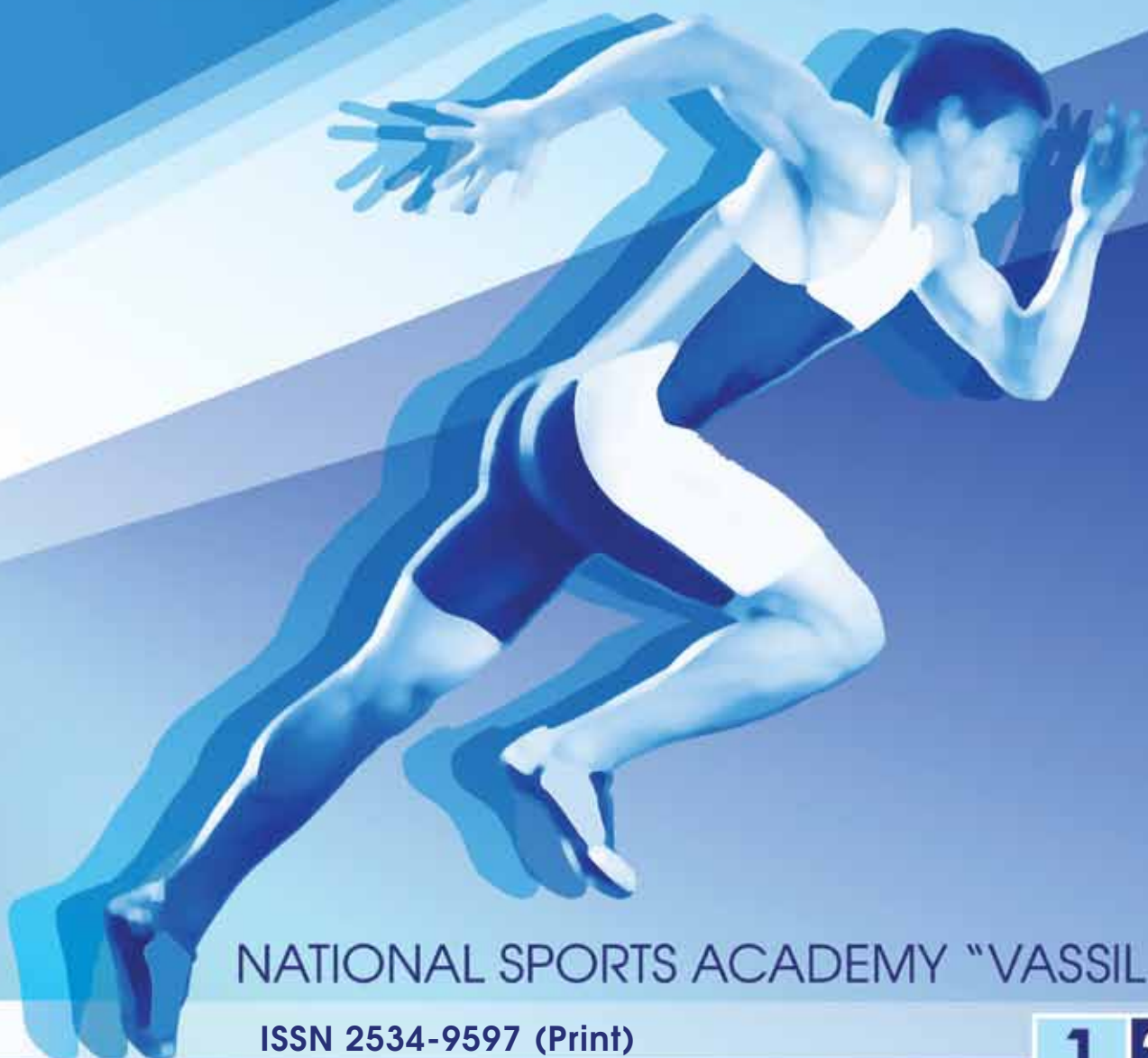


JOURNAL

of

Applied Sports Sciences



NATIONAL SPORTS ACADEMY "VASSIL LEVSKI"

ISSN 2534-9597 (Print)

ISSN 2535-0145 (Online)

1 **2017**

JOURNAL of Applied Sports Sciences

International Scientific Journal

Published and financially supported by the National Sports Academy, Sofia, Bulgaria

Editor in chief: Prof. Tatiana Iancheva, DSc

Editorial Board

Prof. J. P. Verma, PhD

Lakshmi National Institute of Physical Education
(Deemed University), India

Prof. Sidonio Serpa, PhD

University of Lisbon –
Faculty of Human Kinetics, Portugal

Prof. Vassil Girginov, PhD

Brunel University London
College of Health and Life Sciences, UK

Prof. Matthew J. Robinson, PhD

University of Delaware, USA

Prof. Kairat Zakirianov, PhD
Kazakh Academy
of Sports & Tourism, Kazakhstan

Prof. Trayana Djarova – Daniels, PhD

University of Zululand, South Africa

Prof. Luis Miguel Ruiz, PhD

Faculty of Physical Activity and Sport-INEF,
Technical University of Madrid, Spain

Prof. Janis Zidenas, PhD
Latvian Academy of Sport
Education, Latvia

Prof. Milovan Bratic, PhD

Faculty of Sport and Physical Education,
University of Nis, Serbia

Prof. Juris Grants, PhD

Latvian Academy of Sport Education, Latvia

Prof. Pencho Geshev, PhD

National Sports Academy “Vassil Levski”

Assoc. prof. Nikolay Izov, PhD

National Sports Academy “Vassil Levski”

Prof. Apostol Slavchev, PhD

National Sports Academy “Vassil Levski”

Prof. Krasimir Petkov, PhD

National Sports Academy “Vassil Levski”

Prof. Ognyan Miladinov, DSc

National Sports Academy “Vassil Levski”

Assoc. prof. Ivan Maznev, PhD

National Sports Academy “Vassil Levski”

Prof. Daniela Dasheva, DSc

National Sports Academy “Vassil Levski”

Prof. Latchezar Dimitrov, PhD

National Sports Academy “Vassil Levski”

Prof. Svilen Neykov, DSc

National Sports Academy “Vassil Levski”

Prof. Kiril Andonov, DSc

National Sports Academy “Vassil Levski”

Prof. Dr. Nikolay Boyadzhiev, PhD

Medical University – Plovdiv, Bulgaria

Prof. Yana Simova, PhD

Sofia University “St. Kliment Ohridski”
Medical Faculty, Sofia, Bulgaria

Assos. Prof. Vladimir Grigorov, PhD

University of the Witwatersrand, Johannesburg, South
Africa

Prof. Lence Aleksovska Velickovska, PhD

Ss. Cyril and Methodius University in Skopje,
Republic of Macedonia

Prof. Dr. Emin Ergen

Rehabilitation and Sports Medicine Clinic in Doha,
Qatar

Prof. Argon Cuka, PhD

Sports University of Tirana, Albania

Prof. Franja Fratrić,

University “UNION-Nikola Tesla”, Serbia

Assoc. Prof. Sebahattin Devecioğlu

Firat University, Faculty of Sport Sciences,
Turkey

Assoc. Prof. Mehmet Gunay

Gazi Universitesi, Turkey

Dr. Maria Efstratopoulou, PhD

Bishop Grosseteste University, UK

Prof. Biser Tzolov, PhD

National Sports Academy “Vassil Levski”

Prof. Evgenia Dimitrova, DSc

National Sports Academy “Vassil Levski”

Prof. Rumian Hristov, DSc

National Sports Academy “Vassil Levski”

Prof. Bonka Dimitrova, PhD

National Sports Academy “Vassil Levski”

Prof. Diana Dimitrova, PhD

National Sports Academy “Vassil Levski”

Prof. Daniela Lyubenova, PhD

National Sports Academy “Vassil Levski”

Prof. Dimitar Mihaylov, PhD

National Sports Academy “Vassil Levski”

Assoc. Prof. Albena Alexandrova, PhD

National Sports Academy “Vassil Levski”

Assoc. Prof. Zdravko Stefanov, PhD

National Sports Academy “Vassil Levski”

Assoc. Prof. Karolina Lazarova, PhD

National Sports Academy “Vassil Levski”



INTERNATIONAL SCIENTIFIC JOURNAL OF THE NATIONAL SPORTS ACADEMY (NSA), SOFIA, BULGARIA

JOURNAL of Applied Sports Sciences

Vol. 1

July, 2017
www.journal.nsa.bg

CONTENTS

- IMPORTANCE OF ELBOW FLEOR MUSCLE STRENGTH AND ENDURANCE IN SPORTS CLIMBING **3-12**
Michail Michailov, Stanislava Lambreva, Diana Deneva, Hristo Andonov
- STUDY OF THE BALANCE STABILITY OF YOGA EXERCISES PRACTITIONERS **13-20**
Vladimir Angelov, Ognian Tishinov, Evald Albert
- A NEW APPROACH TO INTERPRETATION OF SALIVARY ALFA AMYLASE ACTIVITY CHANGES AS A STRESS INDICATOR **21-30**
Lubomir Petrov, Albena Alexandrova, Evtim Lefterov
- ON THE IMPORTANCE AND NEED OF FLEXIBILITY AND STRENGTH REFINEMENT AS AN ELEMENT OF DANCERS' TRAINING **31-45**
Ina Vladova, Yigit Hakan Ünlü
- COPE WITH SUCCESS IN SPORT **46-57**
Tatiana Iancheva, Milena Kuleva
- PHYSICAL THERAPY AND SWIMMING INFLUENCE ON FEMALE TYPE OF ADIPOSE DEPOSITION AND CELLULITE **58-62**
Ivan Maznev, Nikolay Izov, Milena Nikolova, Antoaneta Dimitrova, Kristin Grigorova- Petrova

