and recovery of gait were found. We believe that the right test battery, applied both for initial evaluation and for monitoring progress from therapy, and the selected components of complex therapy optimize the recovery of this patient population.

ACKNOWLEDGMENTS

The present development is an activity carried out under the project RP-A3/22 "*Complex speech therapy and kinesitherapeutic diagnostics for persons with acquired neurological diseases*", approved and financed by SWU "Neofit Rilski". Scientific research projects and projects for artistic and creative activity for the year 2022; Projects from group A – Infrastructure projects.

REFERENCES

Basilakos, A. & Fridriksson, J. (2022). Types of motor speech impairments associated with neurologic diseases, *Handb Clin Neurol.,* Vol. 185, pp.71-79.

Duffy, JR. (2016). Functional speech disorders: clinical manifestations, diagnosis, and management, *Handb Clin*

Neurol. Vol. 139, pp. 379-388.

Filipova, M. &Popova, D. (2019). Algorithm for determination of kinesitherapy potential in patient with subarachnoid hemorrhage, *Knowledge. International Journal, Medical science and health,* Vol. 40, No. 5, pp. 993-996.

Kent, RD. (2000). Research on speech motor control and its disorders: a review and prospective, *J Commun Disord*. Vol. 33 No. 5, quiz 428, pp. 391-427.

Lubenova, D. & Lubenov, N. (2021). Optimizing video games in neurorehabilitation, *Neurosonology and cerebral hemodynamics*, Vol. 17 No. 2, pp. 1-13.

Milanov, Iv. Stamenova, P., Kaso V. (2018). *National consensus on the prevention, diagnosis and treatment of cerebrovascular diseases - 2018*, under ed. of Iv. Milanov, P. Stamenova, Bulgarian neurology, Vol.19, supplement 1, pp. 32

Mitova, Ek. (2016a) Challenges before hospice care in Bulgaria, *Bulgarian Journal of Public Health*. Vol. 8, No. 2, pp. 31-42.

Mitova, Ek. (2016b) The role of the team in overcoming medico-social problems of persons with mental retardation living in CNST. *Asklepios*, Vol. 11, No 1-2, pp. 243-249.

Moucheboeuf, G. Griffier, R. Gasq, D. Glize, B. Bouyer, L. Dehail, P. Cassoudesalle, H. (2020). Effects of robotic gait training after stroke: A meta-analysis. *Ann Phys Rehabil Med.,* Vol. 63 No. 26, pp 518-534.

Simonska, M. (2020). Team approach in assessment and treatment of communication disorders for people after stroke, *Jubilee scientific conference with international participation "New approaches in public health and health policy",* Pleven, 26-28 November, 2020, pp. 326-329.

Vasileva, D. Lubenova, D, Mihova, M. Dimitrova, A. Grigorova-Petrova, K. (2015). Influence of kinesitherapy on gait in patients with ischemic stroke in the chronic period, *Open Access Macedonian Journal of Medical Sciences*, Vol.3 No. 4, pp. 619–623.

Zhang, D. Liu, Y. Wang, J. Xiao, Q. (2021). Virtual reality for limb motor function, balance, gait, cognition and daily function of stroke patients: A systematic review and meta-analysis., *J Adv Nurs.* Vol. 77 No. 8, pp. 3255-3273.

Corresponding author:
Mariela Filipova, PhD
Head of the Department „Kinsitherapy",
SWU „Neofit Rilski",
Blagoevgrad, Bulgaria
E-mail: mariela_filipova@swu.bg

POSSIBILITIES OF EEG DIAGNOSTICS FOR EVALUATION OF THE MASSAGE EFFECTS

Stela Ivanova[1], Filip Alexiev[2,3]
[1]Department of Kinesitherapy, NSA "Vassil Levski", Sofia, Bulgaria
[2]Neurology Clinic, St Anna University Hospital, Sofia, Bulgaria
[3]Clinic for Neurology and Neurorehabilitation "Dr. Alexiev & Son", Sofia, Bulgaria

ABSTRACT
Massage refers to a wide range of techniques such as effleurage, petrissage, tapping, friction, and vibration, yielding pressure on soft tissues done manually or with devices. Nowadays, massage is widely used in everyday life, sport, and medical care as a complementary and alternative therapy. Although its millenniums of use, there is very little research on its effects on health and disease conditions. As one of the main reasons for this can be pointed out, research methods, most of which need special equipment, and different professionals, are subjective or invasive. Recently, some studies have assessed the physical and physiological effects of massage, such as electroencephalography (EEG). EEG is a rapidly non-invasive test that provides evidence of how the brain functions over time. EEG matured over the decades due to advances in technology. Now it has greater sensitivity, digital recording on hard drives, allowing different processing, and are developed consumer-grade devices, which provide easier obtaining of EEG signals outside of the traditional laboratory settings. Advanced dry wireless headsets enable the use of EEG diagnostic in a natural environment at home, working place, sports halls, fields, etc. EEG has been used for the evaluation of effectiveness and in the comparison between different massage processes. Research investigating the physiological effects of massage therapy with EEG has suggested that massage therapy reduces anxiety, increases frontal delta activity, decreases frontal alpha and beta activity, shifts frontal alpha asymmetry from right-hemisphere dominance to left-hemisphere dominance, increases resting-state alpha activity in the left anterior cingulate cortex, etc.
Conclusion: Together, these findings provide evidence that massage therapy acts to modulate EEG activity and that EEG diagnostic can be a useful non-invasive, and accurate, objective research method for investigation and illustration of massage therapy effects.

Keywords: *massage therapy, electroencephalography, EEG*

INTRODUCTION

Massage is a method of mechanical impact on the body surface caused by the hands of the massage therapist or by devices in order to improve the functional state of different tissues and organs by means of mechanical, reflex, humoral, and bioenergetic action (Zhelev, Kraidzhikova, 2009). Manual massage refers to a wide range of techniques such as effleurage, petrissage, tapping, friction, and vibration, yielding pressure on soft tissues (Kerautret et al., 2021). The American Massage Therapy Association (AMTA) defines massage as "manual soft tissue manipulation, including holding, causing movement, and/or applying pressure to the body (Nakano et al., 2019). Nowadays, massage is widely used in everyday life, sport, and medical care as a complementary and alternative therapy (Chang et al., 2021). It plays an important role in pain reduction and improvement of quality of life in some chronic and disabling diseases such as multiple sclerosis (Marinova, 2018, 2019). But although its millennium of use (Goats, 1994), published research on massage therapy dates back to the 1930s (Field et al., 2007). Controlled studies have only recently been conducted to assess the biochemical, physiological, cognitive, and emotional effects (Diego et al., 2004).

Major limitations of massage therapy studies

Standardization of massage interventions

There are many different types of massage according to the geographical region (e.g., Swedish, Russian, Chinese, Japanese, etc.), purpose of application (e.g., massage for health prevention, sports massage, therapeutic massage, cosmetic massage, etc.) (Zhelev, Kraidzhikova, 2009), massaged tissues (e.g., deep tissue massage (Johnson, 2011), myofascial massage (Dixon, 2007), etc.), combination with other interventions (aromatherapy massage, hot stone massage, vacuum massage, etc.). Furthermore, methodologies of different types of massage have their own features as massaged area, depth, duration, speed, rhythm, sequences of massage strokes and massaged body parts, etc. Additionally, the massage therapist regulates subtle parameters while performing the massage routine and integrates with real-time patient feedback to adjust their gestures (Kerautret et al., 2021). For these rea-

sons, it appears difficult to standardize massage interventions in experimental research protocols.

Sample sizes and control groups

The early studies were limited by being either single cases or very small sample sizes. The samples were often comprised of self-selected clinical patients undergoing treatment for various conditions (Field et al., 2007). Some of massage therapy largest and most interesting effects belong to the multiple-dose effects category (Moyer et al., 2004). However, manual massage requires a trained physiotherapist, and only one person can be massaged at the same time, which makes massage therapy a difficult intervention to scale (Kerautret et al., 2021).

The lack of control groups was another methodological problem of the early studies. Without a control group, the effect of massage could be "placebo" or attention-from-the-therapist effects. Control groups have been used more recently, but they were non-treatment control groups. Thus, the effects could still derive from attention by the therapist (Field et al., 2007).

Measured variables and research methods

Some of the first researches of massage therapy effects measure arterial blood flow, venous blood flow, lymph flow, blood clothing, blood enzyme concentrations, connective tissue and muscle properties and pain (Goats, 1994). Gold standard medical measures have been used nowadays in some studies as, for example, blood pressure measures in hypertension studies, but most of the studies relied on self-report measures (Field, 2016). Most of the assessments were based on subjective routine clinical assessment tools, such as 10-point Visual Analogue Scale (VAS) score, the short form McGill Pain Questionnaire (MPQ), state anxiety inventory (STAI), and other questionnaires (Li et al., 2021). Their excessive use may in part relate to limited funding (Field, 2016) or non-invasive nature of measurement. Also, they needn't special equipment, different professionals to take and examine the samples or functions. Although these tools have clinical meaning, they are subjective and rough (Li et al., 2021).

Recently, there have been some studies assessing physical and physiological effects of massage, such as blood pressure, heart rate, heart rate variability in preterm infants, respiration rate, range of motion, electrocardiogram (ECG), electromyography (EMG) and electroencephalography (EEG) (Li et al., 2020). All of them are objective and give accurate information.

Electroencephalography (EEG)

Electroencephalography is a domain concerning recording and interpretation of the electroencephalogram. Electroencephalogram is a record of the electric signal generated by the cooperative action of brain cells, or more precisely, the time course of extracellular field potentials generated by their synchronous action (Blinowska, Durka, 2006). The EEG is widely used by physicians and scientists to study brain functions and to diagnose neurological disorders. The first EEG recording machine was introduced by Hans Berger in 1929, who suggested that brain currents changed depending upon the functional status of the brain, such as, sleep, anaesthesia, and epilepsy (Siuly et al, 2016). Currently, EEG is expanding beyond sleep, anaesthesia, and epilepsy, and become increasingly important in the diagnosis and treatment of mental and brain neuro-degenerative diseases and abnormalities (Siuly et al, 2016), and other diseases such as chronic kidney disease (Gadewar, 2015), COVID-19 (Petrescu et al., 2020), etc. Recently, it is also used as a neurofeedback method, by means of which the individual may gain better control over the neurophysiological parameters, by inducing changes in brain functioning and, consequently, behavior (Omejc et al., 2019).

The standard method for scalp electrode localization is the international 10-20 electrode system (Siuly et al, 2016) and uses 19 EEG electrodes (and 2 electrodes placed on earlobes A1/A2), related to specific anatomic landmarks (Blinowska, Durka, 2006). Wired and wireless EEG headsets transfer the data to a computer via a cable, wireless or Bluetooth connection, respectively. There are different types of wet EEG devices: soft gel-based, saline solution and dry. Some EEG devices are designed to capture both psychological (brain) and physiological (blood pressure, muscle activity, heart rate, etc.) data (Soufineyestani et al., 2020).

The normal EEG is extremely diverse and has a broad range of physiological variability. EEG waveforms may be characterized based on their location, amplitude, frequency, morphology, continuity (rhythmic, intermittent or continuous), synchrony, symmetry, and reactivity. However, the most frequently used method to classify EEG waveforms is by the frequency (Nayak, Anilkumar, 2020). There

are five major brain waves distinguished by their different frequency ranges: 0.5–4 Hz (delta), 4–8 Hz (theta), 8–13 Hz (alpha), 13–30 Hz (beta) and >30 Hz (gamma) (Siuly et al, 2016).

The traditional method of EEG analysis is visual inspection of the signals plotted on paper, but modern computer analysis can extend electroencephalographer's capabilities by supplying information not directly available from the raw data ((Blinowska & Durka, 2006).

The purpose of our study is to analyze the possibilities of EEG diagnostics for evaluation of the effects of manual massage.

METHODOLOGY

We searched through PubMed, ScienceDirect and Google Scholar engines for research articles, clinical and randomized-control trials using keywords "massage" and "electroencephalography EEG". Inclusion criteria were: using manual massage of different modalities alone and carried out by professional massage therapists. Exclusion criteria were: using mechanical massage, manual massage as part of complex methodology and manual massage, provided not from professional massage therapist.

METHODS

We found out 15 articles, completing our criteria. 2 of them were performed in preterm infants with some of the authors being the same in all 3 teams and with close results (Guzzetta et al., 2009; Guzzatta et al., 2011). Other 2 articles are made by the same team of researchers on nearly the same issue (Shim, Kim, 2014).

We summarized the results by 4 indicators: (1) participants, (2) massage therapy methodology, (3) used EEG devices, and (4) results and conclusion, as followed:

Participants

The age of the participants ranges from preterm newborn infants (28-33-week gestation age) (Guzzetta et al., 2009; Guzzatta et al., 2011) to elderly people above 65 years old (Nakano et al., 2019). Both genders were included with preponderance of females (Eiichi et al., 1988; Yoon, Choi, 2014; Wu et al., 2014). Most of the sample sizes were between 20 and 60 participants (8 studies) (Eiichi et al., 1988; Jones, Field, 1999; Diego et al., 2004; Guzzetta et al., 2011; Buttagat et al., 2012; Sim, Kim, 2014; Wu et al., 2014; Sun et al., 2017; Li et al., 2019), followed by under 20 participants (5 studies) (Guzzetta et al., 2009; Shim, Kim, 2014; Yoon, Choi, 2014; Kaewcum, Siripornpanich, 2017; Nakano et al., 2019) and above 60 participants (1 studies) (Kerautret et al., 2021).

Massage therapy methodology

There was large diversity in massage therapy methodologies. *Duration* ranged from 3-min effleurage (Yoon, Choi, 2014) to 40-min aromatherapy massage (Wu et al., 2014). All except one (Wu et al., 2014) were *partial massages on different body areas*: face (Eiichi et al., 1988); arms and face (Kaewcum, Siripornpanich, 2017); neck region (Shim, Kim, 2014); scapular region (Buttagat et al., 2012); back and hips (Li et al., 2019); back, arms, hands and neck (Jones, Field, 1999); back, shoulders and arms (Diego et al., 2004); hands and feet (Nakano et al., 2019). Used *types of massage* scope from Swedish massage (Jones, Field, 1999; Kaewcum, Siripornpanich, 2017), lymph drainage massage (Shim, Kim, 2014), Chinese massage (Li et al., 2019), and traditional Tai massage (Buttagat et al., 2012) to aromatherapy massage (Wu et al., 2014).

EEG devices

The diversity among the EEG devices and used methods was also very large. Not every study provides a detailed description of the EEG equipment and the information was scarce. The first study used monopolar EEG, according to the international 10-20 system (Eiichi et al., 1988). Latter was used bipolar EEG (Buttagat et al., 2012). Guzzeta et al. (2009 & 2011) used portable digital EEG system. Sun et al. (2017) and Li et al. (2019) used mobile EEG device Emotiv with headset and Bluetooth module for wireless communication. Nakano et al. (2019) used active dry electrode system (Nihon Kohden Co.). The number of channels or active electrodes was also different: 6 channels (Shim, Kim, 2014), 8 electrodes (Guzzetta et al., 2009; 2011), 14 channels (Sun et al., 2017; Li et al., 2019), 16 electrodes (Kerautret et al., 2021), 19 channels (Nakano et al., 2019), 32 electrodes (Kaewcum, Siripornpanich, 2017).

RESULTS

All 15 studies prove that massage affects the EEG activity. In preterm newborn infants, massage accelerates the maturation of brain electrical activity, modifies sleep EEG power, and accelerate visual development (Guzzetta et al., 2009, 2011). Facial

massage has the effect of producing deactivation, resulting in a state of rest similar to that seen in sleep induction through deep relaxation (Eiichi et al., 1988). EEG asymmetry can be attenuated by massage. Greater relative right frontal EEG activation was significantly lessened (Jones, Field, 1999). Moderate massage showed an increase in delta, a decrease in alpha and beta activity, suggesting a relaxation response, and a shift toward left frontal EEG activation. The light massage group showed increased arousal (Diego et al., 2004). A significant increase in relaxation manifested as an increase in delta activity and a decrease in theta, alpha, and beta activity in the Tai massage group (Buttagat et al., 2012). Manual lymph drainage caused an activation shift from the right hemisphere to the left hemisphere in all frontal electrode pairs (Shim, Kim, 2014). The Effleurage technique increased the delta wave and decreased the beta wave in all the frontal, temporal, parietal, and occipital cranial regions. Effleurage may have positive effects on sleep and relaxation (Yoon, Choi, 2014). Alpha brain wave activities were enhanced and delta activities were reduced after a one-time aromatherapy massage treatment. These effects are similar to brain rhythms shown in meditation and neurofeedback training (Wu et al., 2014). The change of pain of the patients with specific low back pain was closely related to the change of the rhythms of the brain in massage therapy (Sun et al.,2017). Unilateral Swedish massage produces a local inhibitory effect on the contralateral somatosensory cortex as demonstrated by the reduction of beta power (Kaewcum, Siripornpanich, 2017). After a massage in the lumbar herniated patient group, the normalized energy of the delta rhythm increased in the left hemisphere, and the normalized energy of theta and alfa rhythm decreased after massage (Li et al., 2019). Resting-state alpha activity significantly increased in the left insular cortex after hand massage, and in the right and left posterior cingulate cortex after foot massage (Nakano et al., 2019). Manual massage promotes a brain state of relaxation, characterized by synchronization detected from parietal sensors (Kerautret et al., 2021).

DISCUSSION

Although millenniums of massage therapy use there is very little research on its effects on health and disease conditions. One of the main reasons for this can be pointed out the research methods, most of which need special equipment and different professionals, are subjective or invasive. EEG is a rapidly non-invasive test that provides evidence of how the brain functions over time. EEG matured over the decades due to advances in technology. Now it has greater sensitivity, digital recording on hard drives, allowing different processing, and are developed consumer-grade devices, which provide easier obtaining of EEG signals outside of the traditional laboratory settings (Williams et al., 2020). Advanced dry wireless headsets enable the use of EEG diagnostic in a natural environment at home, working place, sports halls, fields, etc. EEG has been used for the evaluation of effectiveness and in the comparison between different massage processes. Research investigating the physiological effects of massage therapy with EEG has suggested that massage therapy reduces anxiety, increases frontal delta activity, decreases frontal alpha and beta activity, shifts frontal alpha asymmetry from right-hemisphere dominance to left-hemisphere dominance, increases resting-state alpha activity in the left anterior cingulate cortex, etc.

But there remained many unsolved issues in the field of EEG diagnostics in massage, which raised a large number of questions, as: (1) how different massage strokes altered EEG (which of them induced relaxation and which arousal); (2) does massage on different body parts affected brain electrical activity in different ways; (3) what are the influences of massage technique speed, rhythm and pressure magnitude; (4) how massage promote sleep; (5) how duration of massage therapy remodels EEG parameters; (6) are there any changes in brain electrical activity of the massage therapist; etc. in health and disease conditions.

CONCLUSION

Technological progress has made EEG diagnostic more accessible. Some research in the field of massage therapy already used this kind of diagnostic in their measurements with promising results. Together, these findings provide evidence that massage therapy acts to modulate EEG activity and that EEG diagnostic can be a useful non-invasive, and accurate objective research method for investigation and illustration of massage therapy effects.

REFERENCES

Blinowska, K., & Durka, P. (2006). Electroencephalography (eeg). *Wiley encyclopedia of biomedical engineering*.

Buttagat, V., Eungpinichpong, W., Kaber, D., Chatcha-

wan, U., & Arayawichanon, P. (2012). Acute effects of traditional Thai massage on electroencephalogram in patients with scapulocostal syndrome. *Complementary Therapies in Medicine*,Vol. 20, No. 4, pp. 167-174.

Chang, KM., Luo, SY., Chen, SH., Wang, TP., Ching CT. (2012). Body massage performance investigation by brain activity analysis, *Evid Based Complement Alternat Med,* Vol. 2012, Article ID 252163, 10 pp.

Diego, M., Field, T., Sanders, C., Hernandez-Reif, M. (2004). Massage therapy of moderate and light pressure and vibrator effects on EEG and heart rate, *International Journal of Neuroscience,* Vol. 114, pp. 31-45.

Dixon, M. (2007). *Myofascial Massage*, Lippincott Williams & Wilkins, Baltimore, USA.

Eiichi, J., Yoshiaki, Y., Toshiteru, H., & Tsuneyuki, A. (1998). Effects of facial massage on the spontaneous EEG. *Tohoku Psychologica Folia*, Vo. 47, pp. 8-15.

Field, T. (2016). Massage therapy research review, *Complementary Therapies in Clinical Practice,* Vol. 24, pp. 19-31.

Field, T., Diego, M. & Hernandez-Reif, M. (2007). Massage therapy research, *Developmental Review,* Vol. 27, No. 1, pp. 75-89.

Gadewar, P., Acharya, S., Khairkar, P., Shukla, S., & Mahajan, S. N. (2015). Dynamics of electroencephalogram (EEG) in different stages of chronic kidney disease. *Journal of Clinical and Diagnostic Research: JCDR*, Vol. 9, No. 3, OC25-OC27.

Goats, G. (1994). Massage – the scientific basis of an ancient art: part 1. The techniques, *British Journal of Sports Medicine,* Vol. 28, No. 3, pp. 149-152.

Goats, G. (1994). Massage – the scientific basis of an ancient art: part 2. Physiological and therapeutic effects, *British Journal of Sports Medicine,* Vol. 28, No. 3, pp. 153-156.

Guzzetta, A., Baldini, S., Bancale, A., Baroncelli, L., Ciucci, F., Ghirri, P.,Putignano, E., Sale, A., Viegi, A., Berardi, N., Boldrini, A., Cioni, G., & Maffei, L. (2009). Massage accelerates brain development and the maturation of visual function. *Journal of Neuroscience*,Vol. 29, No. 18,pp. 6042-6051.

Guzzetta, A., D'Acunto, M., Carotenuto, M., Berardi, N., Bancale, A., Biagioni, E.,Boldrini, A., Ghirri, P., Maffei, L. & Cioni, G. (2011). The effects of preterm infant massage on brain electrical activity. *Developmental Medicine & Child Neurology*,Vol. 53,pp. 46-51.

Johnson, J. (2011). *Deep Tissue Massage,* Human Kinetics, USA.

Jones, N. A., & Field, T. (1999). Massage and Music Therapies Attenuate Frontal EEG Asymmetry in Depressed Adolescents, *Adolescence*,Vol. 34, No. 135, pp. 529-534.

Kaewcum, N., & Siripornpanich, V. (2018). The effects of unilateral Swedish massage on the neural activities measured by quantitative electroencephalography (EEG). *Journal of Health Research*, Vol. 36, No. 1, pp. 36-46.

Kerautret, Y., Guillot, A., Daligault, S. & Di Rienzo, F. (2021). Foam Rolling Elicits Neuronal Relaxation Patterns Distinct from Manual Massage: A Randomized Controlled Trial, *Brain Sciences*, Vol. 11, No. 6, pp. 818-834.

Li, H., Du, W., Fan, K., Ma, J., Ivanov, K. & Wang, L. (2020). The Effectiveness Assessment of Massage Therapy Using Entropy-Based EEG Features Among Lumbar Disc Herniation Patients Comparing with Healthy Controls, *IEEE Access,* Vol. 8, pp. 7758-7775.

Li, H., Fan, K., Ma, J., Qiao, X., Yan, Y., Du, W. & Wang, L. (2021). Massage Therapy's Effectiveness on the Decoding EEG Rhythms of Left/Right Motor Imagery and Motion Execution in Patients with Skeletal Muscle Pain, *IEEE Journal of Translational Engineering in Health and Medicine,* Vol. 9, pp. 1-20.

Marinova, D. (2018). Vliyanie na trdizionniya kitaiski masaj (tuina) varchu kachestvoto na jivot pri pacienti s mnozhestvena sklerosa, *Manas,* Vol. 4, No. 2// *Маринова*, Д. (2018). *Влияние на традиционния китайски масаж* (*туйна*) *върху качеството на живот при пациенти* с *множествена склероза*, Манас, *Том* 4, *Бр*. 2, (online).

Marinova, D., Angelcheva, M., Marinov, T., Ignatov, I. (2019). Influence of Tuina Therapy on Pain as Regards Quality of Life Among Patients Suffering from Multiple Sclerosis, *Journal of Medicine, Physiology and Biophysics,* Vol. 52, pp. 1-6.

Moyer, C., Rounds & J., Hannum, J. A Meta-Analysis of Massage Therapy Research, *Psychological Bulletin,* Vol. 130, No. 1, pp. 3-18.

Nakano, H., Kodama, T., Ueda, T., Mori, I., Tani, T. & Murata, S. (2019). Effect of Hand and Foot Massage Therapy on Psychological Factors and EEG Activity in Elderly People Requiring Long-Term Care: A Randomized Cross-Over Study, *Brain Sciences,* Vol. 9, No. 3, pp. 54-61.

Nayak, C., & Anilkumar, A. (2020). *EEG Normal Waveforms*. StatPearls.

Omejc, N., Rojc, B., Battaglini, P., & Marusic, U. (2019). Review of the therapeutic neurofeedback method using electroencephalography: EEG Neurofeedback. *Bosnian Journal of Basic Medical Sciences*, Vol. 19, No. 3, pp. 213–220.

Petrescu, A. M., Taussig, D., & Bouilleret, V. (2020). Electroencephalogram (EEG) in COVID-19: a systematic retrospective study. *Neurophysiologie Clinique*, Vol.

50, No. 3, 155-165.

Shim, J. M., & Kim, S. J. (2014). Effects of manual lymph drainage of the neck on EEG in subjects with psychological stress. *Journal of Physical Therapy Science*,Vol. 26, No. 1,pp. 127-129.

Shim, J. M., & Kim, S. J. (2014). Manual lymph drainage attenuates frontal EEG asymmetry in subjects with psychological stress: a preliminary study. *Journal of Physical Therapy Science*,Vol. 26, No. 4,pp. 529-531.

Siuly, S., Li, Y., Zhang, Y. (2016). *EEG Signal Analysis and Classification,* Springer, Switzerland.

Soufineyestani, M., Dowling, D., & Khan, A. (2020). Electroencephalography (EEG) technology applications and available devices. *Applied Sciences*, Vol. 10, No. 21, pp. 7453-7475.

Sun, X., Li, H., Du, W., Chen, W., Zhou, F., & Wang, L. (2017). Analysis of Electroencephalogram of patients with specific low back pain with the massage treatment. In *2017 39th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)*, pp. 479-483. IEEE.

Williams, N., McArthur, G., & Badcock, N. (2020). *10 years of EPOC: A scoping review of Emotiv's portable EEG device.* BioRxiv.

Wu, J. J., Cui, Y., Yang, Y. S., Kang, M. S., Jung, S. C., Park, H. K., Yeun, H. Y., Jang, W. J., Lee, S., Kwak, Y. S. & Eun, S. Y. (2014). Modulatory effects of aromatherapy massage intervention on electroencephalogram, psychological assessments, salivary cortisol and plasma brain-derived neurotrophic factor. *Complementary Therapies in Medicine*,Vol. 22, No. 3,pp. 456-462.

Yoon, I., & Choi, H. (2014). Effects of Effleurage Technique of Massage on the Electroencephalogram. *Kor J Aesthet Cosmetol*, Vol. 12, No. 6,pp. 899-905.

Zhelev, V.& Kraidzhikova, L. (2009). *Masaj. Higienen, sporten, lecheben I kozmetichen*, Avangard Prima, Sofia // Желев, В., Крайджикова, Л. (2009). *Масаж. Хигиенен, спортен, лечебен и козметичен*, Авангард Прима, София.