OPTIMIZATION OF TEACHING METHODS IN SPORTS CLASSES WITH STUDENTS WITH VISUAL IMPAIRMENTS Mariana Albert, Evald Albert	63-77
GOAL-ORIENTED BREATHING EXERCISES IN ACUTE PERIOD AFTER STROKE Kristin Grigorova-Petrova	78-83
EFFECT OF SWIMMING AND PHYSIOTHERAPY IN PATIENTS WITH NEPHROLITHIASIS Nikolay Izov, Ivan Maznev, Milena Nikolova, Dance Vasileva	84-89
AUTHOR'S GUIDELINES GENERAL INFORMATION	90-97

ISSN 2534-9597 (Print)

ISSN 2535-0145 (Online)

IMPORTANCE OF ELBOW FLEXOR MUSCLE STRENGTH AND ENDURANCE IN SPORTS CLIMBING

**Michail Michailov^{1,2}, Stanislava Lambreva¹, Diana Deneva¹,
Hristo Andonov¹**

¹ National Sports Academy “Vassil Levski”, Sofia, Bulgaria

² Medical Commission of the Union Internationale
des Associations d’Alpinisme (UIAA MedCom) Bern, Switzerland

ABSTRACT

The muscles that exert most during sport climbing are the finger flexors followed by elbow flexors (EF). Nevertheless, climbers’ EF strength and endurance have not been tested in an isolated manner and EF endurance has not been assessed at different relative intensities. Purpose: To determine the importance of EF maximal strength and endurance in sports climbing. Methods: Nine male sports climbers and a control group of seven male sports students performed an EF maximal strength (MS) test and four EF endurance tests representing isometric muscle contractions at 90%, 70%, 50% and 30% of the maximal voluntary contraction (MVC). Results: Sports climbers sustained longer than the controls at 70 % (39±11 versus 28±7 s; $p=0.044$, $\eta^2=0.259$) and 50%MVC (57±10 versus 48±6 s; $p=0.050$, $\eta^2=0.248$). The highest effect size was estimated for the force-time integral related to body mass at 70% MVC (107±27 versus 75±18 N.s/kg; $p=0.018$, $\eta^2=0.338$). The two groups did not differ in MS (313±52 versus 338±55 N; $p=0.372$) or MS related to body mass (4.6±0.6 versus 4.2±0.8 N/kg; $p=0.623$). Climbing ability significantly correlated only with MS related to body mass. The relationship between MS related to body mass and on sight ability was strong ($r=0.806$, $p=0.016$). Conclusion: EF strength and endurance appear to be key performance factors in sports climbing. Sports climbing demands a high level of EF endurance during muscle contractions of high intensity. An excessive increase of EF endurance would not necessary lead to a significant improvement in climbing ability. However, higher climbing ability demands increased EF maximal strength.

Keywords: rock climbing, isometric muscle contraction, maximal strength, muscle endurance

INTRODUCTION

Sports climbing demands a complex development of motor abilities (Michailov, 2014). It is a whole body activity where major muscle groups of the upper extremity, trunk, and lower extremity actively contribute in order to progress on the climbing route (Phillips, Sassaman, Smoliga. 2012). Nevertheless, the rate of exertion of some muscle groups is significantly higher. The relative contribution is greater and the fatigue is deeper in finger flexor muscles followed by elbow flexor muscles (Deyhle et al., 2015; Koukoubis et al., 1995). Finger flexor muscles maintain the upper limb supports. At the same time, finger flexor muscles are small and hold significant load. Thus, climbing specific finger grip strength related to body mass correlates strongly with climbing ability and is a performance factor of major importance (Baláš et al., 2015; Grantet al., 1996; Michailov, Mladenov, Schoeffl, 2009; Philippe et al., 2012). Another key performance factor is the finger flexor muscle endurance. This was evidenced in studies investigating climbing and hanging time to failure or force-time integral (FTI) from continuous or intermittent isometric contractions, which were performed using sport-specific dynamometers (Balas et al., 2012; Balas et al., 2016; MacLeod et al., 2007; Michailov, 2014; Michailov et al., 2016; Philippe et al., 2012; Vigouroux, Quaine, 2006; Fryer et al., 2015).

To be efficient, sports climbers aim to load the upper limbs as little as possible during climbing. Sports climbers can postpone the performance limiting fatigue of the muscles at the upper limbs by distributing as much as possible weight on their feet. Moreover, producing forces with the knee extensor muscles instead of using elbow flexor muscles is to be preferred

when moving the center of mass higher. Nevertheless, in some climbing situations there is a great reliance on the elbow flexor muscles in order to reach the next hold. Considerable efforts of the elbow flexors cannot be avoided for example in overhanging terrain where the load at the upper limb supports increases to more than half of the climber's weight (Noé et al., 2001). Thus, several authors have found out that climbing ability is significantly related with shoulder girdle strength (Wall et al., 2004; Kodejška, Baláš, 2016) and endurance (Balas et al., 2012; Grantet al., 1996) as well as explosive strength of the upper limbs (Berrostegieta, 2006; Draper et al., 2011; Laffaye et al., 2014).

Shoulder girdle strength was estimated through arm lock-off (the climbers applied maximal force on an apparatus with the shoulder and elbow flexed at 90°) (Wall et al., 2004) or diagonal reach tests (the climbers had to reach with one hand as far as possible in the diagonal direction while maintaining a position on an overhanging wall) (Kodejška, Baláš, 2016). Shoulder girdle endurance was assessed through bent-arm hanging and explosive strength was assessed through powerful pull-ups. The results of these tests carry combined information on arm, back and shoulder strength and endurance. To the best of our knowledge, elbow flexor muscle strength and endurance have not been tested in an isolated manner. Moreover, elbow flexor endurance has not been assessed performing tests at different relative intensities prescribed as percentages of the maximal voluntary contraction (MVC).

During tests such as bent-arm hanging athletes with different body mass or maximal strength would not be placed at a similar working regime (e.g. the rela-

tive intensity will be lower for a stronger climber compared to a weaker climber with the same body mass). Therefore, it would not be clear whether the test score reflects the muscle endurance level or is influenced by athlete's maximal strength or body mass. Muscle contraction intensity should determine the relative contribution of the aerobic and anaerobic energy systems and the number of fast muscle fibers recruited. Therefore, when evaluating muscle endurance, it is to be preferred the intensity to be set as percentage of the MVC. The performance of several elbow flexor endurance tests of different relative intensity can serve to determine the %MVC which has the highest criterion validity with respect to climbing performance. Such investigation would bring more inside knowledge on the specific adaptation of the elbow flexors in sport climbers and may serve to create improved training plans.

Thus, the aim of the present study was to determine the importance of maximal strength and muscle endurance of the elbow flexors in sports climbing.

METHODS

Participants

Nine sport climbers (age 31.6 ± 4.3 years, 11.6 ± 6 years of climbing experience) and a control group of seven sport students (age 22.6 ± 2.7 years) volunteered and gave informed consent to participate in the study. Climbers' reported their current climbing ability in the red-point and on-sight styles using the IRCRA scale (Draper et al., 2015). Red point and on sight achievements were 22.0 ± 2.4 (range 19 – 26) and 18.6 ± 1.8 (range 16 – 21), respectively. Red-point refers to climbing a route after it has been previously attempted. On-sight refers to a first

try with no prior knowledge.

Study design

This study sought to bring evidence whether maximal strength and endurance of the elbow flexors are performance limiting factors in sport climbing as well as to show at which intensity climbers are adapted to perform better compared to non-climbers. This would also determine the percentage MVC that is more useful to be prescribed when evaluating climbers' elbow flexor endurance.

Therefore, the climbers and the control group performed a maximal strength test and four muscle endurance tests to assess the maximal duration of isometric contraction at 90%, 70%, 50% and 30% MVC.

Methodology

The maximal strength test and the muscle endurance tests were performed with the use of a strength measuring device 3DSAC (Balas et al., 2016) 3DSAC has a measuring range of ± 2 kN, 0.5% accuracy, and sampling rate 125 Hz. 3DSAC includes a guidance module, which gives real-time feedback through graphical and acoustic signals. This enabled the participants to perform the muscle endurance tests by controlling the prescribed intensity of muscle contractions. During the maximal strength test participants performed three maximal voluntary contractions separated by rest intervals of 1 minute. Maximal strength was determined by the highest force value from the three attempts. The muscle endurance tests at higher intensity preceded the tests at lower % MVC. The test at 90% MVC was performed 5 minutes after the maximal strength test. The break before performing the test at 70% MVC was 10 minutes, and the next two brakes were 20 minutes.

The target force during the muscle endurance tests was automatically calculated. It was presented graphically along with a target zone with lower and upper limits in which the generated force could vary $\pm 10\%$. Participants had to maintain the force within the prescribed limits for as long as possible. The software automatically stopped the endurance tests when the force dropped below the lower limit for more than one second.

All tests were performed with the right arm and in all tests elbow flexors acted isometrically. Participants were tested on a bench in a supine position with fixed right upper arm, trunk and low-

er limbs (Figure 1). The right elbow was flexed at 90 degrees and the right forearm was in half supine position. Participants applied forces on 3DSAC through a metallic chain, which was horizontal to the ground and fixed on the one side at the force measuring module of 3DSAC and on the other side at the distal part of the right forearm.

Maximal strength and maximal strength related to body mass (relative strength) were registered through the maximal strength test. Parameters calculated in the muscle endurance tests were: time spent in the target zone (Ttz), FTI and FTI related to body mass.



Figure 1. *Body and arm position during dynamometry using 3DSAC*

Statistical analysis

Descriptive analysis was performed to present mean values, standard deviations and confidence intervals of the measured parameters. Differences between climbers and control group were analyzed with One-Way analysis of variance (ANOVA) and effect sizes were

estimated through the calculation of eta squared (η^2). Statistical significance was set to $p \leq 0.05$. Spearman's rank correlation coefficients were calculated to determine relationships between climbing ability variables and test results. All statistical analyses were performed with the use of SPSS 19 (IBM, New York, USA).