Corresponding author:
Stela Ivanova, PhD
Department of TM of the kinesitherapy
National Sports Academy "Vassil Levski"
1, Gurgulyat, str.
Sofia, Bulgaria
Email: stela.kalinova@gmail.com

RESEARCH OF HAMSTRINGS MUSCLES IN CHILDREN SPORTS KARATE

Yordan Georgiev[1], Nezabravka Gencheva[2] & Todor Marinov[2]
[1]Medical University Varna
[2]National Sports Academy , "Vassil Levski" Sofia, Bulgaria

ABSTRACT
The functional disorder of the hamstrings muscles is associated with prolonged sitting in a chair, poor posture, lack of motor activity and others. Maintaining elastic muscle tissue is an important factor for children practicing martial arts; karate in particular. This study has the purpose to examine hamstring muscles and their condition in children practicing karate. Methodology
During the period between March - May 2022, we worked with 30 children in total, in the age group between 8-10 years old, who were practicing karate or boxing in clubs "Fighters", located in the city of Varna, and club "Khan Krum", located in the city of Shumen, respectively. For most accurate results, we formed two separate groups with 15 children each. The participants in our control group were training boxing, whilst the children in our experimental group were practicing karate. All 30 children had been training for a period of 6 months, practicing 2 times per week, one astronomical hour per session. At the beginning of every training session with our experimental group, we treated the hamstring muscles of the participants with post-isometric relaxation.
To conclude our findings, we assessed the condition of the hamstring muscles of all 30 children at the beginning and end of the study period, utilizing the method of Laseg and a Seat Test with outstretched legs on the floor with a slope to the toes.
Results
The results at the end of the study period show that the functional deficit of the hamstring muscles continues to be present in 11 children training boxing. In comparison, only five out of 11 initially diagnosed children with hamstring muscle imbalance from our experimental group showed signs of no improvement.
Conclusion
The results of this study prove the hypothesis that practicing karate with the inclusion of PIR leads to improved elasticity of the hamstring muscles. The proper selection of physiotherapeutic methods and their regular application could not only heal hamstring muscle stiffness but it could also prevent it, if applied from an early age.

Keywords: *Karate, Children, Hamstrings*

INTRODUCTION

The flexibility of muscle tissue is important for normal functioning both in the daily life of a person and in sports activities (Bahr, Holme, 2003). Limited flexibility reduces the functional level of the musculoskeletal system and can be a prerequisite for multiple injuries (Davis, Ashby, 2005 and (Park, Lee, 2017). Functional disorder of the posterior femoral muscles (hamstring) is associated with prolonged sitting in a chair, poor posture, lack of motor activity, insufficient stretching, etc.

Maintaining elastic muscle tissue is an important factor in children practicing martial arts, especially karate (Kisner, Colby, 2012). The main function of the ischiocrural muscles is flexion in the knee joint. The ischiocrural muscles include three muscles: m.semimembranosus, m. semitendinosus and m. biceps femoris, which are two-joint postural muscles of type I fibers with a tendency to shorten.
Maintaining elastic muscle tissue is an important factor in children practicing martial arts, especially karate (Kisner, Colby, 2012). The main function of the hamstring muscles is flexion in the knee joint. The hamstring muscles include three muscles: m.semimembranosus, m. semitendinosus and m. biceps femoris, which are two-joint postural muscles of type I fibers with a tendency to shorten.

They are involved in the medial and lateral stabilization of the knee joint. Depending on the position of the hip joint, these muscles assist in lateral (external) and medial (internal) rotation of the tibia. These biomechanical and anatomical features of the hip flexors of the knee joint determine the need for precise functional diagnosis and preparation of a set of exercises to maintain their mobility (Popov, 2009). Muscle imbalances are believed to be the cause and at the root of many musculoskeletal disorders. The shortening of the posterior femoral muscles can have a negative impact on the lower limbs, the pelvis and spine and, mostly, on the general condition of the adolescent organism (Neuman, 2010, Atkinson et al., 2011). Hamstring mus-

cle imbalance is widespread in athletes (Henricson et al., 1984). In our opinion, the natural length of the hamstring muscles has a significant role in the quality of body movement, which coincides with the study of Kendall et al., 2005. Shortening of this muscle group leads to low back pain, nerve compression, contractures and sports injuries. The incorrect methodology for stretching and maintaining muscle balance is also the cause of the appearance of pathological conditions. Multiple studies have reported lower hamstring muscle strength and better postural control in female compared to male athletes. It is not known whether these differences are innate in children and adolescents or are caused by participation in different sports (Holm, Vøllestad, 2008).

In 2011, Nasiri et al. performed a study to compare four methods of HR (dynamic stretch), SS (static stretch), minimal isometric relaxation and reciprocal inhibition on the knee extension velocity of 60 healthy subjects with hamstring shortness between the ages of 18 and 28 years for 6 weeks. The results of this study indicated that static stretching had the best effect compared to the other three methods (Nasiri, Balavar et al., 2011). On the other hand, in 2010 tests were conducted on the effect of HR for 5 seconds and SS for 7 seconds on the flexibility of the hamstring muscles of 80 healthy women between the ages of 20 and 30. In this study, the range of motion of active knee extension, with the hip placed in 90 degrees of flexion, was measured with a goniometer. The authors reported that the range of knee extension was significantly increased in the HR groups compared to others (Yogeeta. 2010).

In 2006, Biddington et al. investigated the effects of SS and HR on flexibility, strength and maximal extension of the thigh muscles in 32 healthy subjects with short tendon and reported that there was no significant difference between these two methods in terms of increases in these indices (Biddington, John, 2006). In 2005, Odunaiya et al. compared time periods of 15, 30, 60, 90 and 120 seconds of the SS technique on hamstring muscle flexibility in 60 healthy subjects with shortened hamstrings for 6 weeks and reported no significant difference between these time periods (Odunaiya et al .,2006).

In 2003, Nachtwey et al. investigated the direct and indirect effects of HR for 15 seconds on hip muscle flexibility and hip range of motion in 27 healthy subjects with a shortened tendon as measured by a goniometer and reported that the direct results of this technique were significantly more effective than indirect (Haji Hasani, 2014). In 2002 Carrie et al. performed a study on the benefits of HR and SS on participants' shortened thigh muscles. In this study, the SS technique was reported to increase the flexibility and length of this muscle, and the range of motion of the hip increased compared to HR (Carrie, 2002). In 2002, Draper et al. reported that HR was the most effective method compared to other methods for increasing hamstring length, comparing the effects of HR, SS, Ballistic Stretch, and Passive Stretch on participants' flexibility and lengthening of shortened muscles, should be mentioned, that SS is the second most effective method after HR (Draper et al., 2002).

Multiple studies have reported paradoxical results regarding the effectiveness of HR and SS in increasing hip flexibility and knee range of motion. These studies used the passive knee extension test, unlike previous studies that used the straight leg raise (SLR), the pelvic cycle did not impair the tests and results showed greater accuracy in examining the hip muscles and movement in the knee joint compared to the old methods.

After the literature review, it is clear that the flexibility of the hamstring muscles is important for activities of daily life such as sitting, standing up, standing, walking, as well as for sports. In the studied articles, we did not find a definite methodology for exercises that affect the flexibility of the hamstring muscles. Studies indicate that there are paradoxical results regarding the effectiveness of methods to increase the flexibility of the thigh muscles.

The aim of our research is to study the condition of the hamstring muscles in children practicing karate.

METHODOLOGY

During the period from March to May 2022, a total of 30 children in the age group of 8-10 years from the sports club "Karate Fighters" in the city of Varna and from the Center for Personal Development Support - Student Sports School "Khan Krum", department in the boxing city of Shumen were examined. We divided the examined children into two groups of 15 children each - control (training boxing) and experimental (training karate). Children

participated in the study voluntarily. Their parents gave permission to participate in the study through informed consent. All participants in the study have been training for six months, twice a week, with the duration of each activity being one astronomical hour. In the preparatory part of the training of the experimental group, we included post-isometric relaxation (PIR) of the hamstring muscles. We assessed the condition of the hamstring muscles at the beginning and end of the research period using the Lasegue test and the sitting test with legs extended on the floor with an inclination towards the toes. In this way, we determine whether there is a difference between the control and experimental groups.

METHODS

1. *In sports physiotherapy, the method of post-isometric relaxation (PIR)* is very often used, which successfully copes with the relaxation and lengthening of shortened muscles. This is a very effective and safe technique that a therapist can use to reduce muscle tone and increase range of motion in a joint.

Description of the technique.
We stretch the shortened muscle with light pressure to its maximum length - there should be no pain. We remind the tested person to resist our pressure with minimal force, without any movement (isometric), inhale slowly for 8-10 seconds, and hold the breath for 1-3 sec. The test subject is asked to relax the muscle and slowly exhale, in which case we stretch the muscle and hold for 10 to 20 seconds. or as much as is needed for complete relaxation.

2. *The Lasegue test (SLR).* This test was first described by Charles Lasègue (1816–1883). Most often used to identify damage to disc pathology. It can also be classified as a neurodynamic assessment test because it can detect excessive nerve root tension or compression. The test can also determine the pain in the lower back. Apart from neurological symptoms, the test is also used to determine the level of shortening of the posterior femoral muscles. (Pesonen et al., 2021)

Description of the technique.
The subject lies supine on a couch and the therapist passively raises his leg, keeping the knee in full extension. Each leg is tested separately, testing the unaffected leg first. When performing the SLR test, the therapist stands on the tested side with the distal hand around the patient's heel and the proximal hand on the patient's distal thigh (front). The clinician continues to raise the leg by contracting at the hip until the subject feels pain or tightness in the back of the leg.

3. *Test- sitting with legs stretched out on the floor.*
The test is used for the level of flexibility of the lower limbs. There are many tests that are used to determine flexibility of the lower limbs, but they differ in performance and measuring devices. The sitting test with legs stretched out on the floor we used was performed as a qualitative test (reaching toe level). It is very suitable for diagnosing the minimal mobility of the hamstrings.

Description of the technique
The person being tested sits on the floor with their legs extended in front of them. The plantar part of the feet/ankle are placed firmly against the wall. Both feet should be firmly pressed to the floor. With palms on the floor and hands next to each other, the person being tested stretches forward as far as possible along the thigh-calf line to the tips of the toes. The arms are parallel, not at different levels. The subject holds this position for one to two seconds. If it cannot reach the toes, the measured value is negative. The distance between the level of the fingers and the tips of the toes is measured in centimeters (Tittlbach et al., 2005).

RESULTS

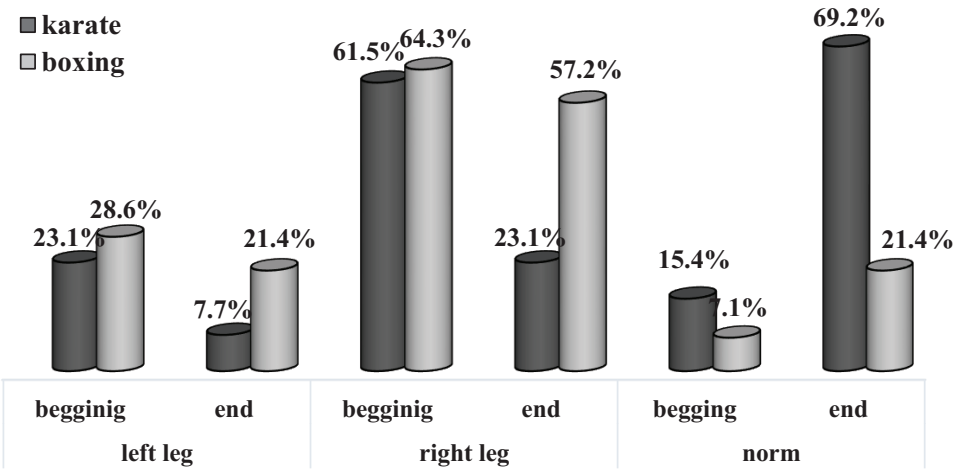


Figure 1. *Percentage ratio of those examined by "Lasegue test" at the beginning and end of the study*

The tests done on the flexibility of karate and boxing athletes using the Lasegue test show that at the beginning of the measurement the two groups have close results. At the end of the research period, it was observed that the karate group significantly improved the flexibility of the hamstring muscles. While in the boxing training group, the flexibility remains little or unchanged. The main difference is seen in the measurement of the right leg in 61.5% of the initially tested karate athletes.

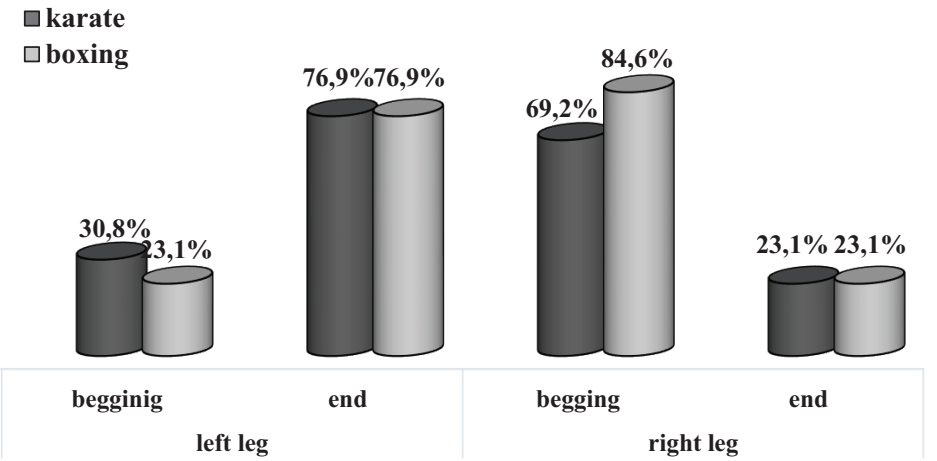


Figure 2. *Percentage ratio of subjects examined by the "Sitting with legs outstretched" test at the beginning and end of the study (%)*

The flexibility of the karate and boxing athletes, as measured by the "Sitting with legs outstretched" test, was not significantly different at the beginning of the study. The difference is seen in the ratio between the left legs in 30.8% of karate athletes compared to the right leg in 69.2%. At the beginning of the study, it was observed that the left leg in both groups of athletes had a significantly reduced flexibility compared to the right leg. (Figure 2)

After considering the results of the tests used, the flexibility of the hamstring muscles in the experimental group improved significantly. We believe that this is due to the systematic implementation of PIR and karate techniques that improve the condition of the hamstring muscles.

DISCUSSION

The most common injuries in kickboxers are: shoulder, back, hip, knee and ankle sprains (Ro-

maine et al., 2003) We agree with Malliaropoulos et., that increasing hamstring flexibility is an important factor in treatment and the prevention of injuries from excessive pressure on the lower limbs. (Malliaropoulos et al., 2004). Similar post-study analyzes were made by Dadebo et al, (2004) in soccer players who, after stretching exercises, had a significantly reduced risk of injury. In the present study, post-isometric relaxation (PIR) was applied as an addition to the methodology in children practicing karate. The PIR technique was performed according to the conditions of the training room. Applied functional tests for the condition of the hamstring muscles in children provide information that with irregular and incorrect performance of the exercises to improve the flexibility of the hamstring muscles shortens. Early diagnosis and timely measures can lead to the prevention of muscle imbalances and injuries during training. In support of our opinion is the study by Hartig and Henderson, 1999, according to which the inclusion of a stretching program can statistically reduce hamstring injuries. There is other evidence linking reduced flexibility with hamstring injury (Witvrouw et al., 2003), as well as some retrospective evidence performed on athletes with a history of injury (Jonhagen et al., 2003).

Our study shows that the systematic use of lower extremity flexion technique and PIR in children practicing karate improves the elasticity of the hamstring muscles, compared to children practicing boxing, in which no technique to improve flexibility is used systematically. This suggests fewer injuries in the experimental group. There are similar results from Puentedura et al. (2011) who investigated the effects of the two techniques (Static and Dynamic Stretch and Hold Relaxation) on the flexibility and length increase of the hamstring muscles in 13 healthy subjects. Researchers state that both techniques significantly increase hamstring flexibility and length (Puentedura et al., 2011). An interesting fact is how gender affects muscle flexibility. In 2008 Holm & Vollestad proved that female hamstring extensibility is better. (Holm, Vøllestad, 2008). This is a challenge for further research in this direction.

CONCLUSION

Muscular imbalance, the risk of injuries and the inability to optimally function of the child's organism depend on the quality examination of the muscles and the correct execution of exercises to improve flexibility. The results obtained from the study show that practicing karate in combination with PIR leads to an improvement in the muscle balance of the hamstring muscles. The correct selection of karate and kinesitherapeutic agents can lead to better growth and development of the child's organism.

REFERENCES

Atkinson, K., Coutts, F., Hassenkamp, AM. (2011). A problem solving approach, *Physiotherapy in orthopedics*; (2):236-41

Bahr, R., Holme, I. (2003) Risk factors for sports injuries--a methodo-logical approach. *Br J Sports Med*, 37(5):384-9

Biddington, C.M., John, N.W. (2006). The effect of proprioceptive neuromuscular facilitation vs. static stretching vs. control on the hamstring muscle group for flexibility, peak torque, and power. *Semantic scholar*. 51-84

Carrie, R. (2002). The effect of time on static stretch on the flexibility of hamstring muscles. *J physical therap*; 74 (1) : 845 -50

Dadebo, B., White, J., George, K. P. (2004). A survey of flexibility training protocols and hamstring strains in professional football clubs in England. *Br J Sports Med.* 38(4):388-94

Davis, D. S., Ashby, P. E., McCale, K. L., McQuain, J. A., Wine, J. M. (2005). The effectiveness of 3 stretching techniques on hamstring flexibility using consistent stretching parameters. *J Strength Cond Res.* 19(1):27-32

Draper, D.O., Miner, L., Knight, K.L., Ricard, M.D. (2002). The Carry-Over Effects of Diathermy and Stretching in Developing Hamstring Flexibility. *J Athl Train*; 37 (1) : 37 -42.

Hartig, D. E., Henderson, J. (1999). Increasing Hamstring Flexibility Decreases Lower Extremity Overuse Injuries in Military Basic Trainees. *Am J Sports Med*, Mar-Apr;27(2):173-6

Hasani, A., Bakhtiari, A., Amoozadeh, K.M. Comparative Study of Static Stretch and Hold Relax on Increasing the Motion Range of Knee Extension and Flexibility of Shortened Hamstring Muscles of Male Students in Semnan. *Middle East J Rehabil Health* Stud. 2014;1(2):e24365. doi: 10.17795/mejrh-24365

Henricson, A.S., Fredriksson, K., Persson, I., Pereira, R., Rostedt, Y., Westlin, N.E. (1984). The effect of heat and stretching on the range of hip motion. *J Orthop Sports Phys Ther*; 6 (2): 110-5

Holm, I., Vøllestad, N. (2008). Significant effect of gender on hamstring-to-quadriceps strength ratio and static balance in prepubescent children from 7 to 12 years of age. *The American Journal of Sports Medicine*: 36(10)

Kendall, F.P., Kendall, E., Creary, M., Geise, P. (2005). Muscle testing and function; 39 -42

Jonhagen, S., Nemeth, G., Eriksson, E. (1994). Hamstring Injuries in Sprinters: The Role of Concentric and Eccentric Hamstring Muscle Strength and Flexibility. *The American Journal of Sports Medicine*. Mar-Apr;22(2):262-6

Kisner, C., Colby, L.A. (2012). Therapeutic exercise foundations and tech-niques. 6th ed. *Philadelphia (PA)*: F.A. Davis Company

Malliaropoulos, N., Papalexandris, Papalada,A, Papacostas E. (2004). The role of stretching in rehabilitation of hamstring injuries: 80 athletes follow-up, *Medicine and Science in Sports and Exercise*, vol. 36, no. 5, pp. 756–759

Nasiri, M., Balavar, M., Asghari, A., Khodamoradi, A., Imanzadeh, M. (2011). The effecct of four different muscle stretches on the flexibility of hamestring muscles in university boys of 18 to 28 years old of Mohabad Payame Noor University. *Middle east J Sci Res*; 8 (2) : 416 -23

Neumann, D.A. (2010). Kinesiology of the Musculoskeletal System: Foundations for Rehabilitation; *Elsevier*

Odunaiya, N.A., Hamzat, T.K., Ajayi, O.F. (2006). The effects of static stretch duration on the flexibility of hamstring muscles. *Afr J biomed res*; 8 (2) : 79 -82

Park, H.Y., Lee, M. M. (2017). A comparison of the effect of stretching technique on hamstring muscle for flexibility, strength, pressure pain threshold value and muscle tone. *J Korean Soc Phys Med*, 12(4):39-46

Pesonen, J., Shacklock, M., Rantanen, P., Mäki, J., Karttunen, L., Kankaanpää, M., Airaksinen, O., Rade, M. (2021). Extending the straight leg raise test for improved clinical evaluation of sciatica: reliability of hip internal rotation or ankle dorsiflexion. *BMC Musculoskeletal Disorders*. Dec;22(1):1-8

Popov, N. (2009). Kineziologiq i patokineziologiq na oporno dvigatelen aparat, *Uchebnik, NSA PRES, Sofia. (In Bulgarian*) pp. 259-267

Puentedura, E.J., Huijbregts, P.A., Celeste, S., Edwards, D., In, A., Landers, M.R. (2011). Immediate effects of quantified hamstring stretching: hold-relax proprioceptive neuromuscular facilitation versus static stretching. *Phys Ther Sport*; 12 (3) : 122 -6

Romaine, L.J., Davis, S.E, Casebolt, K., Harrison, K.A. (2003). Incidence of injury in kickboxing participation. *J Strength Cond Res*. Aug;17(3):580-6

Tittlbach, S., Kolb, H., Woll, A. & Bos, K. (2005). Karlsruher gesundheitsorientierter Fitness Test. *Bewegungstherapie und Gesundheitssport*, 21(3), 109-115

Vertonghen, J., Theeboom, M. (2010). The social-psychological outcomes of martial arts practise among youth: a review. *J Sports Sci Med*; 9(4):528-537.

Witvrouw, E., Danneels, L., Asselman, P., D'Have, T., Cambier, D. (2003). Muscle flexibility as a risk factor for developing muscle injuries in male professional soccer players. A prospective study. *Am J Sports Med*. Jan-Feb;31(1):41-6

Yogeeta, SK. (2010). Effectiveness of passive stretching versus hold relax technique in flexibility of hamstring muscle. *Online J Health Allied Sci*; 9 (3): 13

Corresponding author:
Yordan Georgiev,
Rehabilitator Training Sector,
Medical College,
Medical University of Varna,
84 Tzar OsvoboditelStr., 9000,
Varna, Bulgaria,
E-mail: yordan.georgiev@mu-varna.bg

THE EFFECT OF A SPECIALIZED PHYSIOTHERAPY PROGRAM IN AN INFANT WITH A RARE GENETIC DISEASE

Madlena Ilcheva
National Sports Academy "Vassil Levski", Sofia, Bulgaria

ABSTRACT
Introduction: The specialized physiotherapy program is a set of purposeful techniques and methodologies, profiled for work with children. Early physical therapy intervention is essential for the prevention and reduction of the pathological impact on the neuromotor capabilities of children with neurological impairment caused by a genetic disease.
Purpose: The aim of the study is to monitor the effectiveness of a specialized physiotherapy program in a child with a deviation in neuromotor development. The therapy was performed 5 times a week for 3 months. The object of the study is the influence of physiotherapy in case of deviation in the neuromotor development of an infant with a rare genetic disease. The contingent of the study is 1 infant with a rare genetic disease - isovaleric acidemia and is the only case of a patient with such a disease in Bulgaria. The infant is 9 months old (7 adjusted months). The deviations are expressed in pathologically amplified and persistent primitive reflexes and delay in motor development. We assessed gross motor development by the method of Gross Motor Function Measure – 88 in the beginning and then made a reassessment on the 3rd month from the beginning of the therapy.
Results: The analysis of the results shows that the specialized physiotherapy program influenced the neuromotor development of the patient - helping to integrate primitive reflexes; to develop and improve motor skills.
Conclusions: Specialized physiotherapy is an effective treatment for neuromotor deviation in infant with a rare genetic disease.

Keywords: *physiotherapy, infant development, rare genetic disease*

INTRODUCTION

Isovaleric academia (IVA) is an autosomal recessive inborn error of leucine metabolism caused by a deficiency of the mitochondrial enzyme isovaleryl-CoA dehydrogenase (IVD) (Vockley, Ensenauer, 2006). The enzyme defect results in the accumulation of derivatives of isovaleryl-CoA including free isovaleric acid, 3-hydroxyisovaleric acid, isovaleryl (C5)-carnitine, and isovalerylglycine (IVG) which partly may exert neurotoxicity (Grünert et al, 2012). IVA was the first of the organic acidemias to be described and its nature was elucidated due to a combination of astute clinical acumen and new technology (Vockley, Ensenauer, 2006). The first two patients were described in 1966 and in 1967 (Budd et al., 1967; Efron, 1967; Tanaka et al., 1966).

IVA derives its name from the elevated concentrations of isovaleric acid found in patients. The normal concentrations of isovaleric acid in plasma are less than 10 μM. During remission, patients may have from normal to 10 times normal concentrations of isovaleric acid (10 to 50 μM), but during severe episodes, the levels rise as high as 100 to 500 times normal (600 to 5000 μM), according to European registry and network for intoxication type metabolic diseases (E-IMD).

Isovaleric acidemia is a rare disorder that presents either soon after birth or during infancy. It is a metabolic disorder which disrupts or prevents the normal metabolism of certain proteins. It may present up to adolescence. It affects an equal number of males and females (National Organization for Rare Disorders 2020)

The prevalence of this condition is 1 per 526,000 in Western populations (Moorthie et al., 2014). The estimated prevalence in the general population of Europe is 1/100,000 (Loots et al., 2005). It has a prevalence of 1 in 62,500 (in parts of Germany) to 1 in 250,000 live births (in the United States) (Ensenauer et al., 2011).

As can be seen there are different data regarding the prevalence.

Different information is also observed as to how many phenotypes it is. According to Cederbaum, Berry, 2012 there are 2 major phenotypes: an acute form manifests as catastrophic disease in the newborn period, and the late-onset type is characterized by chronic, intermittent episodes of metabolic decompensation. The degree of enzyme deficiency and the mutations differ between the two extreme

presentations. In the acute form, the infants become extremely sick in the first week of life. Metabolic acidosis is present, usually with an elevated anion gap and ketosis. There may be secondary hyperammonemia, thrombocytopenia, neutropenia, and sometimes anemia, resulting in pancytopenia. The babies usually lapse into a coma. Dialysis therapy may be necessary. As with other organic acid disorders for which an amino acid determines organic acid production, the treatment also consists of protein restriction, intravenous fluids with glucose, and perhaps sodium bicarbonate, protein-free formula with calories via nasogastric tube, glycine (250 mg/kg/day), and carnitine supplementation (Sweetman and Williams, 2001). In the chronic, intermittent form of isovaleric acidemia, patients have repeated episodes of metabolic decompensation precipitated by infections, primarily or excessive protein intake. Some of these episodes may mimic Reye syndrome. The same therapeutic principles are applied to the treatment of neonatal disorders.

According to Couce et al., 2016, 3 characteristic phenotypes have been identified: asymptomatic presentation, a chronic intermittent form with onset in infancy or childhood, and an acute neonatal form with early onset of metabolic decompensation that can lead to coma and death.

There is consensus among the authors regarding the clinical picture, especially regarding characteristic sweaty feet or rancid cheese odor caused by isovaleric acid that is noted on the body or in urine, especially if it is acidic. Other symptoms are poor feeding, vomiting, lethargy, and seizures.

In a study conducted with 21 children and adults, 44 % of investigated study patients (7/16) showed mild motor dysfunction, and only 19 % (3/16) had cognitive deficits (Grünert et al., 2012).