RESULTS

Participants' body mass, maximal and relative strength are provided in Table 1. Sports climbers had significantly lower body mass compared to control group ($p = 0.016$) but the two groups did not differ in maximal or relative strength ($p > 0.05$). Table 2 lists the results from the muscle endurance tests. Sports climbers had higher Ttz ($p = 0.044$) and FTI related to body mass

($p = 0.018$) at 70% MVC as well as higher Ttz at 50% MVC ($p = 0.050$) than the control group. The effect size was greater for FTI related to body mass in the endurance test at 70% MVC. No other significant differences ($p < 0.05$) were found. Climbing ability significantly correlated only with relative strength. Relative strength correlated strongly with the on-sight achievement ($r = 0.806$, $p = 0.016$).

Table 1. *Body mass, maximal and relative strength of climbers and control group*

Parameter	Participants	Mean	SD	Confidence interval		p	η^2
				Lower limit	Upper limit		
Body mass (kg)	Control group (n 7)	81.43	13.14	69.28	93.58	0.016*	0.351
	Sport climbers (n 9)	67.87	6.18	63.12	72.63		
Maximal strength (N)	Control group (n 7)	338	55	286	389	0.372	0.057
	Sport climbers (n 9)	313	52	273	353		
Relative strength	Control group (n 7)	4.2	0.8	3.5	4.9	0.263	0.089
	Sport climbers (n 9)	4.6	0.6	4.1	5.1		

Relative strength, maximal strength (N) related to body mass (kg); SD, standard deviation, significant differences ($p < 0.05$).*

Table 2. *Performance characteristics in the endurance tests at different intensity of isometric muscle contraction*

% MVC	Parameter	Participants	Mean	SD	Confidence interval		p	η^2
					Lower limit	Upper limit		
90	Ttz (s)	Control group (n 7)	16.63	7.02	9.26	23.99	.664	.015
		Sport climbers (n 9)	18.20	6.52	13.19	23.21		
	FTI (N.s)	Control group (n 7)	4182	1975	2110	6255	.782	.006
		Sport climbers (n 9)	4449	1663	3171	5727		
	FTI/kg (N.s/kg)	Control group (n 7)	53.04	23.01	28.89	77.18	.358	.065
		Sport climbers (n 9)	66.57	29.13	44.18	88.96		

70	Ttz (s)	Control group (n 7)	27.98	7.13	21.38	34.57	.044	.259
		Sport climbers (n 9)	38.51	10.85	30.17	46.85		
	FTI (N.s)	Control group (n 7)	6095	1651	4568	7622	.224	.104
		Sport climbers (n 9)	7262	1933	5776	8748		
	FTI/kg (N.s/kg)	Control group (n 7)	75.18	17.63	58.88	91.49	.018	.338
		Sport climbers (n 9)	106.96	27.24	86.02	127.90		
50	Ttz (s)	Control group (n 7)	48.01	5.87	42.58	53.44	.050	.248
		Sport climbers (n 9)	57.29	10.15	49.49	65.1		
	FTI (N.s)	Control group (n 7)	7771	1599	6292	9251	.921	.001
		Sport climbers (n 9)	7880	2443	6002	9758		
	FTI/kg (N.s/kg)	Control group (n 7)	96.92	22.58	76.03	117.81	.238	.098
		Sport climbers (n 9)	115.77	35.05	88.82	142.71		
30	Ttz (s)	Control group (n 7)	102.38	40.33	65.08	139.68	.251	.093
		Sport climbers (n 9)	126.94	41.02	95.41	158.47		
	FTI (N.s)	Control group (n 7)	8491	2044	6601	10382	.354	.061
		Sport climbers (n 9)	10322	4695	6713	13931		
	FTI/kg (N.s/kg)	Control group (n 7)	107.92	36.06	74.57	141.27	.132	.154
		Sport climbers (n 9)	150.68	62.94	102.30	199.06		

%MVC, relative intensity – percentage of maximal voluntary contraction; Ttz, time spent in the force target zone ($\pm 10\%$ target force); FTI, force-time integral; FTI/kg, force-time integral (N), related to body mass (kg); SD, standard deviation.

DISCUSSION

A new finding is that elbow flexor muscle endurance time at 70% and 50% MVC is a distinguishing ability with sports climbers. Nevertheless, it seems that climbers' elbow flexor muscle performance at 70% MVC is the most important because the largest effect size was found for FTI related to body mass in the endurance test at 70% MVC. It is known that FTI compared to test time is a better measure of climbing specific intermittent finger flexor endurance (MacLeod et al., 2007). The highest effect size of the difference between the climbers from the present study and the control group was found for FTI related to body mass in the test at 70% MVC (Table 2). This can be explained with the fact that FTI related to body mass carries information about both endurance and strength components as well as better reflects the specificity of climbing activity, because climbers have to overcome their weight in order to progress on the route.

70% MVC is an intensity, at which part of IIX muscle fibers and a large portion of IIA muscle fibers are recruited (Hannerz 1974). The present results show that climbers are adapted to exercise in such conditions. The present findings are in conformity with the findings of Esposito et al. (2009) who concluded that there is a shift of climbers' finger flexor muscles toward faster motor units.

The present study also shows that climbing demands a high level of elbow flexor endurance. However, an excessive increase of this ability would not necessarily lead to a significant improvement in climbing performance. This is evidenced by the lack of significant correlations between the measured parameters in the elbow flexor endurance tests and climb-

ing achievements in the red point and on-sight styles.

Unlike climbers' endurance tests results, elbow maximal strength related to body mass significantly correlated with climbing performance. It can be assumed that increasing elbow flexor strength while possessing high levels of other abilities of major importance (such as finger strength and endurance) will improve climbing performance. However, climbers elbow flexor maximal strength test results were not higher compared to the control group and climbers' elbow flexors may not be stronger than elbow flexors of other athletic populations. Previous studies suggested that elbow flexor maximal strength is a key performance factor in sports climbing. The authors of these studies conducted tests, which involve simultaneous action of arm, shoulder and back muscles. Wall et al. (2004) found moderate ($r \sim 0.6$) and Kodejška and Baláš (2016) found strong ($r = 0.76$) correlations between climbing ability and results from shoulder girdle strength tests. Furthermore, other studies showed that explosive strength of the upper limbs assessed through powerful pull-ups is also an important ability in sports climbing (Berrosteigeta, 2006; Draper et al., 2011; Laffaye et al., 2014). The participants in these latter studies had to reach with one or both hands as high as possible and the score in cm correlated strongly with climbing ability ($r \sim 0.7$) (Draper et al., 2011; Laffaye et al., 2014).

Different types of muscle fibers are activated depending on the intensity of muscle contractions (Hannerz 1974). Intensity will determine to which type of muscle fibers the training is directed and the training effect (i.e. maximal strength, intra-muscular coordination, muscle hy-

pertrophy, muscle endurance). There is a nonlinear relationship between intensity and maximum duration of isometric muscle contractions (Rohmert, 1960). Thus, intensity can be predicted during training using the maximum time for which the athlete is able to maintain a static position. The use of generalized models of the intensity-duration relationship of isometric muscle contractions cannot precisely prescribe isometric exercise in accordance with the training goal of an athlete in a specific sports discipline. This relationship is different for different populations and muscle groups (Avin, Law, 2011, Law, Avin 2010). The present study provides information (duration of muscle contraction at different intensities, Table 2) about optimizing the training of elbow flexor muscle strength and endurance during isometric exercise in climbing.

The authors acknowledge that the sample size in the climbing and control groups limit the performance of thorough statistical analysis. Therefore, it cannot be claimed that the results of the present study are valid for the entire climbing population. Further studies with larger

samples of not only male but also female participants of all ages and climbing ability levels should be conducted to confirm the present findings. Fatigue might have prevented participants, especially the less trained, from fully realizing their maximal potential in the last muscle endurance tests. However, the breaks between these tests (20 minutes) were considered optimal based on a pilot study, which showed that blood lactate concentration is reduced to rest level 15 minutes after completing a muscle endurance test at medium intensity (50 – 70% MVC).

CONCLUSION

Elbow flexor strength and endurance appear to be key performance factors in sports climbing. Climbers should concentrate on training elbow flexor endurance at high intensities. Excessive development of elbow flexor endurance is not necessary. However, higher climbing ability demands increased elbow flexor maximal strength. The present results may be useful to precisely prescribe training of elbow flexor strength and endurance when climbers use isometric exercise.

REFERENCES

- Avin, K.G., Law, L.A. (2011), Age-related differences in muscle fatigue vary by contraction type: a meta-analysis, *Physical Therapy*, Vol. 91 No. 8, pp. 1153-1165.
- Baláš, J., Michailov, M., Giles, D., Kodejška, J., Panáčková, M., & Fryer, S. (2016), Active recovery of the finger flexors enhances intermittent handgrip performance in rock climbers, *European Journal of Sport Science*, Vol. 16 No. 7, pp. 764-772.
- Baláš, J., Pecha, O., Martin, A.J., Cochrane, D. (2012), Hand-arm strength and endurance as predictors of climbing performance, *European Journal of Sport Science*, Vol. 12 No. 1, pp. 16–25.
- Baláš, J., Mrskoc, J., Panáčková, M., & Draper, N. (2015), Sportspecific finger flexor strength assessment using electronic scales in sport climbers, *Sports Technology*, doi:10.1080/19346182.2015.1012082
- Berrostegieta, J.I. (2006), Relation between specific force tests and chained degree in high level sport climbers, in:

Moritz EF, Haake S, ed. The engineering of Sport 6, Volume 2. Developments for disciplines. New York Springer Science and Business Media.