METHODOLOGY

The current study aims to monitor the effectiveness of a specialized physiotherapy program in a child with a deviation in neuromotor development. The therapy was performed 5 times a week for 3 months in the Medical center "Kids with developmental problems", Sofia. The object of the study is the influence of physiotherapy in case of deviation in the neuromotor development of an infant with a rare genetic disease. The contingent of the study is one infant with a rare genetic disease - isovaleric acidemia, and is the only case of a patient with such a disease in Bulgaria. The infant is 9 months old (7 adjusted months). The infant has a twin sister who shows no sign of abnormal development. The twins were born prematurely. When the patient started therapy, she had no diagnosis. The patient's clinical picture includes pathologically amplified and retained primitive reflexes, delay in motor development, spasticity, genovarus deformity, torticollis, plagiocephaly, trunk asymmetry, sensory defensiveness, and divergent strabismus, facial dysmorphism, and some gastrointestinal abnormalities. Pathologically amplified reflexes were the Moro reflex and tonic labyrinthine reflex. The spasticity in the lower limbs provoked a presumptive diagnosis of cerebral palsy, diparesis. Later, the diagnosis of cerebral palsy was rejected after genetic testing, and the genetic disease - isovaleric acidemia – was confirmed. We assessed gross motor development by the method of Gross Motor Function Measure – 88 (Russell, et al., 2002) at the beginning of the therapeutic course and then made a reassessment on the 3rd month from the beginning of therapy. The parents were asked to grant an informed permission to examine the infant and publish the results in a scientific article.

PHYSICAL THERAPY

The specialized combined physical therapy program consisted of elements of Glenn Doman's method (Doman, 2005): we stimulated crawling (Figure 1) and rolling over from prone to supine position and vice versa (on a modified incline track). Used modification of hanging on brachiation ladder (Doman et al., 2006) (Figure 2) and Temple Fay "patterning" technique (Doman, 2005). We included inhibitory techniques and modification of primitive reflex integration techniques (Figures 3 and 5). Techniques for inducing reflex movements. We applied compression application modification of swaddling (Figure 5).

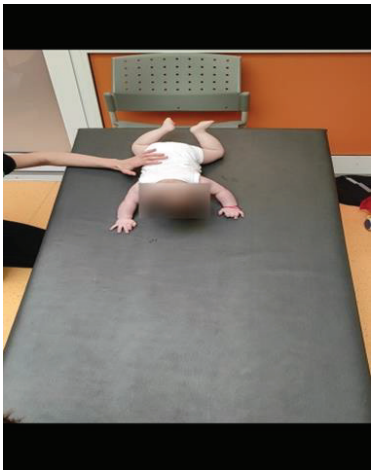


Figure 1. *Crawling by the Doman's method*

Figure 2. *Hanging by the Doman's method*

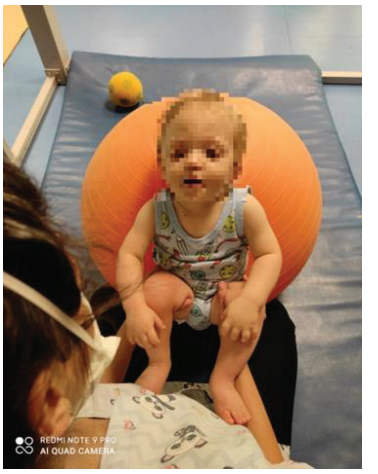


Figure 3. *Primitive reflex integration techniques*

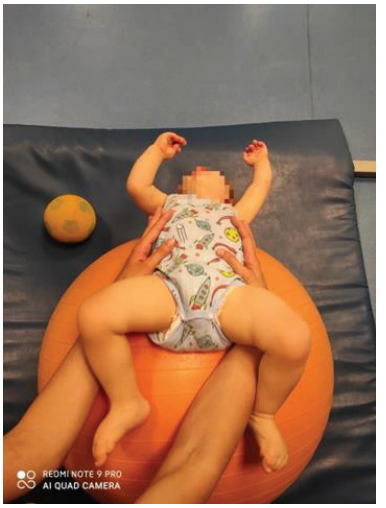


Figure 4. *Primitive reflex integration techniques*

Figure 5. *Compression application modification of swaddling*

RESULTS AND DISCUSSION

The statistical processing of the data shows a significant improvement in the GMFM-88 results at the 3rd month – 15.68 % compared to 0.78 % at the beginning (Figure 6).

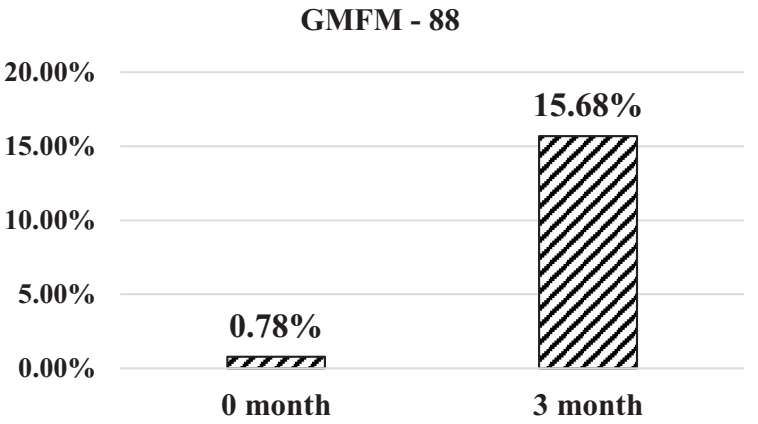


Figure 6. *GMFM-88 results at the beginning and at the 3rd month*

We can assume that the suppression and integration of retained primitive reflexes were primely important for an effective physical therapy program. Development of psychomotor, social, educational, and communication skills is inhibited with persistence or re-emergence of primitive reflexes demonstrated in patients with brain damages, such as cerebral palsy or stroke (Arcilla, Vilella, 2022).

Sensory defensiveness of the patient provoked highly manifested Moro reflex – the reflex was provoked by touch, sound, visual stimuli, movement, and changing body position. The reflex manifestation prevented the patient from flexing his head forward, bringing his hands together in the middle line, transferring a toy from hand to hand (hand-hand coordination), eye-hand coordination, hand-mouth coordination, and rolling over from prone to supine position. The persistent pathologically increased tonic labyrinthine reflex prevented the infant from flexing the head to the chest, maintaining a prone position, and required a specific way of holding. At this age, both the Moro reflexes and tonic labyrinthine reflex should already be integrated (Goddard, 2005; Flehmig, Rauterberg, 1979). Several studies have shown a relationship between the persistence of primitive reflexes after the time of their appearance and the disturbance in motor development, like in this study by Chinello et al., 2018 - the persistence of primitive reflexes might alter the developmental trajectory of future motor ability, and therefore their evaluation might be an early indicator of atypical development.

Retained primitive reflexes can disturb natural development and involve difficulties in social and educational children's life. They can also impact psychomotor development. Mature responses in a child's psychomotor progress can only occur if the central nervous system itself has reached maturity. The process consists of the transition made from brain stem reflex response to cortically controlled response. It seems reasonable to introduce reflexes integration therapy in children with low psychomotor skills. Primitive reflexes routinely tested can contribute to improved early psychomotor development in children with needs, thus preventing many difficulties which children can encounter within their social and school life (Gieysztor et al., 2018).

A study by Marquis et al., 1984 confirms a high incidence of motor delays among very low birth weight (VLBW) infants and demonstrates a clear association between retained primitive reflexes and delayed motor development in VLBW infants.

We can hypothesize that swaddling was the primary technique supporting the Moro reflex integration.

Swaddling decreased startles in quiet sleep (QS) and rapid eye movement (REM), full arousal in QS, and progression of startle to arousal in QS (Gerard et al., 2002)

The other thing we can assume is that *The Doman's method* effectively improves rolling over, crawling and gross motor functions in general.

CONCLUSION

Specialized physiotherapy effectively treats neuromotor deviation in infants with a rare genetic disease.

REFERENCES

Arcilla, C. K., Vilella, R. C. (2022). Tonic neck reflex. *StatPearls* [Internet]. Treasure Island (FL): StatPearls Publishing

Budd, M. A., Tanaka, K., Holmes, L. B., Efron, M. L., Crawford, J. D., Isselbacher, K. J. (1967). Isovaleric acidemia: clinical features of a new genetic defect of leucine metabolism. *NEJ Med*. 10.1056/NEJM196708172770701

Cederbaum, S., Berry, G. (2012). Inborn Errors of Carbohydrate, Ammonia, Amino Acid, and Organic Acid Metabolism. *Avery's Diseases of the Newborn* 10.1016/B978-1-4377-0134-0.10022-8

Chinello, A., Gangi, V. D., Valenza, E. (2018). Persistent primary reflexes affect motor acts: Potential implications for autism spectrum disorder. *Res Dev Disabil.* 10.1016/j.ridd.2016.07.010.

Couce, M., Aldamiz-Echevarría, L., Bueno, M., Barros, P., Belanger-Quintana, A., Blasco, J., García-Silva, MT., Márquez-Armenteros, A., Vitoria, I., Vives, I., Navarrete, R., Fernández-Marmiesse, A., Pérez, B., Pérez-Cerdá, C. (2016). Genotype and phenotype characterization in a Spanish cohort with isovaleric acidemia. *Journal of Human Genetics*. 10.1038/jhg.2016.144

Doman, G. (2005). *What to do about your brain-injured child*. Square One Publishers. 978-0757001864

Doman, G., Doman, D., Hagy, B. (2006). *How to teach your baby to be physically superb*. Square One Publishers. 978-0757001925

Efron, M. L. (1967). Isovaleric acidemia. *Am J Disease of Children*. 10.1001/archpedi.1967.02090160124015

Ensenauer, R., Fingerhut, R., Maier, E., Polanetz, R., Olgemöller, B., Röschinger, W., Muntau., A. (2011). Newborn screening for isovaleric acidemia using tandem mass spectrometry: data from 1.6 million newborns. *Clin Chem*. 10.1373/clinchem.2010.151134

European registry and network for Intoxication type Metabolic Diseases. Isovaleric acidemia (IVA). https://www.e-imd.org/diseases/organic-acidurias-oads/isovaleric-acidemia-iva. (accessed 19 Sept. 2022).

Flehmig, I., Rauterberg, K. (1979). *Normale Entwicklung des Säuglings und ihre Abweichungen: Früherkennung und Frühbehandlung*. Stuttgart: Thieme. 3135606015

Gerard, C. M., Harris, K. A., Thach, B. (2002). Spontaneous arousals in supine infants while swaddled and unswaddled during rapid eye movement and quiet sleep. *Pediatrics*. 10.1542/peds.110.6.e70

Gieysztor, E. Z., Choińska, A. M., Paprocka-Borowicz, M. (2018). Persistence of primitive reflexes and associated motor problems in healthy preschool children. *Arch Med Sci*. 10.5114/aoms.2016.60503

Goddard, S. (2005). *Reflexes, Learning And Behavior: A Window into the Child's Mind : A Non-Invasive Approach to Solving Learning and Behavior Problems.* Fern Ridge Pr. 9780976454304

Grünert, S., Wendel, U., Lindner, M., Leichsenring, M., Schwab, KO., Vockley, J., Lehnert, W., Ensenauer, R. (2012). Clinical and neurocognitive outcome in symptomatic isovaleric acidemia. *Orphanet J Rare Dis*. 10.1186/1750-1172-7-9

Loots, D. T., Erasmus, E., Mienie, LJ. (2005). Identification of 19 new metabolites induced by abnormal amino acid conjugation in isovaleric acidemia. *Clin Chem*. 10.1373/clinchem.2005.048421

Marquis, P. J., Ruiz, N. A, Dillard, R. G. (1984). Retention of primitive reflexes and delayed motor development in very low birth weight infants. *J Dev Behav Pediatr*. 10.1097/00004703-198406000-00004

Moorthie, S., Cameron, L., Sagoo, G. S., Bonham, J. R. & Burton, H. (2014). Systematic review and meta-analysis to estimate the birth prevalence of five inherited metabolic diseases. *J. Inherit. Metab. Dis.* 10.1007/s10545-014-9729-0.

Rare Diseases. National Organization for Rare Disorders. (2020). Isovaleric Acidemia. https://rarediseases.org/rare-diseases/acidemia-isovaleric/. (Accessed 19 Sept. 2022).

Russell, D., Rosenbaum, P., Avery, L., Lane, M. (2002). *Gross Motor Function Measure (GMFM-66 and GMFM-88) User's Manual*. London, United Kingdom: Mac Keith Press;

Sweetman, L., Williams, J. D. (2001). Branched chain organic acidurias. In: Scriver C, Beaudet AL, Sly W, Valle D, editors. *The Metabolic and Molecular Basis of Inherited Disease. 8th edition*. New York: McGraw-Hill

Tanaka K, Budd M. A, Efron ML, Isselbacher KJ. (1966). Isovaleric acidemia: a new genetic defect of leucine metabolism. *Proc. Natl. Acad. Sci. USA*. 10.1073/pnas.56.1.236

Vockley, J., Ensenauer, R. (2006). Isovaleric Acidemia: New Aspects of Genetic and Phenotypic Heterogeneity. *Am J of Medical Genetics Part C Seminars in Medical Genetics*. 10.1002/ajmg.c.30089

Corresponding author:
Madlena Ilcheva,
PhD student
Department of Kinesitherapy and Rehabilitation
National Sports Academy "Vassil Levski"
E-mail: madlena_ilcheva@mail.bg

EFFECTS OF EXERCISE PROGRAMS ON THE CERVICAL SYNDROME: A SYSTEMATIC REVIEW

Bojan Jorgić, Sandra Kostić, Stefan Đorđević, Miljan Hadžović & Vladimir Antić

Faculty of Sport and Physical Education, University of Niš, Serbia

ABSTRACT

Cervical syndrome is one of the most common painful conditions of modern times. It can be defined as a set of disorders caused by degenerative changes to the joints of the cervical spine. The clinical picture of a person affected by the cervical syndrome includes pain, increased tone of the neck muscles, as well as the muscles of the shoulder girdle, reduced range of motion of the cervical spine, etc. This study aimed to determine the effects of exercise programs on cervical syndrome based on a systematic review of previous research. PubMed, Google Scholar, SCIndex, and Medline databases were all searched to compile data on the effects of exercise programs on cervical syndrome. The following keywords were used in the search: cervical syndrome, physical exercise, and neck pain. The inclusion criteria were that the papers were written in English, were available in full text, and were published between 2015 and 2020. Based on the set criteria, 13 studies were included in the final analysis. Based on their analysis, it was determined that various forms of physical exercise programs have numerous positive effects among people affected by the cervical syndrome (reduction of pain, increased range of motion of the cervical spine, increased muscle strength and endurance of neck muscles, relaxation of cervical flexor muscles, reduction of pain in response to pressure, reduction of nocturnal neck pain, etc.). Physical exercise programs lead to strengthening and increased flexibility. By strengthening the musculature, the support that the muscles give to the surrounding joints increases, while the increase in flexibility affects the function of the joints and enables a greater range of motion, which is reduced by cervical syndrome. Due to all the previously mentioned positive effects of physical exercise programs among people affected by the cervical syndrome, physical exercise programs should be included as their first-line treatment.