Deyhle, M.R., Hsu, H.S., Fairfield, T.J., Cadez-Schmidt, T.L., Gurney, B.A., Mermier, C.M. (2015), Relative importance of four muscle groups for indoor rock climbing performance, *The journal of Strength and Conditioning Research*, Vol. 29 No. 7, pp. 2006-2014.

Draper, N., Dickson, T., Blackwell, G., Priestley, S., Fryer, S., Marshall, H., et al. (2011), Sport-specific power assessment for rock climbing, *Journal of Sports Medicine and Physical Fitness*, Vol. 51 No. 3, pp. 417-425.

Draper, N., Giles, D., Schöffl, V., Fuss, F., Watts, P., Wolf, P., Abreu, E. (2015), Comparative grading scales, statistical analyses, climber descriptors and ability grouping: International Rock Climbing Research Association Position Statement, *Sport Technology*, doi:10.1080/19346182.2015.1107081

Esposito, F., Limonta, E., Cè, E., Gobbo, M., Veicsteinas, A., Orizio, C. (2009), Electrical and mechanical response of finger flexor muscles during voluntary isometric contractions in elite rock-climbers, *European Journal of Applied Physiology*, Vol. 105 No. 1, pp. 81-92.

Fryer, S., Stoner, L., Lucero, A., Witter, T., Scarrott, C., Dickson, T., Cole, M., Draper, N. (2015), Haemodynamic kinetics and intermittent finger flexor performance in rock climbers, *International Journal of Sports Medicine*, Vol. 36 No. 2, pp. 137-142.

Grant, S., Hynes, V., Whittaker, A., Aitchison, T. (1996), Anthropometric, strength, endurance and flexibility

characteristics of elite and recreational climbers, *Journal of Sports Sciences*, Vol. 14 No. 4, pp. 301-309.

Hannerz, J. (1974), Discharge properties of motor units in relation to recruitment order in voluntary contraction. *Acta Physiologica Scandinavica*, Vol. 91 No. 3, pp. 374-384.

Law, L.A., Avin, K.G. (2010), Endurance time is joint-specific: a modelling and meta-analysis investigation, *Ergonomics*, Vol. 53 No. 1, pp. 109-129.

Kodejška, J., Baláš, J. (2016), Shoulder girdle strength and finger flexor strength in prediction of performance in female rock climbers, *Studia Sportiva*, Vol. 10 No. 2, pp. 46-54.

Koukoubis, T.D., Cooper, L.W., Glisson, R.R., et al. (1995), An electromyographic study of arm muscles during climbing, *Knee Surgery, Sports Traumatology, Arthroscopy*, Vol. 3 No. 2, pp. 121-124.

Laffaye, G., Collin, J.M., Levernier, G., Padulo, J. (2014), Upper-limb power test in rock-climbing, *International Journal of Sports Medicine*, Vol. 35 No. 8, pp. 670-675.

MacLeod, D., Sutherland, D.L., Buntin, L., Whitaker, A., Aitchison, T., Watt, I., Bradley, J., Grant, S. Physiological determinants of climbing-specific finger endurance and sport rock climbing performance, *Journal of Sports Sciences*, Vol. 25 No. 12, pp. 1433-1443.

Michailov, M., Rokowski, R., Ręgwelski, T., Staszkiwicz, R., Szygula, Z., Brown, L. (2017), Physiological Responses During Two Climbing Tests With Different Hold Types, *International Journal of Sports Science & Coaching*, Vol. 12 No. 2, pp. 276-283.

Michailov, M.L., Mladenov, L.V.,

Schoeffl, V.R. (2009), Anthropometric and strength characteristics of world-class boulderers, *Medicina Sportiva*, Vol. 13 No. 4, pp. 231-238.

Michailov, M.L. (2014), Workload characteristic, performance limiting factors and methods for strength and endurance training in rock climbing, *Medicina Sportiva*, Vol. 18 No. 3, pp. 97-106.

Noé, F., Quiane, F., Martin, L. (2001), Influence of steep gradient supporting walls in rock climbing: Bio-mechanical analysis. *Gait and Posture* 2001, Vol. 13 No. 2, pp. 86–94.

Philippe, M., Wegst, D., Muller, T., Raschner, C., & Burtscher, M. (2012), Climbing-specific finger flexor performance and forearm muscle oxygenation in elite male and female sport climbers, *European Journal of Applied Physiology*, Vol. 112 No. 8, pp. 2839-2847.

Phillips, K.C., Sassaman, J.M., Smoliga, J.M. (2012), Optimizing Rock

Climbing Performance Through Sport-Specific Strength and Conditioning, *Strength & Conditioning Journal* Vol. 34 No. 3, pp. 1-18.

Rohmert, W. (1960), Determination of the recovery pause for static work of man. *Internationale Zeitschrift Fur Angewandte Physiologie, Einschliesslich Arbeitsphysiologie*, Vol. 18, pp. 123-164.

Vigouroux, L., Quaine, F. (2006), Fingertip force and electromyography of finger flexor muscles during a prolonged intermittent exercise in elite climbers and sedentary individuals. *Journal of Sports Sciences*, Vol. 24 No. 2, pp. 181-186.

Wall, C.B., Starek, J.E., Fleck, S.J., and Byrnes, W.C. (2004), Prediction of indoor climbing performance in women rock climbers. *The journal of Strength and Conditioning Research*, Vol. 18 No. 1, pp. 77-83.

Correspondence:

Michail Michailov
National Sports Academy Vassil Levski",
Sofia, Bulgaria
E-mail: michailovi@hotmail.com

STUDY OF THE BALANCE STABILITY OF YOGA EXERCISES PRACTITIONERS

Vladimir Angelov, Ognian Tishinov,
Evald Albert

National Sports Academy "Vassil Levski". Sofia, Bulgaria

ABSTRACT

Yoga is an ancient system with complex effect on humans. The aim of this study was to determine the effect of the different structural groups of yoga exercises on the balance abilities of the practitioners. The object of the research was the balance stability. The subject of the study was the value and frequency fluctuations of COG during the execution of the control balance exercise. A contingent of the study was a group of 25 practitioners.

The basic scientific method used for the realization of this research is the method of posturographic analysis. It allows to determine the dynamics of COG. The practical experiment includes measurements after every training impact with various structural groups of yoga exercises.

The results concern the movements of the projection of COG. The collected data is presented through tables and graphs. The results reflect the dynamics of the COG during the execution of the balance exercise. Thus, this paper established the effect of the impact of various yogic exercises on the balance stability of the participants.

Keywords: *postural stability, stabilogram analysis, posturographic platform, balance abilities, yoga asana.*

INTRODUCTION

Balance stability is a psychomotor quality with a great importance for the human motor activity. It is a prerequisite for the successful realization of the athletes in all sports. This characteristic of balance stability has directed our attention to study this quality in the conditions of yoga practice.

Yoga is an ancient system with complex effects on the human – physical, mental and spiritual. Its wide-ranging and beneficial influence on the body is well-known. In this article, the attention is focused to the yogic asanas as means for developing the physical component of the Human system.

According to the **hypothesis** of the study, the practice of different groups of yogic exercises generates inhomogeneous traces of reflections related to the motor functions of the practitioners. We assume that the physiological states after execution of various structural groups of yogic asanas will influence in a different way the balance abilities of the practitioners.

By their nature, asanas can be defined as static exercises with a predominant stretching effect. Their great diversity implies the necessity of their systematization. Figure №1 shows an exemplary classification of yogic asanas according to the direction of their impact.

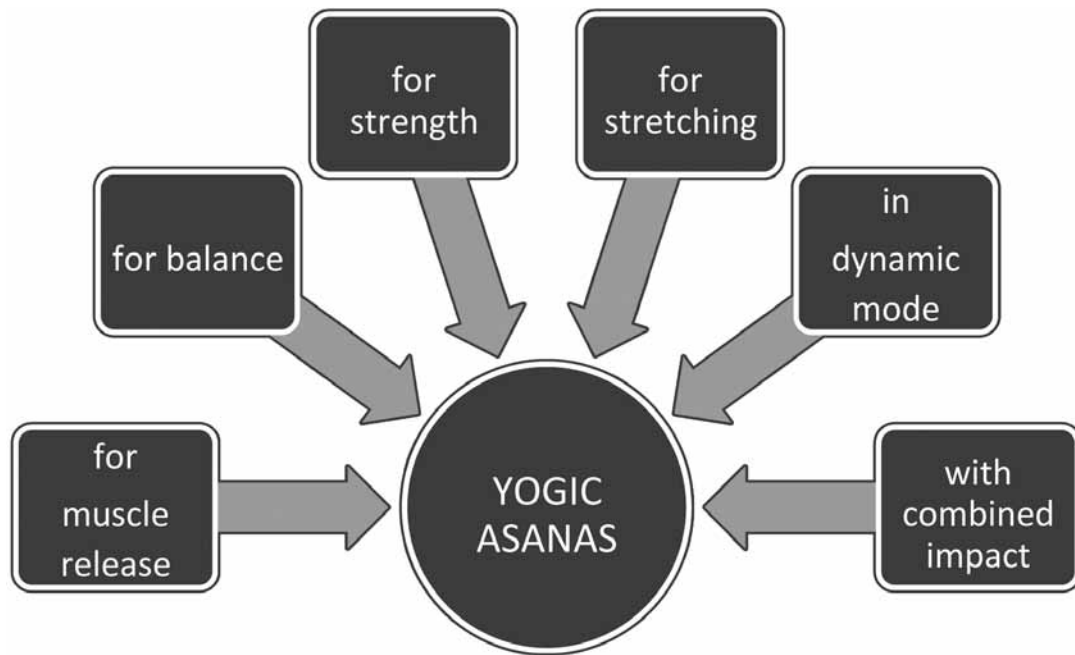


Figure 1. *Classification of yogic asanas according to the orientation of their impact.*

Numerous information sources were examined for the realization of the study. Their review showed that among the observed effects from the yogic asanas performance there is no evidence for their influence over balance stability. This finding is confirmed by authors such as Farhi D. (2001), Iyengar B. K. S. (1995), Kaminoff L, Matthews A. (2011), Long R. (2009), Smith J., Hall D., Gibbs B. (2005), Stephens M. (2010), Albert M. (2015). This provoked our interest to explore this problem. An additional reason for the research was our idea to use an apparatus method to establish the balance stability. The reviewed literature showed that similar methods were used by other specialists, including Bizzo G., Guillet M., Patat A. et al. (1985), Gagey P. M., Weber B. (1995), Gurfinkel V. S., Kots Y. M., Shik M. L. (1965), Kapteyn T. S., Bles W., Njikiktjen Ch. J. et al. (1983), Skvortsov D.V. (2000).