Keywords: *the cervical spine, upper back, pain, activity*

INTRODUCTION

Decreased physical activity and long-term sedentary habits contribute to the emergence of numerous painful conditions of the human locomotor apparatus. One such state that emerges is *cervical syndrome* (Anušić, 2011). Numerous individuals experience neck pain at least once during their lifetime, whereby the greatest frequency of occurrence is for the ages of 30 to 50. The cervical syndrome is present in 8% of all cases of painful states of the locomotor apparatus. Furthermore, almost twice as many cases of this syndrome are registered among the female population compared to the male population (Minić, Ivković, 2014). The basic symptoms which lead an individual to seek medical attention are neck pain which might extend along the arm, toward the shoulders, shoulder blades, and frequent and persistent headaches, accompanied by dizziness (Jevtić, 2006). Regarding the pathophysiology of cervical syndrome, its key characteristic is the emergence and progression of degenerative tissue processes due to metabolic and mechanical damage. The resulting degenerative processes can affect inter-vertebral bodies, joints, the surrounding connective tissue, and ligaments (Minić, Ivković, 2014). Based on the localization of the emergent changes and symptoms, a distinction can be made between the following clinical forms, Cervical syndrome, Cervicocephalic syndrome, Cervicaobrachial Syndrome, and Vertebrobasilar insufficiency (Jandrić et al., 2010).

Once the cervical syndrome has been diagnosed, conservative or operative treatment begins. Conservative treatment, among other things, includes physical exercise. Exercise is recommended as a first-line treatment for cervical syndrome. The exercise program should be controlled and dosed so as to ensure positive effects without the emergence of unwanted effects (Liang et al., 2019). Numerous individuals affected by cervical syndrome avoid exercise due to the fear that the pain in their joints will increase, as well as weakness and fatigue. However, physical exercise is precisely one of the crucial links in the chain of the overall treatment of individuals affected by cervical syndrome (Bertozzi et al., 2013). Based on the aforementioned, the paper aims to use a systematic review to analyze the existing research and determine the effects of exercise programs on the cervical syndrome.

METHODS

Electronic databases such as PubMed, Google Scholar, SCIndex, Plos, MEDLINE, and NCBI were used to compile data on the effects of exercise programs on cervical syndrome. Papers published between 2015 and 2020 were analyzed.

The following keywords were used in the search: *cervical syndrome, exercise, physical activity, and upper back pain.*

The inclusion criteria were that the papers were written in English, were available in full, and were published between 2015 and 2020.

RESULTS

The keywords were used to identify 2567 papers. Following the implementation of the inclusion criteria, the final analysis included 13 studies analyzed in detail in Table 1.

Table 1. *Analysis of the compiled studies*

Reference	Sample of participants	Groups	Experimental program		Measuring instruments and results
			Frequency and duration	Exercise program	
Javanshir et al. (2015)	YA: 38 ± 4 G: m, f n = 60	1EG (n=30) 2EG (n=30)	OD – 10 weeks TD - 30 min HY – 3 times	1EG: Cranio-cervical flexion exercises. 2EG: Cervical flexion exercises.	Sig.↑ increase in the dimensions of the LC (cross-section, width, thickness) in 1EG compared to 2EG. Sig.↑ increase in the thickness of SCM 2EG compared to 1EG.
Langevin et al. (2015)	YA: 18 – 65 G: m, f n = 36	1EG (n=18) 1CG (n=18)	OD – 4 weeks WF – 2 times	1EG: Manual ther apy for the cervical and thoracic part of the spine with specific techniques for the increase in the size of the IVF, stabilization, and mobility exercises. 1CG: general manual therapy for the cervical and thoracic spine.	Both groups indicate significantly better results for the NDI, QuickDash, NPRS following the completed exercise program, compared to the initial values.
Bobos et al. (2016)	YA: 18 – 65 G: m, f n = 60	1EG (n=20) 2EG (n=20) 1CG (n=20)	OD – 7 weeks TD – 30-40 min WF – 2 times	1EG: Exercises for strengthening and stretching deep cervical flexors. 2EG: Exercises for strengthening and stretching the surface cervical flexors. 1CG: Exercises from a physiatrist's manual, or from a recording. The exercises were done at home.	The measured parameters included: NDI, NPRS, CCFT, PPT. Both experimental groups indicate Sig.↑ better results for the measured parameters compared to the control group, but without greater differences in the results between the 1EG and 2EG. The only more significant difference was noted for CCFT which is Sig.↑ better for the 1EG compared to the 2EG and 1CG.
Izquierdo et al. (2016)	YA: 18 – 55 G: m, f n = 28	1EG (n=14) 2EG (n=14)	OD – 8 weeks TD – 20 min per day WF – 2 times a day, every day	1EG: Exercises for cranio-cervical flexion (the aim was the activation of deep cervical flexors with a minimal activation of superficial cervical flexors). 2EG: Proprioceptive training of the neck.	Both experimental groups indicated Sig.↑ better results on the CCFT following the completed program. Without changes to the PPT test for both groups. Both groups indicate Sig.↑ reduction in pain in the neck at rest (VAS pain intensity scale).

Celenay, et al. (2016)	YA: 18 – 65 G: m, f n = 102	1EG (n=51) 2EG (n=51)	OD – 4 weeks TD – 60 min WF – 3 times	1EG: Exercise program for progressive cervical and scapulothoracic stabilization with manual therapy. 2EG: Exercise program for progressive cervical and scapulothoracic stabilization without manual therapy.	Better results for SF36, NDI, a reduction in nightly cervical pain, an increase in the range of motion of the cervical spine in 1EG compared to 2EG. Pain at rest and during activity, PPT, as well as the cervical extension and lateral flexion did not differ Sig.⊠ between the 1EG and 2EG.
Rota et al. (2016)	YA: 36 – 53 G: m, f n = 384	1EG (n=192) 1CG (n=192)	OD – 12 months	For 1-6 months the 1EG performed relaxation exercises for the cervical spine 1-2 times a day with 3 exercises to correct posture every couple of hours. For 6-12 months the same program was followed by the 1CG.	The measurement results at the end of month 6 (PTS, CTS, CMT) were Sig.↑ better for the 1EG compared to the 1CG. The measurement results at the end of month 12 did not indicate significant differences between the control and experimental group.
Cho et al. (2017)	YA: 20-29 G: m, f n = 32	1EG (n=16) 1EG (n=16)	OD – 4 weeks In both groups, 10 interventions were carried out over a period of 4 weeks.	1EG: Neck mobility exercises, cervical retraction exercises. 2EG: Thoracic mobility exercises and thoracic extension exercises.	The results measured 2 weeks after the completed program indicate Sig.↑ better results for the CVA, NPRS and NDI in 2EG compared to 1EG.
Lin et al. (2018)	YA: 1EG: 57.3±8.74 2CG: 58.15±8.17 G: m, f n = 72	1EG (n=32) 1CG (n=32)	OD – 6 weeks TD – 35-55 min WF – 3 times	1EG: Exercises of cranio-cervical flexion, progressive exercises with elastic bands, modified Brügger exercises with 'classical' physical therapy. 1CG: Only physical therapy.	The experimental group indicated Sig.⊠ better results of the CCFT, as well as increased muscle strength of the neck muscles compared to the control group.
Chung et al. (2018)	YA: 1EG: 34.27 ± 8.74 1CG: 37.37 ± 10.24 G: m, f n = 41	1EG (n=22) 1CG (n=19)	OD – 8 weeks TD – 30-45 min WF – 3 times	Both groups began their training sessions by stretching their neck muscles (3 series, 30 seconds). 1EG: Following the stretching, the group did cranio-cervical flexion. 1CG: Following the stretching, the group did plyometric exercises.	The following results were measured: VAS, NDI, muscle strength, range of motion of the cervical spine. Both groups indicated Sig.↑ better results for the measured parameters.
Yildiz et al. (2018)	YA: 18-45 G: m, f n = 30	1EG (n=15) 1CG (n=15)	OD – 8 weeks TD – 30-45 min WF – 3 times	1CG: Neck extension exercises, cranio-cervical flexion exercises, cervical retraction exercises. + manual therapy of the neck 1EG: did additional scapular stabilization exercises.	Both groups indicated Sig.↑ improvement in the parameters of VAS, NDI. There were no differences between the groups for scapular kinematics.

Suvarnnato et al. (2019)	YA: 1EG: 43.27±9.68 2EG: 43.5±12 1CG: 42.05±8.48 G: m, f n = 54	1EG (n=18) 2EG (n=18) 1CG (n=18)	OD – 6 weeks WF – 2 times	1EG: Isometric exercises for m. semispinalis cervicis. The group performed 3 sets of exercises per day, each set consisting of 10 exercises, each exercise lasting 10 seconds. 2EG: Exercises for the deep cervical flexors. Three sets each with 10 exercises per set. 1CG: classical forms of physiotherapy lasting 30 minutes each.	The experimental groups noted a Sig.↑ improvement in the NDI index, NPS, CVA and strength of the neck muscles compared to the control group.
Rodriguez-Sanz et al. (2020)	YA: 1EG: 49.72 ± 17.56 2EG: 48.76 ± 14.53 G: m, f n = 58	1EG (n=29) 1EG (n=29)	OD – 4 weeks TD –20 min WF – 1 time	1EG: Exercises for the deep cervical flexors, strength exercises for the neck muscles. 2EG: Exercises for the deep cervical flexors, strength exercises for all the neck muscles + manual therapy of the cervical spine.	The following parameters were measured: NDI, PPT, VAS, CCFT 2EG indicated a Sig.↑ greater improvement of the measured parameters after completing the program, compared to the 1EG.
Skillgate et al. (2020)	YA: 18 – 70 G: m, f n = 619	1EG (n=145) 2EG (n=160) EG(n=169) 4EG (n=147)	OD – 6 weeks TD – 30-60 min WF – 3-6 times	1EG: Deep massage of the neck region and the thoracic region of the back. 2EG: Independent exercises of extension, retraction, lateralization, neck rotation; exercises for the mobilization of the scapulae and strength exercises for the neck. 3EG: A combination of massage and independent exercises for the 2EG. 4EG: advice and recommendations of physiotherapists regarding exercise, posture, therapy for neck pain.	The intensity of the pain (the CPQ scale) for 1EG and 3EG was significantly lower in weeks 7 and 12 compared to 4EG. 2EG indicated a significantly reduced pain intensity following measurements taken in week 26. The results indicate that combined therapy (massage+exercise) provides the best short-term results.

M - male participant; F – female participant; YA – years of age; G – gender; 1EG – first experimental group; 2EG – second experimental group; 3EG – third experimental group; 4EG – fourth experimental group; 1CG – first control group; OD – overall program duration; WF – weekly frequency; TD – duration of individual training sessions; Sig.↑ - statistically significant; LC - Longus colli; SCM - Sternoclidomastoid; IVF - intervertebral foramen, QuickDash - Shortened Version of the Disabilities of the Arm, Shoulder and Hand Questionnaire, NDI - Neck Disability Index, NPRS - Numeric Pain-Rating Scale, CPQ - Chronic Pain Grade questionnaire; VAS - Visual Analogue Scale; CCFT - Cranio-cervical flexion test performance, PPT - Pressure pain thresholds, SF36 - Medical Outcomes Study 36-Item Short-Form Health Survey; PTS - Pericranial Muscle Tenderness, CTS - Cervical Muscle Tenderness; CMT - Cumulative Muscle Tenderness; CVA - Craniovertebral angle

The analyzed studies showed an equal prevalence of participants of each gender. Regarding the number of participants, the fewest, 28, took part in the study by Izquierdo et al. (2016), while the largest sample of participants, 619, took part in the study of Skillgate et al. (2020). The age of the participants in the analyzed studies was 30 - 60 years on average. Only in the study of Cho et al. (2017) was the age of participants between 20 and 29. In 7 of the 13 analyzed studies, the participants were divided

into experimental and control groups (Langevin et al., 2015; Bobos et al., 2016; Rota et al., 2016; Lin et al., 2018; Chung et al., 2018; Yildiz et al., 2018; Suvarnnato et al., 2019). In the remaining six studies the participants were divided into several experimental groups with no control groups (Javanshir et al., 2015; Izquierdo et al., 2016; Celenay et al., 2016; Cho et al., 2017; Rodriguez-Sanz et al., 2020; Skillgate et al., 2020).

The duration of the exercise program, the duration of individual training sessions, as well as the weekly frequency of the training sessions differed. In 4 of the studies, the program lasted for four weeks (Langevin et al., 2015; Celenay et al., 2016; Cho et al., 2017; Rodriguez-Sanz et al., 2020). Three of the studies, lasted for six weeks (Lin et al., 2018; Suvarnnato et al., 2019; Skillgate et al., 2020). In 1 study, the program lasted for seven weeks (Bobos et al., 2016). In 3 studies, the program lasted 8 weeks (Izquierdo et al., 2016; Chung et al., 2018; Yildiz et al., 2018). In 1 study, the program lasted for ten weeks (Javanshir et al., 2015). The longest exercise program lasted 12 months (Rota et al., 2016). The individual training sessions, on average lasted from 30 to 60 minutes in most studies. The number of training sessions per week also varied, but in most of the studies, it ranges from 3 to 6 training sessions per week. Only in the study by Rodriguez-Sanz et al. (2020) did the exercise program have a frequency of once a week, while in the studies of Bobos et al. (2016) and Suvarnnato et al. (2019), the frequency was two times a week.