The aim of this study is to determine the effect of practicing various structural groups of yoga exercises on the balance abilities of the practitioners. The following tasks for achievement of the purpose were solved:

A classification of yogic asanas according to the direction of the impact was made.

An experimental group and a control balance exercise were created to assess the balance abilities with the use of the method of posturographic analysis.

A practical experiment was carried out with the use of a posturographic platform and application of a training impact with five different groups of asanas.

The collected data were systematized and analyzed.

The object of the research is balance stability. **The subject** of the study is the value of the amplitude and the frequency fluctuations of the COG during the execu-

tion of the control balance exercise. The study was done among a group of students from NSA “Vassil Levski” with major “Acrobatics and Trampoline”.

This publication is intended for a wide range of sports experts. Its design is focused on exploring the effects of yogic asanas that have not been identified yet. This makes the research important and original. The proof of the main thesis and hypothesis of the survey would determine the significance of this article for the sports practice.

METHODS

The basic research method for the realization of this work is the method of posturographic analysis. It allows us to determine the dynamics of the COG

while participants retain the balance position. The control balance exercise is shown in figure №2.

The method of stabilogram analysis is essentially an apparatus method. It is carried out using a posturographic platform, which was invented by eng. Ogni-an Tishinov in 1983. It works on the principle of a pressure. The signals are captured by sensors, converted into digitals and recorded into a computer device. Fig.3 shows an exemplary stabilogram. A specialized software to analyze the results was developed (Tishinov, O., 2017). The software allows reporting the value of the amplitude displacement and the frequency of fluctuations of the projection of the COG in relation to the supporting area.



Figure 2. *A control balance exercise*

The amplitude of the displacement gives information about the end values of the balance fluctuations related to keeping the projection of the COG within the boundary of the supporting area. The frequency of fluctuations informs about the speed of the compensatory actions related to the internal control through the proprioceptors of the motor apparatus. Thanks to the balance coefficient created by the authors of this work, results from different measurements can be compared. The balance coefficient represents the ratio between the amplitude of displacement and the frequency of fluctuations of the COG.

The practical experiment was realized on a contrasting principle, alternating measurement and training impact. Six series of measurements were performed. Each series included an athlete's

holding the control balance exercise on the stabilogram platform for 40 seconds. The first measurement was made at the beginning of the research before the participants performed the yoga exercises. It was followed by a training consisting of five groups of asanas. The duration of the workload in each group was 5 min. It included 10 asanas. After each training session, a rest of 3 minutes was given, followed by a measurement of the balance stability through the control exercise performed on the stabilogram platform.

The groups of yoga exercises used were applied in the following sequence: asanas for muscle release, strength asanas, stretching asanas, asanas in dynamic mode, asanas for balance. The survey was done among 25 participants.

SOFTWARE: eng. O. Tishinov

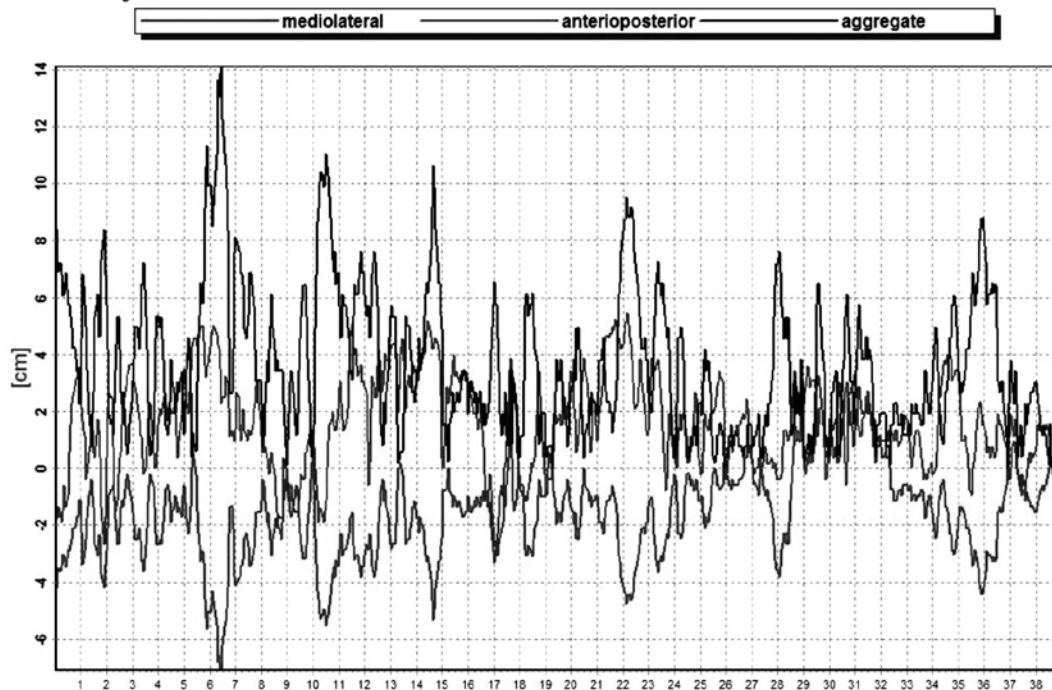


Figure 3. *An exemplary stabilogram*

RESULTS

The research of the balance stability was carried out with the help of a posturographic platform and specialized software. The apparatus configuration allows registration of the collected data from the measurement and their graphical expression by stabilograms (Figure 3). On this basis, three basic parameters

were established and analyzed: amplitude of the COG deviation, rate of the COG fluctuations and balance coefficient. The data collected were systematized and statistically processed using the variance analysis method (Tables 1 and 2).

In summary, the results are presented in the diagram (Fig. 4.)

Table 1. *Systematization of the collected data from the variance analysis method in the I, II and III measurement.*

Parameters	Amplitude 1	Frequency 1	Coefficient 1	Amplitude 2	Frequency 2	Coefficient 2	Amplitude 3	Frequency 3	Coefficient 3
Min	3,47	3,68	0,84	2,60	3,87	0,48	3,10	3,49	0,66
Max	20,32	5,24	5,48	10,60	5,46	2,55	12,40	5,19	3,38
R	16,85	1,56	4,64	8,00	1,59	2,07	9,30	1,70	2,72
X	9,37	4,27	2,30	5,69	4,56	1,32	6,52	4,29	1,63
S	5,27	0,50	1,51	3,35	0,58	0,86	3,50	0,61	1,05
V	56%	12%	66%	59%	13%	65%	54%	14%	64%
As	1,32	0,85	1,46	0,53	0,51	0,45	0,56	0,32	0,67
Ex	2,24	1,07	2,33	-1,77	-1,39	-1,84	-1,14	-1,27	-1,06

Table 2. *Systematization of the collected data from the variance analysis method in the IV, V and VI measurement.*

Parameters	Amplitude 4	Frequency 4	Coefficient 4	Amplitude 5	Frequency 5	Coefficient 5	Amplitude 6	Frequency 6	Coefficient 6
Min	4,71	3,90	0,85	2,08	3,51	0,35	4,88	3,23	1,05
Max	13,60	9,97	2,38	10,69	5,88	2,45	14,40	5,53	4,23
R	8,89	6,07	1,53	8,61	2,37	2,10	9,52	2,30	3,18
X	7,80	5,20	1,57	5,32	4,50	1,43	10,16	4,24	2,50
S	2,98	2,01	0,54	3,19	0,81	0,88	3,12	0,72	0,98
V	38%	39%	34%	60%	18%	61%	31%	17%	39%
As	0,99	2,41	0,10	0,66	0,84	-0,10	-0,29	0,33	0,43
Ex	0,95	6,09	-1,43	-1,03	-0,16	-2,07	-0,16	0,71	0,28

DISCUSSION

The analysis of the amplitude of the COG deviations in relation to the support area (Fig. 4.) shows that the highest average values for this parameter were found after the impact with balance asanas (10.2 cm) and in the initial measurement before yogic exercise ex-

ecution (9.4 cm). The established average values and range are high, that means a low degree of balance stability. It is logical that the results of the initial measurement, which precedes the training impacts, fall into the “low balance stability” category. The data collected after performing the yogic asanas

with a balance effect are illogical at first glance. The highest amplitude variations of the COG were recorded after yoga exercises, which in its specialization was closest to the dynamics of the control balance exercise. The explanation of the established negative motor transference is the assumption that the restorative processes of the neuromuscular apparatus after a training impact that is the same as the control effect is incomplete, despite the fact that the rest period between the different groups of yoga exercises is the same. This fact draws our attention on planning further studies to determine the regularities that characterize the optimal psycho-physiological conditions for achieving maximum high levels of balance stability.