Most of the reviewed and analyzed studies included exercise programs featuring exercises meant to increase cranio-cervical mobility, strengthen the neck muscles, and exercise the deep cervical flexors. In certain studies, the exercise program included manual cervical traction (Celenay et al., 2016; Yildiz et al., 2018; Rodriguez-Sanz et al., 2020), as well as physical therapy.

DISCUSSION

By analyzing the papers in Table 1 and considering their year of publication, we can conclude that the issue of the effects of exercise programs on cervical syndrome continued to be a topical one over the past five years, i.e., from 2015 to 2020.

If we were to analyze the prevalence of the gender of the participants in the selected studies, we could note that cervical syndrome is equally present both among men and women. From the point of view of the age of the participants, an analysis of the included studies leads us to the conclusion that cervical syndrome is present both among the older and younger population, which can be noted in the study of Cho et al., where the age of the participants was 20-29 (Cho et al., 2017), or in the study of Skillgate et al. (2020) where the oldest participants were 70 years of age.

When it comes to the duration of the exercise program and any success related to it, we can note that in most of the studies, 7 out of 13, the program lasted 4-6 weeks and led to positive results (Langevin et al., 2015; Celenay et al., 2016; Cho et al., 2017; Rodriguez-Sanz et al., 2020; Lin et al., 2018; Suvarnnato et al., 2019; Skillgate et al., 2020). Therefore, it could be concluded that programs which last from 4 to 6 weeks result in positive therapeutic effects in the case of individuals affected by cervical syndrome. In addition, exercise programs which last longer than six weeks have positive therapeutic effects among individuals affected by cervical syndrome. For example, in 3 of the studies in which the exercise program lasted eight weeks, positive results were noted following the completion of the program (Izquierdo et al., 2016; Chung et al., 2018; Yildiz et al., 2018). If we were to analyze the association between the duration of individual training sessions and any positive effects, based on the analyzed studies, it could be concluded that the best results are obtained from training sessions that last 30 to 60 minutes, as noted in 7 of the 13 studies (Javanshir et al., 2015; Bobos et al. 2016; Celenay et al., 2016; Lin et al., 2018; Chung et al., 2018; Yildiz et al., 2018; Skillgate et al., 2020). In the study of Rodriguez-Sanz et al. (2020), the results indicate that positive therapeutic effects were achieved during a training session that last 20 minutes.

Based on the achieved effects, the analyzed results indicate that following the experimental program, the intensity of the pain at rest and during activity is statistically significantly reduced, as is the pain felt when pressure is applied to the neck. Furthermore, there was a statistically significant increase in the cervical spine's range of motion and a decrease in the sense of rigidity, as well as a decrease in dysfunction and the inability to perform everyday activities (Langevin et al., 2015; Bobos et al., 2016; Izquierdo et al., 2016; Celenay et al., 2016; Rota et

al., 2016; Cho et al., 2017; Lin et al., 2018; Chung et al., 2018; Yildiz et al., 2018; Suvarnnato et al., 2019; Rodriguez-Sanz et al., 2020; Skillgate et al., 2020). In the study by Suvarnnato et al. (2019), it was determined that the exercise program increased the cranio-vertebral angle in individuals affected by cervical syndrome. Javanshir et al. (2015) determined that cranio-cervical flexion exercises had a greater impact on the *m. longus colli*, while cervical flexion exercises had a greater effect on the *m.sternocleidomastoideus.*

Based on the complete analysis of the selected studies and the recommendations given by Stevanović et al. (2019), the main aims of cervical syndrome therapy include a decrease in neck pain, the preservation of the physiological range of motion of the cervical spine, correction of the asymmetry which is a result of muscle weakness or the shortening of soft tissue, an increase in muscle strength of the neck muscles, improvement in circulation and trophism, and the re-establishment of previously disrupted functions.

CONCLUSION

The analysis of the compiled studies indicates that there are numerous positive effects and benefits of exercise programs for cervical syndrome. The positive effects of the analyzed exercise programs are primarily reflected in the reduction of pain, strengthening of the musculature of the shoulder-neck region, a decrease in the tension of the neck and shoulder musculature, and an increase in the range of motion of the cervical spine. It could be concluded that physical exercise programs have numerous positive therapeutic effects on cervical syndrome and that they should be included in first-line treatment for cervical syndrome.

REFERENCES

Anušić, N. (2011). *Kineziterapijski tretman cervikalnog sindroma* (Kinesitherapy treatment of the cervical syndrome). Banja Luka: Panevropski univerzitet "Apeiron".

Bobos, P., Billis, E., Papanikolaou, D. T., Koutsojannis, C., & MacDermid, J. C. (2016). Does Deep Cervical Flexor Muscle Training Affect Pain Pressure Thresholds of Myofascial Trigger Points in Patients with Chronic Neck Pain? A Prospective Randomized Controlled Trial. *Rehabilitation research and practice*, 6480826, 1-8.

Bertozzi, L., Gardenghi, I., Turoni, F., Villafañe, J. H., Capra, F., Guccione, A. A., & Pillastrini, P. (2013). Effect of therapeutic exercise on pain and disability in the management of chronic nonspecific neck pain: systematic review and meta-analysis of randomized trials. *Physical therapy*, 93(8), 1026–1036.

Izquierdo Gallego, T., Pecos-Martin, D., Lluch Girbés, E., Plaza-Manzano, G., Rodríguez Caldentey, R., Mayor Melús, R., Blanco Mariscal, D., & Falla, D. (2016). Comparison of cranio-cervical flexion training versus cervical proprioception training in patients with chronic neck pain: A randomized controlled clinical trial. *Journal of rehabilitation medicine*, 48(1), 48–55.

Jandrić, S., Petrović, V., Stanetić, K., Stoisavljević-Šatara, S. (2010). *Cervikalni sindrom* (The cervical syndrome). Banja Luka: Udruženje ljekara porodične medicine Republike Srpske.

Javanshir, K., Amiri, M., Mohseni Bandpei, M. A., De las Penas, C. F., & Rezasoltani, A. (2015). The effect of different exercise programs on cervical flexor muscles dimensions in patients with chronic neck pain. *Journal of back and musculoskeletal rehabilitation*, 28(4), 833–840.

Langevin, P., Desmeules, F., Lamothe, M., Robitaille, S., & Roy, J. S. (2015). Comparison of 2 manual therapy and exercise protocols for cervical radiculopathy: a randomized clinical trial evaluating short-term effects. *The Journal of orthopaedic and sports physical therapy*, 45(1), 4–17.

Lin, I. H., Chang, K. H., Liou, T. H., Tsou, C. M., & Huang, Y. C. (2018). Progressive shoulder-neck exercise on cervical muscle functions in middle-aged and senior patients with chronic neck pain. *European journal of physical and rehabilitation medicine*, 54(1), 13–21.

Liang, L., Feng, M., Cui, X., Zhou, S., Yin, X., Wang, X., Yang, M., Liu, C., Xie, R., Zhu, L., Yu, J., & Wei, X. (2019). The effect of exercise on cervical radiculopathy: A systematic review and meta-analysis. *Medicine*, 98(45), 1-7.

Minić, S., Ivković, S. (2014). Laseroterapija bola kod akutnog cervikalnog sindroma (Laser therapy in acute cervical syndrome treatment). *Praxis Medica*, 43(4); 13-19.

Rota, E., Evangelista, A., Ceccarelli, M., Ferrero, L., Milani, C., Ugolini, A., & Mongini, F. (2016). Efficacy of a workplace relaxation exercise program on muscle tenderness in a working community with headache and neck pain: a longitudinal, controlled study. *European journal of physical and rehabilitation medicine*, 52(4), 457–465.

Rodríguez-Sanz, J., Malo-Urriés, M., Corral-de-Toro, J., López-de-Celis, C., Lucha-López, M. O., Tricás-Moreno, J. M., Lorente, A. I., & Hidalgo-García, C. (2020). Does the Addition of Manual Therapy Approach to a Cervical Exercise Program Improve Clinical Outcomes for Patients with Chronic Neck Pain in Short- and Mid-Term?

A Randomized Controlled Trial. *International journal of environmental research and public health*, 17(18), 1-19.

Skillgate, E., Pico-Espinosa, O. J., Côté, P., Jensen, I., Viklund, P., Bottai, M., & Holm, L. W. (2019). Effectiveness of deep tissue massage therapy, and supervised strengthening and stretching exercises for subacute or persistent disabling neck pain. The Stockholm Neck (STONE) randomized controlled trial. *Musculoskeletal Science and Practice*, 45, 1-12.

Suvarnnato, T., Puntumetakul, R., Uthaikhup, S., & Boucaut, R. (2019). Effect of specific deep cervical muscle exercises on functional disability, pain intensity, craniovertebral angle, and neck-muscle strength in chronic mechanical neck pain: a randomized controlled trial. *Journal of pain research*, 12, 915–925.

Stevanović, P., Nešić, D., Lađević, N. (2019). *Medicina bola* (A medical study of pain). Beograd: Medicinski fakultet u Beogradu.

Celenay, S. T., Akbayrak, T., & Kaya, D. O. (2016). A Comparison of the Effects of Stabilization Exercises Plus Manual Therapy to Those of Stabilization Exercises Alone in Patients With Nonspecific Mechanical Neck Pain: A Randomized Clinical Trial. *The Journal of orthopaedic and sports physical therapy*, 46(2), 44–55.

Cho, J., Lee, E., & Lee, S. (2017). Upper thoracic spine mobilization and mobility exercise versus upper cervical spine mobilization and stabilization exercise in individuals with forward head posture: a randomized clinical trial. *BMC Musculoskeletal Disorders,* 18(1). https://pubmed.ncbi.nlm.nih.gov/29233164/

Chung, S., & Jeong, Y. G. (2018). Effects of the flexion and isometric neck exercise compared in patients with chronic neck pain: A randomized controlled trial. *Physiotherapy theory and practice*, 34(12), 916–925.

Yildiz, T. I., Turgut, E., & Duzgun, I. (2018). Neck and Scapula-Focused Exercise Training on Patients With Nonspecific Neck Pain: A Randomized Controlled Trial. *Journal of sport rehabilitation*, 27(5), 403–412.

Corresponding author:
Bojan Jorgić, PhD
Department for Applied Kinesiology
Faculty of Sport and Physical Education,
University of Niš
18000 Niš, Serbia
E-mail: bojanjorgic@yahoo.com

PHYSICAL ACTIVITY AND PREVALENCE OF DYSMENORRHEA AMONG UNIVERSITY STUDENTS IN BULGARIA

Diana Popova-Dobreva
National Sports Academy „Vassil Levski", Sofia, Bulgaria

ABSTRACT
Introduction. In the methodological literature, the prevalence of painful menstruation has not been sufficiently studied, which has aroused our research interest.
Methodology. A survey was conducted with 185 Bulgarian women. The average age of the women surveyed is 22 years. The physical activity of women is categorized into three levels: adherence to the recommended 150 to 300 minutes per week of moderate physical activity or 75 to 150 minutes of high intensity, less than the recommended and irregular physical activity. The frequency of painful menstruation has been established. A self-assessment of perception of the effect of menstrual pain on performance is made. Characteristics of women are made by age, BMI and number of births. The regularity, duration and abundance of the monthly blood circulation were studied.
Results. Of the surveyed contingent of women, 46% follow the recommended physical activity by the WHO. 21.62% of women report an irregular menstrual cycle. Only 3.78% of women report lack of menstrual pain. 34.05% of the women do not take analgesics during the menstrual cycle.
Discussion. The high prevalence of dysmenorrhea necessitates more in-depth study.
Conclusions. Our study revealed a high degree of dysmenorrhea among University Students in Bulgaria. The presence of pain during the menstrual cycle is the reason for taking analgesics and has a negative impact on performance.

Keywords: *Physical activity, Prevalence of Dysmenorrhea*

INTRODUCTION

Primary dysmenorrhea is due to muscle cramps that cause ischemia and corresponding pain, most often in the hours immediately before and after the onset of menstruation. Although painful menstruation is the most common gynecological complaint affecting girls and young women, many of them do not seek medical advice and remain untreated. Modern science is looking for alternative methods of a conservative treatment to reduce the dependence on medication for pain reduction (Kamel et al., 2017).

Physiotherapy has appropriate means that are effective in this direction. Collaborative efforts by healthcare professionals should focus on raising awareness and improving treatment strategies for dysmenorrhea.

Aim and objectives of the study

The objectives of this study are: (1) to reveal the prevalence of Dysmenorrhea among University students in Bulgaria and (2) to establish how menstrual pain impacts work ability.

METHODS

The applied methodology includes an online-based anonymous study, which focuses on the prevalence of Dysmenorrhea among Bulgarian college women and how much Menstrual pain impacts their work ability. A characteristic of the studied contingent on age, BMI, physical activity, duration, abundance, and regularity of the monthly cycle was made. The presence of menstrual pain was assessed with a visual analog scale from 0 to 10, where 0 is no pain. The women indicated whether they took painkillers in the presence of pain during menstruation. The surveyed contingent of women filled out an Internet-based questionnaire.

In the statistical processing of data to establish the relationship between the indicators studied by us, we use the Pearson correlation coefficient (r).

RESULTS

The results of 185 women surveyed (average age is 22 years) were analyzed. 21.65% of the women surveyed reported an irregular cycle. This fact is impressive and warrants further investigation. The results of the study are graphically presented in terms of the physical activity of the women studied their BMI, duration, and abundance of menstruation, the presence of pain, and its impact on their ability to work. Statistical processing of the dependencies of the studied indicators was done.