The lowest average values of the COG amplitude variations were recorded after performance of asanas in dynamic mode (5.3 cm) and after asanas

for relaxation (5.7 cm). This means that the impact of these exercises is the most beneficial for the balance abilities of performers. The existence of small amplitude deviations of the COG after performing yoga asanas with a relaxing effect can be considered logical. The explanation is that such effects activate the parasympathetic part of the nervous system. This leads to calming the participants, which is a favorable condition for better balance stability. The low values of the COG amplitude after performing asanas in dynamic mode provoke interest. There is a regularity according to which the dynamic exercises activate the sympathetic part of the nervous system to a greater degree. We believe that the physiological conditions resulting from such impacts stimulate the balance abilities as a result of increased muscle tone, which allows the better movement management.

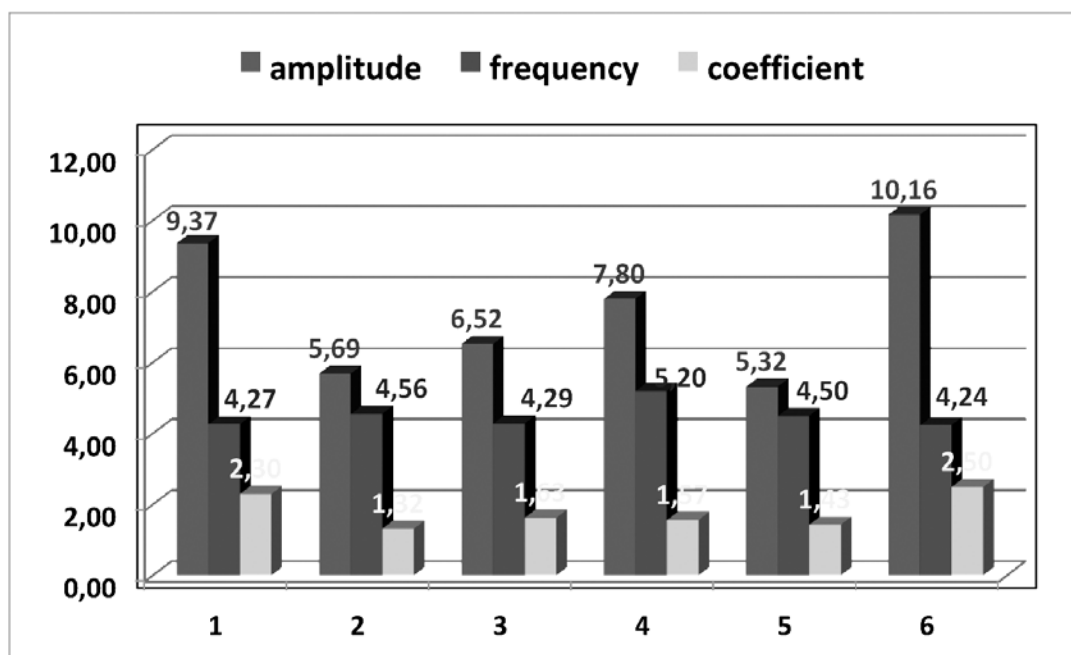


Figure 4. An average value of the established parameters during the conducted measurements

The analysis of the frequency fluctuations of the COG can be defined as a relatively new characteristic associated with the balance stability study. The average values of this parameter established by this survey during the measurements are approximately the same. As mentioned above, this parameter gives information about internal efforts during the performance of the control balance exercise. The diagram in Fig. 4 shows that the fluctuations of the COG from the measurement after the performance of asana with stretching effect have the highest frequency. We believe that this finding does not constitute a sufficient enough reason for the data to be defined as regularity.

The balance coefficient, determined by the authors of this work, allows finding of the ratio between the amplitude deviation of the COG and its frequency fluctuations. This coefficient evaluates the balance abilities and synthesizes information about the shifting of the COG in relation to the support and the internal efforts of every participant. From the diagram in Fig. 4 it can be concluded that the registered values of this coefficient confirm the effects established by the COG amplitude deviations. The fact that deserves attention is the lowest value of the balance coefficient established during the measurement after the performance of the asanas with a relaxing effect. This gives reason to define this group of exercises as an impact that creates the most

favorable conditions for achieving a high level of balance stability.

CONCLUSIONS

The analysis of the results allows the following conclusions to be drawn:

The established average values of the three parameters (the amplitude of the COG deviations, the frequency fluctuations of the COG and the balance coefficient) allow to conclude that among the five test groups of yoga exercises the asanas for muscle release and those in dynamic mode have the most beneficial physiological effect on balance abilities.

The results from the study prove that performance of the balance asanas leave traces of reflections which impede the motor activity connected with balance abilities. This means that application of the balance asanas is not recommended immediately prior to balance exercises.

The unexpected results that have been identified focus our attention on planning future research to establish all regularities that determine the optimal psycho-physiological conditions for performing balance exercises.

The applied algorithm for processing the survey data is based on the principle of reading the registered amplitude variations of a given parameter. We believe that such an approach is applicable in analyzing similar processes in the study of kinematic and dynamometric parameters.

REFERENCES:

Albert M. (2015). Kinzitrapevtichna progrma za podobriavane fizicheskata de-sposobnost pri studenti sas zritelni narush-enia. *Dissertation*

Bizzo G., Guillet M., Patat A. et al.

(1985). Specifications for building a vertical force platform designed for clinical stabilometry. *Med. & Biol. Eng. & Comput.*, N23, pp. 474-476.

Farhi D. (2001). *Yoga Mind, Body & Spirit: A Return to Wholeness*. Newleaf.

- Gagey P. M., Weber B. (1995). Posturologie. Regulation et dereglements de la station debout. *Masson*, Paris, pp. 145.
- Gurfinkel V. S., Kots Y. M., Shik M. L. (1965). Regulation of man's posture. *Nauka*, Moscow.
- Iyengar B. K. S. (1995). *Light on Yoga: Yoga Dipika*. Thorsons.
- Kaminoff L., Matthews A. (2011). Yoga Anatomy – 2nd Edition. *Human Kinetics*
- Kapteyn T. S., Bles W., Njiokiktjien Ch. J. et al. (1983). Standardization in platform stabilometry being a part of posturography. *Agressologie*, Vol.7., N24, pp. 321-326.
- Long, R. (2009). *The Key Muscles of Yoga: Scientific Keys*, Volume I. Bandha Yoga Publications.
- Long, R. (2009). *The Key Poses of Yoga: Scientific Keys*, Volume II. BandhaYoga.
- Skvortsov D.V. (2000). Clinical analysis of movements. Stabilometry. AOZT Antidor, Moskow.
- Smith, J., Hall, D., Gibbs, B. (2005). *Yoga for everyone*. Lorenz Books.
- Stephens, M. (2010). *Teaching Yoga: Essential Foundations and Techniques*. North Atlantic Books.
- Tishinov, O. et al. (1983). *Stabilograph* – AS №33600. Sofia

Correspondence:

Vladimir Angelov
National Sports Academy "Vassil Levski",
Sofia, Bulgaria
E-mail: angelov.vl@gmail.com

A NEW APPROACH TO INTERPRETATION OF SALIVARY ALFA AMYLASE ACTIVITY CHANGES AS A STRESS INDICATOR

Lubomir Petrov¹, Albena Alexandrova^{1,2}, Evtim Lefterov¹

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

²Bulgarian Academy of Sciences, Sofia, Bulgaria

ABSTRACT

Contemporary sport induces a serious physical and mental stress in athletes. This could result in lowering of their sports performance. Thus, the evaluation of stress in athletes is an important milestone in their preparation. Establishing levels of stress would allow targeted work by coaches and sports specialists to increase the resistance of competitors to stress. In this regard, the use of non-invasive methods for stress testing is essential. Recently, the use of saliva as a biological research material becomes of increasing interest.

The aim of this study was to establish the potential of alpha amylase activity, protein and potassium concentrations in saliva to reflect adequately the degree of stress in athletes.

Eleven boxers, participants in the National Championship, took part in the study. Saliva was collected by salivettes three times: 1) one week before the competition, 2) before the draw of lot, and 3) before the first bout. The salivary alpha amylase activity (sAA), protein and potassium concentrations were detected with commercially available kits.

The sAA, protein and K⁺ concentrations rose significantly in stress conditions. The individual values of sAA showed large differences that could be explained by the poly-allelic expression of sAA whose activity depends on the number of alleles (2 to 14) with each individual.

All tested indices could serve as indicators for evaluation of stress level in athletes as a high correlation between the protein and K⁺ and sAA values was found.

In order to evaluate the changes in sAA and to compare the individual results between athletes we suggested the sAA to be presented in relative units. The activities, measured in calm conditions long time before a competition could be assumed as a baseline and the coefficient of increase in sAA in a stressful condition could be accepted as a "stress coefficient".

Keywords: *noninvasive methods, protein concentration, potassium concentration, saliva, salivary alfa amylase, sport, stress.*

INTRODUCTION

The competitive nature of sport requires athletes to show maximum capability under a great psychological pressure. The result of the competition is usually very important for a large range of people such as athletes themselves, coaches and teammates, family, friends, fans and even for the state prestige. At the same time, nowadays, because of the nearly aligned forces of the elite sportsmen, the final result of the race is usually very unsure until the last moment. Thus each competition provokes variety of stressful situations and respectively a wide range of stress reactions in the athletes.

Currently, there are changes in the rules of many sports in order to increase their attractiveness. In general these changes are related to an increase in the number of bouts and reduction of the break between them (e.g. in boxing), which further increases the level of stress in athletes. Increased stress requires application of appropriate methods for its diagnosis. This would result in obtaining data about athletes' stress levels and a purposeful work aimed at increasing the sustainability to acute and chronic stress impact, to manage stress and to apply methods for relaxation and recovery.