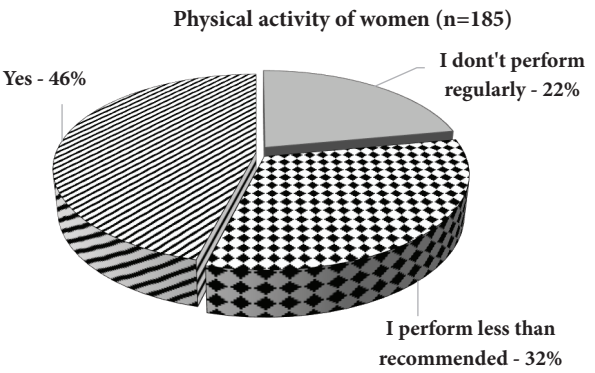


Figure 1. *Physical activity of women*

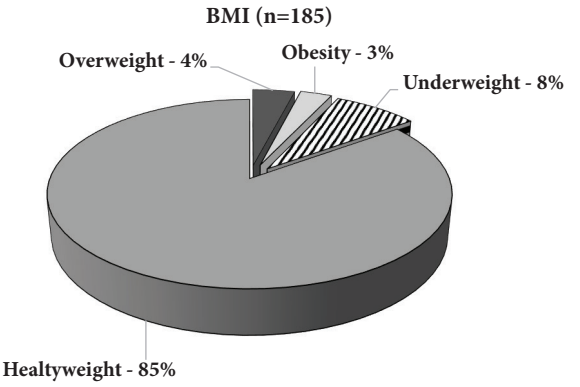


Figure 2. *BMI of the researched women*

Less than half of the women surveyed (46%) follow the recommendations of the World Health Organization for physical activity. A further extension of the research is needed, which is followed by the creation of policies to promote the importance of physical activity for maintaining a healthy lifestyle.

For the most part, the women we studied with premenstrual symptoms were of normal weight (85%). A quarter of the young women surveyed were not at a healthy weight – 4% of women are overweight, 8% with obesitas and 3% are underweight.

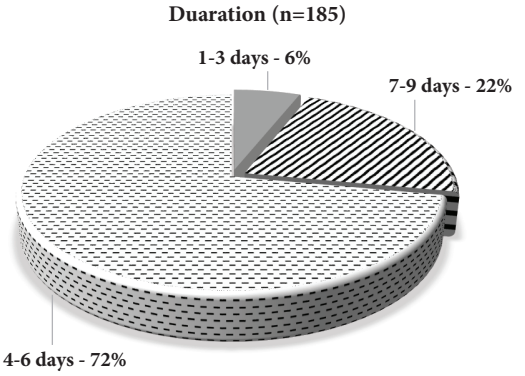


Figure 3. *Duration of monthly bleeding*

As shown in Figure 3 the duration of monthly bleeding in most of the examined women is between 4-6 days (72%). In 22% the duration is between 7-9 days and in 6% 9 between 1-3 days.

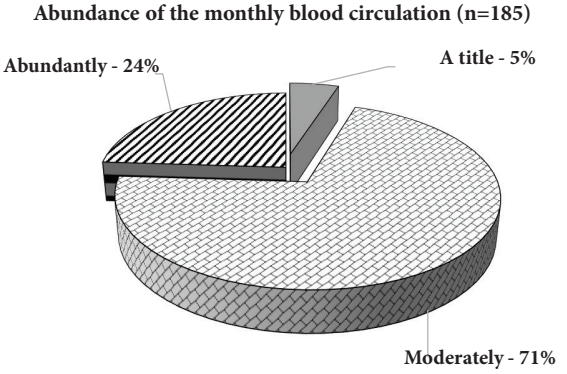


Figure 4. *Abundance of the monthly blood circulation*

In 71% of the examined women, the abundance of bleeding was moderate. 24% of women have heavy menstruation and 5% have scanty menstruation. The obtained results correspond to the trend established in methodological literature for a correlation between the length and abundance of the menstrual cycle.

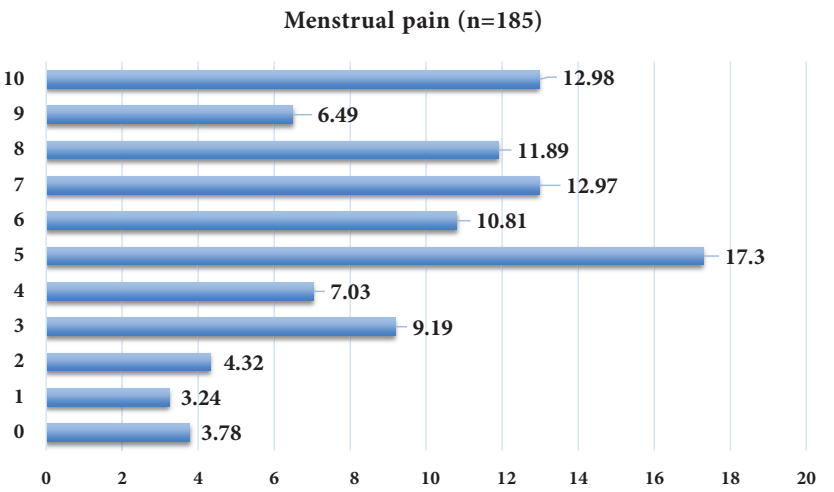


Figure 5. *Menstrual pain*

Over 72% of the women studied experienced pain equal to or greater than a score of 5 on a visual analog scale. Of all 185 women studied, 36.76% sometimes take pain medication, 29.19% take medication in more than half of the pain cases, and only 34.05% of the women do not take medication. An insignificant 3.78% reported no pain during menstruation. Mild pain between 1 and 4 on the visual-analog scale was experienced by 23.78%.

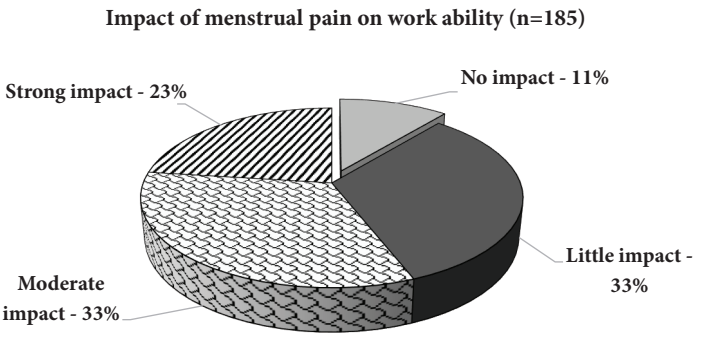


Figure 6. *Impact of menstrual pain on work ability*

Menstrual pain had a strong impact on work ability for 56% of women (33% severe impact and 23% moderate impact). In only 11% of the examined women, the pain had no impact on their ability to work.

Table 1. *Pearson correlation coefficient (r) (n=185)*

Indicators	PA	Pain	Impact	BMI	Duration
PA	1				
Pain	.04	1			
Impact	.15*	.662**	1		
BMI	.116	-.051	-.031	1	
Duration	.09	.227**	.157*	.072	1

To establish the relationship between the indicators we studied, we used the Pearson correlation coefficient (r).

The analysis of the obtained results established that there is a statistically significant correlation coefficient at $\alpha = .05$ between the indicators of Pain and the Impact of menstrual pain on work ability.

The statistical processing of the obtained results confirms the negative impact of the greater pain on the *I*mpact of menstrual pain on work ability of the women we studied. This trend is visible from the analysis of the results in Table 1.

DISCUSSION

Primary dysmenorrhea manifests itself in adolescence and, unlike secondary dysmenorrhea, there is no pelvic pathology (e.g., endometriosis, pelvic adhesions, pelvic inflammatory diseases, etc.). Etiologically, dysmenorrhea is associated with overproduction of prostaglandins. Prostaglandins cause constriction of the blood vessels that supply the uterus, abnormal contractile activity of the uterus, resulting in hypoxia of the uterus, and increased sensitivity of nerve endings. It has been shown that in dysmenorrhea there is an overproduction of prostaglandins. Physical exercises that aim to improve circulation in the pelvis can reduce these effects.

There is a direct correlation between the intensity of the pain and the heaviest amount of menstrual flow. The pain usually peaks between 24 and 48 hours, which coincides with the time of maximum blood flow, and subsides after 2 or 3 days as blood volume decreases. In secondary dysmenorrhea, however, the pain may begin before the onset of menstrual bleeding and remain after it ends (8 to 72 hours) (López-Liria et al., 2021).

Pain during the menstrual cycle is common in women, especially in nulliparous women. Most women who experience pain during their period avoid physical activity. Studies have shown that women who exercise prefer not to interrupt their activity during their cycle, and some of them tolerate physical activity very well.

Dysmenorrhea treatment, including physical therapy, is aimed at improving function, resulting in fewer lost work days, absences from school, or extracurricular activities. Medical treatment of dysmenorrhea is achieved by PG inhibitors of prostaglandins, which are nonsteroidal anti-inflammatory drugs (NSAIDs), and hormonal drugs such as contraceptives (López-Liria et al., 2021). The use of these medications is limited due to their side effects and especially stomach irritation. It is for this reason that physiotherapy has an important role as an additional treatment.

Physiotherapy means to relieve painful menstruation are the use of heat, massage, physical exercises, yoga, kinesio tape, spinal manipulation, biofeedback, etc. (Armour et al., 2019; Carroquino-Garcia et al., 2019; Kannan, Claydon, 2014; Kim, 2019; López-Liria et al., 2021; Matthewman et al., 2018; Toprak et al., 2020; Katevska, Popova-Dobreva, 2014).

Conclusion. Our study revealed a high prevalence of menstrual pain in young girls. The presence of pain affects their ability to work and is the reason for massive acceptance of painkillers. A study suggests the need for further research into the possibilities of physiotherapy treatments and the importance of physical activity in maintaining health.

REFERENCES

Armour, M., Ee, C. C., Naidoo, D., Ayati, Z., Chalmers, K. J., Steel, K. A., de Manincor, M. J., & Delshad, E. (2019). Exercise for dysmenorrhoea. The Cochrane database of systematic reviews, 9(9), CD004142. https://doi.org/10.1002/14651858.CD004142.pub4

Carroquino-Garcia, P., Jiménez-Rejano, J. J., Medrano-Sanchez, E., de la Casa-Almeida, M., Diaz-Mohedo, E., & Suarez-Serrano, C. (2019). Therapeutic Exercise in the Treatment of Primary Dysmenorrhea: A Systematic Review and Meta-Analysis. *Physical therapy*, *99*(10), 1371–1380. https://doi.org/10.1093/ptj/pzz101

Kamel, D. M., Tantawy, S. A., & Abdelsamea, G. A. (2017). Experience of dysmenorrhea among a group of physical therapy students from Cairo University: an exploratory study. Journal of pain research, 10, 1079–1085. https://doi.org/10.2147/JPR.S132544

Kannan, P., & Claydon, L. S. (2014). Some physiotherapy treatments may relieve menstrual pain in women with primary dysmenorrhea: a systematic review. Journal of physiotherapy, 60(1), 13–21. https://doi.org/10.1016/j.jphys.2013.12.003

Katevska, Y., Popova-Dobreva, D. Kinesitherapy in women with dysmenorrhea, 9-th FIEP and 7-th International Scientific Congress "Sport, Stress, Adaptation", 9-11 October 2014, Sofia. Congress Proceedings, ISSN 2367-458X, 721-727

Kim S. D. (2019). Yoga for menstrual pain in primary dysmenorrhea: A meta-analysis of randomized controlled trials. *Complementary therapies in clinical practice*, *36*, 94–99. https://doi.org/10.1016/j.ctcp.2019.06.006

López-Liria, R., Torres-Álamo, L., Vega-Ramírez, F. A., García-Luengo, A. V., Aguilar-Parra, J. M., Trigue-

ros-Ramos, R., & Rocamora-Pérez, P. (2021). Efficacy of Physiotherapy Treatment in Primary Dysmenorrhea: A Systematic Review and Meta-Analysis. *International journal of environmental research and public health*, *18*(15), 7832. https://doi.org/10.3390/ijerph18157832

Matthewman, G., Lee, A., Kaur, J. G., & Daley, A. J. (2018). Physical activity for primary dysmenorrhea: a systematic review and meta-analysis of randomized controlled trials. *American journal of obstetrics and gynecology*, *219*(3), 255.e1–255.e20. https://doi.org/10.1016/j.ajog.2018.04.001

Toprak Celenay, S., Kavalci, B., Karakus, A., & Alkan, A. (2020). Effects of kinesio tape application on pain, anxiety, and menstrual complaints in women with primary dysmenorrhea: A randomized sham-controlled trial. *Complementary therapies in clinical practice*, *39*, 101148. https://doi.org/10.1016/j.ctcp.2020.101148

Corresponding author:
Diana Popova-Dobreva, PhD
Faculty of Public Health and Health Care,
National Sports Academy „Vassil Levski“,
Sofia, Gurgulqt 1 str.
E-mail: dobreva_da@yahoo.com

International Scientific Congress
"Applied Sports Sciences"

2-3 December 2022
Sofia, Bulgaria

PROCEEDING BOOK

Volume 2

EDITORS OF THE PROCEEDING BOOK:
Prof. Tatiana Iancheva, DSc
Assoc. Prof. Stefka Djobova, PhD
Assist. Prof. Milena Kuleva, PhD
Design: Stanislav Hristov, Svetla Kostova, Radostina Angelova
Printed and bounded by: ZONA ArtPRINT Ltd.
Publisher: Scientific Publishing House NSA Press

ISBN (Online): 978-954-718-702-3
ISBN (Print): 978-954-718-701-6

PARTNERS

Ministry of Youth and Sport

Sofia Municipality

100 years of the Bulgarian Olympic Committee

SOFIA EUROPEAN CAPITAL OF SPORT

HYUNDAI

Ecopharm

PRISTA OIL

SVILOSA
Pulp in harmony with nature

Nestlé

СПОРТ ТОТО

ЛЕДИНА
Изворна вода

mazda

ФАНТАСТИКО

Fibank
Моята банка

efbet

DARRIK

MetaTron Lux
LICENSED PRODUCER OF HunterDouglas®

JOY station

ТАНДЕМ

Рик Тур
туристическа агенция

dsport

A1

ОСМАР

NU BOYANA film studios

AMER SPORTS

Chateau Botevo winery

Ford

STOJNA spring water

MEDIA PARTNERS

БНТ

BULGARIAN NATIONAL RADIO®