There are different biochemical methods for the study and estimation of sports stress. Since the venous blood samples are unpleasant procedure for many athletes, in recent years there has been a growing interest in obtaining biological materials for research with non-invasive methods (Gröschl, 2008). Suitable alternative is a saliva sample, which has the following advantages: collected through non-invasive procedure that does not

require special training, without higher risks of infections, easy store and processing (Kaufman and Lamster, 2002). One of the most informative methods to assess the stress levels is the evaluation of cortisol concentration in saliva, but it requires special equipment, supplies and prolonged laboratory processing. For the purposes of sports practice easily accessible and field applicable non-invasive methods are needed. Promising in this respect are salivary alpha-amylase activity (sAA), protein concentration, concentrations of K⁺ and Na⁺ in saliva (Richter et al., 1998; Minasian et al., 2004; Granger et al., 2007; Ullmann et al., 2010). In the scientific literature methods and apparatus for rapid determination of these parameters have already been described, but their interpretation for the purposes of sports practice is still a poorly developed area (Yamaguchi et al., 2004, Yamaguchi et al., 2006; Shimazaki et al., 2008).

This study aimed to test the capacity of the following indices: activity of alpha-amylase, protein concentration, and K⁺ concentration in saliva to be used as markers for early detection of sport stress. The accumulation of data and experience for correct interpretation of these indices will be a useful tool for evaluating the competitive stress in sport practice. This study is a continuation of our previous research in the area of stress in sport (Petrov et al., 2012, Petrov et al., 2014; Petrov et al., 2015).

MATERIALS AND METHODS

Participants

Eleven athletes from the boxing teams of National Sports Academy "Vasil Levski", Sofia, Bulgaria took part in the study; all of them participants in

the National Championship. The average age of the tested persons was 20.2 ± 1.17 years (from 19 to 23 years) and the average sports experience was 7.5 years. At the beginning of the study all respondents were informed about the aims, objectives and conduction of the study and signed a declaration of informed consent, according to the Helsinki Declaration on ethical treatment of humans (WMA, 2013) and Health Act of the Republic of Bulgaria.

DESIGN OF THE EXPERIMENTS

Saliva was collected from the athletes three times: 1) one week before the National Championship to obtain the baseline values of the tested indices, 2) before the draw of lot, and 3) before the first bout.

Salvia collection

Saliva was collected with cotton swab salivetes (Sarstedt AG & Co, Nuembrecht, Germany) without stimulation of salivary glands. All salivetes were previously marked with code numbers, time and date. In order to reduce the influence of other factors on the saliva composition the athletes were instructed one day before sample's collection to avoid alcohol consumption, cigarette's smoking, coffee drinking and heavy meal intake. Before the sample collection, the athletes rinsed their mouth with distilled water. Respondents themselves placed the swab under their tongue for 2 minutes, and then put the swab into the salivete. After sampling, the salivetes were transported to the laboratory as soon as possible in a cooler bag. Salivetes were centrifuged at 1000 g and the resulting saliva was stored at -20°C up to the biochemical analysis.

Protein concentration

The concentration of the protein was determined by the kit Total Protein liquid color (REF 10570, HUMAN Gesellschaft für Biochemica und Diagnostica MbH, Wiesbaden, Germany). Each sample (50 μl) was added to the biuret reagent (1000 μl). The mixture was stirred vigorously and after 10 min incubation at 25°C the samples were subjected to photometry at a wavelength of 540 nm with the use of Biochemical Analyzer Human80. The amount of protein was estimated with the formula $C = 80 \times (\Delta A_{\text{sample}} / \Delta A_{\text{standard}}) [\text{g/L}]$.

Activity of alpha amylase

For determining the activity of alpha amylase a commercially available kit (Alfa-amylase Colorimetric test, REF E12 218A, EMAPOL, Gdansk, Poland) was used. The method is based on the capacity of α -amylase to catalyze the hydrolysis of the substrate 2-chloro-4-nitrophenil-maltotriozid. The release rate of the product 2-chloro-4-nitrophenol is proportional to the increase in absorbance at a wavelength of 410 nm, and is a measure for determining the activity of α -amylase in the sample. The procedure was as follows: Each sample was previously diluted 1:100 and 10 μl of the latter was added to the reagent (1000 μl). The mixture was stirred vigorously and was incubated at 25°C for 1 min. After that the samples were read at 410 nm with the use of Biochemical Analyzer Human80. The absorption of each sample was detected again after 1, 2 and 3 minutes. The activity of α -amylase was calculated with the formula $(\Delta A \text{ sample/min}) \times 24820 (37^{\circ}\text{C}) [\text{U/L}]$ and was presented as normal logarithm, $\ln(\text{sAA})$.

K⁺ Concentration

For measurement of K⁺ concentration a turbidimetric test (Potassium liquirapid, REF 10118, HUMAN Gesellschaft fur Biochemica und DiagnosticaMbH, Wiesbaden, Germany) was used. The method is based on the ability of the potassium ions in a protein-free alkaline medium to react with sodium tetraphenyl borate to form a fine turbid suspension of potassium tetraphenyl borate. The resulting turbidity is proportional to the concentration of K⁺. Each sample (50 µl) was added to the precipitation solution (500 µl). The mixtures were thoroughly mixed and centrifuged at high speed for 10 min. In order to obtain a homogeneous turbidity 100 µl of the supernatant or 100 µl of the standard were pipetted into 1000 µl of the working reagent. The samples and standard were mixed well and after 5 min the absorption of the standard and the samples were read against working reagent within 5 to 30 min at a wavelength of 578 nm with a biochemical Analyser Human80.

The amount of K⁺ was estimated with the formula $C = 5 \times (\Delta A_{\text{sample}} / \Delta A_{\text{standard}})$ [mmol/L].

Statistical analysis

The statistical analysis of the results was performed with the use of the Statistical Package SPSS 19. Variation and correlation analyses were applied and the nonparametric ANOVA for repeated measures (Friedman one-way analysis of variance by ranks) with post hoc analysis of Dunns was used for verifying the statistical reliability of the resulting differences in the average values. Throughout the text, the dispersion of averages is presented with a standard deviation (\pm SD), and in the charts with their standard error (\pm SE).

RESULTS

The anthropometric data of the respondents and the result of their participation in the National Championship are presented in Table. 1. Seven of the athletes took prizes in the competition.

Table 1. *Anthropometric data of the boxers and their ranking in the national championship*

No	Age (years)	Height (cm)	Weight (kg)	Category (kg)	Ranking
1	20	169	62	60	2 place
2	21	175	59	56	2 place
3	20	176	76	75	3 place
4	19	165	54	49	3 place
5	21	184	72	75	
6	20	172	58	60	1 place
7	20	180	72.5	75	3 place
8	20	175	66.5	70	
9	19	173	60	56	
10	19	180	85	81	
11	23	174	65	64	1 place

The individual values of the sAA for each athlete are presented in Fig. 1. The activities were in the range of 3.56 to 6.86 ln (sAA) one week before the competition, from 4.87 to 7.85 ln (sAA) before the draw and from 5.18 to 8.24 ln (sAA) prior to the first bout. For most athletes the enzyme activity rose before drawing of lot and reached even higher values before the bout. However the sAA of athletes №4, №5 and №10 before the draw were greater than before the first bout.

Fig. 2 presents the average values of the sAA of the entire team in the three sampling points of the research. A statistically significant increase from the baseline before the draw the lot (6.83 ± 0.82 ln(sAA) vs 5.50 ± 0.84 ln(sAA)) and before the first bout (7.03 ± 0.89 ln(sAA) vs 5.50 ± 0.84 ln(sAA)) was observed. There was no statistically significant difference between the values before drawing of lot and before the first bout.

The individual values of the total protein concentration in saliva for each participant are presented in Fig. 3. The protein concentrations were within the range of 0.12 - 0.94 g/L before the competition, 0.30 - 2.78 g/L before the draw of lot and 0.48 - 3.66 g/L before the first bout. In general (except boxer №3) low values for protein concentration were observed a week before the competition when the athletes were in a relative physiological rest. In stress conditions such as drawing of lot and competition the values rose as for some boxers the highest value was registered before the draw and for others - before the first bout.

Fig. 4 presents the average values of the total protein concentration in saliva of all boxers during the study. The resulting pattern was similar to those of the dynam-

ics of sAA: in comparison to the baseline values a significant increase in protein concentration before the draw of lot (1.59 ± 0.86 g/L vs 0.44 ± 0.29 g/L) and before the first bout (1.49 ± 1.02 g/L vs 0.44 ± 0.29 g/L) was observed. The difference in the average concentration of total protein before the draw the lot and before the first bout was not statistically significant.

The individual concentrations of K⁺ in the saliva of each participant showed a significant increase immediately before the draw of lot and before the bout. The values ranged within 13.7 - 26.4 mmol/L one week before the competition, before the draw of lot were min 20.0 and max 59.5 mmol/L, and before the first bout were from 27.6 up to 55.8 mmol/L (Fig 5). The tendency was the same as in the dynamics of protein concentration and sAA: in stress condition (before both the draw the lot and the bout) the values were higher than in a relative mental rest (one week before the competition), as for some boxers the highest values were registered before the draw of lot, while for others - before their first bout in the championship.

In Fig. 6 the average values of the saliva K⁺ concentration of all boxers are presented. A statistically significant increase from baseline was detected before the draw of lot (34.70 ± 10.54 mmol/L vs 20.43 ± 4.20 mmol/L). The average value before the first bout was also significantly higher (35.96 ± 8.45 mmol/L vs 20.43 ± 4.20 mmol/L) than those obtained one week before the competition. The difference in average before the draw the lot and before the first bout was statistically insignificant.

Table 2 presents the correlation matrix of the studied parameters. High, statistically significant correlations be-

tween the activity of sAA measured in the three stages of the study (0.812; 0.924 and 0.665) were identified. The protein concentrations measured before draw of lot and before bouts were also highly correlated ($r = 0.752$, $p = 0.019$). The individual values of the studied biochemical indicators were also strong mutually correlated. The concentration of total protein in the saliva before bouts strongly correlated with the sAA before the draw of lot and before fights ($r = 0.738$, $p = 0.023$; $r = 0.736$, $p = 0.024$). The K^+ concentration one week before the competition and the sAA both before the competition and before bouts were also highly correlating ($r = 0.792$, $p = 0.011$; $r = 0.738$, $p = 0.022$).

Table 2. Correlation matrix of the investigated biochemical parameters. The significant correlations are highlighted in gray

		sAA one week before	sAA before draw of lot	sAA before the bout	Protein one week before	Protein before draw of lot	Protein before the bout	K+ one week before	K+ before draw of lot
sAA before draw of lot	Correlation	0.812	1						
	Significance	0.002							
sAA before the bout	Correlation	0.924	0.665	1					
	Significance	0.000	0.025						
Protein one week before	Correlation	-0.055	-0.035	0.064	1				
	Significance	0.879	0.924	0.860					
Protein before draw of lot	Correlation	0.385	0.460	0.388	0.494	1			
	Significance	0.243	0.155	0.238	0.147				
Protein before the bout	Correlation	0.613	0.738	0.736	0.655	0.752	1		
	Significance	0.079	0.023	0.024	0.056	0.019			
K+ one week before	Correlation	-0.173	-0.464	0.062	-0.094	-0.143	-0.231	1	
	Significance	0.611	0.151	0.857	0.797	0.674	0.549		
K+ before draw of lot	Correlation	0.436	0.231	0.461	0.213	0.639	0.514	0.366	1
	Significance	0.180	0.495	0.153	0.555	0.034	0.156	0.268	
K+ before the bout	Correlation	0.792	0.542	0.738	-0.018	0.435	0.512	-0.441	0.245
	Significance	0.011	0.132	0.022	0.963	0.242	0.158	0.234	0.525

DISCUSSION

The working hypothesis of this study was that some biochemical indices, obtained by noninvasive methods (saliva collection), could be used for adequate evaluation of the competitive stress features. This hypothesis was probated in real competitive conditions, the National Championship. The results showed a statistically significant increase in all tested biochemical indices (sAA, protein concentration and K⁺ concentration) measured either before the draw of lot or before the first bout in comparison to the same indices, measured one week before the competition. According to the coaches' opinion, pending the outcome of the draw of lot induces in boxers stress in the same range as before the bout. It is well known that high levels of stress influence negatively sports results (Bali, 2015). In this study we registered a notably very low activity of sAA (calculated as $\ln(\text{sAA})$) in the samples of the winner (athlete №6) in all three measurements.

In regards to raw sAA (before their logarithmic-transformation), we observed large variations in the values of the tested individuals. Kobayashi et al. (Kobayashi et al., 2012) also found a considerable inter-individual dispersion for raw sAA (coefficient of variation 67%). In order to improve the statistical distribution of salivary alpha-amylase numerical transformations, square root-, and natural logarithmic-transformation for sAA values were proposed. The numerical transformations square and root transformation were insufficient. The logarithmic transformation appears to improve the distribution of sAA better. However these mathematical transformations diminished inter-individual

variation up to 20% - 30% without any physiological reasons.

The large differences in this indicator could be explained with the fact that the gene for AA expression is poly-allelic and thus the enzyme activity depends on the number of alleles at each person (2 to 14) (Perry et al., 2007; Falchi et al., 2014). Elbers et al. (Elbers et al., 2011) reported a significant correlation between the number of genetic copies of sAA (AMY1) and its activity ($r = 0.45$; $p < 0.001$). Therefore, it can be assumed that both the basal activity of sAA at rest and its increased activity in stressful situations are proportional to the number of genetic copies of AMY1 in the tested individual. This assumption explains the high correlation coefficients in all three measurements. Therefore, based on the relative increase in sAA activity versus the sAA activity measured in physical and mental rest, a method for evaluation of the stress response magnitude could be proposed. In this study the activities measured one week before the competition could be assumed as a baseline and the coefficient of increase in sAA activity before the draw of lot or before the match, could be accepted as a "stress coefficient" (Fig. 7).

The substantial difference in the interpretation of the results represented directly and the use of the proposed "stress coefficient" may become clear when we compare Fig. 1 and Fig. 7. For example, in Fig. 1 the sAA of boxer №6 (gold medalist) showed the lowest values, whereas the second gold medalist (boxer №11) showed the highest values. However, when the results were recalculated with the use of the "stress coefficient", these athletes could be classified as competi-

tors with moderate level of stress reaction both before the draw of lot and before the first bout. Thus, this method of data presentation is in line with the concept that moderate stress leads to the highest level of performance (Bali, 2015).

The high correlation between the protein concentration and K⁺ concentration and sAA is interesting and could be used for developing of methods for express field assessment of pre-start stress with widespread use in sports practice. For example, K⁺ concentration may be determined without the use of any reagents, only with a portable analyzer with an ion-selective electrode.

CONCLUSIONS

The sAA and salivary protein concentration rose in conditions of pre-start and competitive stress. However, sAA showed large individual differences. In order to avoid this problem, we suggested the changes in sAA to be present in units relative to their values in physical and mental rest conditions. For this purpose, the

samples should be collected by the competitors themselves at home with previously given salivettes. The basal values of the sAA should be measured in samples, collected several times during the day, in order to obtain a circadian rhythm, in a period long before major competitions.

The information received from the sAA overlaps to a large extent those, obtained by salivary protein concentration data. Thus, we believe that the measurement of the protein concentration has valuable advantages in practical terms that include lower cost, shorter time to determine and less fluctuation of results.

The measured concentrations of K⁺ in our experiments were within the range of the ion-selective electrode sensitivity. This observation allows an express measurement of this indicator in field conditions without the use of reagents. Therefore, the K⁺ concentration in saliva could serve as a perspective express indicator for evaluation of stress in sports practice.

REFERENCES

- Bali, A. (2015) Psychological Factors Affecting Sports Performance, *International Journal of Physical Education, Sports and Health*, Vol. 1 No. 6, pp. 92–95.
- Elbers, C. C., Thompson, S. R., Ranciaro, A., Meskel, D. W., Belay, G. and Tishkoff, S. A. (2011) Amylase gene copy numbers and salivary amylase activity in ethnically diverse populations from Ethiopia, in *The 12 th International Congress of Human Genetics and the American Society of Human Genetics 61 st Annual Meeting October 11-15*, p. 36.
- Falchi, M., El-Sayed Moustafa, J. S., Takousis, P., Pesce, F., Bonnefond, A., Andersson-Assarsson, J. C., Sudmant, P. H., Dorajoo, R., Al-Shafai, M. N., Bottolo, L., Ozdemir, E., So, H.-C., Davies, R. W., Patrice, A., Dent, R., Mangino, M., Hysi, P. G., Dechaume, A., Huyvaert, M., Skinner, J., Pigeyre, M., Caiazzo, R., Raverdy, V., Vaillant, E., Field, S., Balkau, B., Marre, M., Visvikis-Siest, S., Weill, J., Poulain-Godefroy, O., Jacobson, P., Sjostrom, L., Hammond, C. J., Deloukas, P., Sham, P. C., McPherson, R., Lee, J., Tai, E. S., Sladek, R., Carlsson, L. M. S., Walley, A., Eichler, E. E., Pattou, F., Spector,

- T. D. and Froguel, P. (2014) Low copy number of the salivary amylase gene predisposes to obesity, *Nature genetics*. Nature Publishing Group, a division of Macmillan Publishers Limited. All Rights Reserved., Vol. 46 No. 5, pp. 492–7.
- Granger, D. A., Kivlighan, K. T., El-Sheikh, M., Gordis, E. B. and Stroud, L. R. (2007) Salivary alpha-amylase in biobehavioral research: recent developments and applications, *Ann N Y Acad Sci.*, Vol. 1098, pp. 122–144.
- Gröschl, M. (2008) Current status of salivary hormone analysis, *Clinical chemistry*, Vol. 54 No. 11, pp. 1759–69.
- Kaufman, E. and Lamster, I. B. (2002) The diagnostic applications of saliva-a review, *Critical reviews in oral biology and medicine: an official publication of the American Association of Oral Biologists*, Vol. 13 No. 2, pp. 197–212.
- Kobayashi, H., Park, B.-J. and Miyazaki, Y. (2012) Normative references of heart rate variability and salivary alpha-amylase in a healthy young male population, *Journal of physiological anthropology*, Vol. 31, p. 9.
- Minasian, S. M., Gevorkian, E. S., Daian, A. V., Grigorian, G. G. and Grigorian, G. S. (2004) Influence of mental and emotional stress on the levels of electrolytes in the saliva of senior schoolchildren, *Gig Sanit.*, No. 4, pp. 46–48.
- Perry, G. H., Dominy, N. J., Claw, K. G., Lee, A. S., Fiegler, H., Redon, R., Werner, J., Villanea, F. A., Mountain, J. L., Misra, R., Carter, N. P., Lee, C. and Stone, A. C. (2007) Diet and the evolution of human amylase gene copy number variation, *Nature genetics*, Vol. 39 No. 10, pp. 1256–60.
- Petrov, L., Alexandrova, A. and Chanev, S. (2015) Heart rate variability in experimental model of competitive stress in handball, *International Journal of Sport Studies*, Vol. 5 No. 11, pp. 1194–1202.
- Petrov, L., Atanasov, P., Zaekov, N., Alexandrova, A., Zsheliaskova-Koynova, Z. and Achkakanov, I. (2012) Physiological and non-invasive biochemical indexes in a model of emotional stress in shooters, *Scripta Scientifica Medica*, Vol. 44 No. 1, pp. 55–58.
- Petrov, L., Bozhilov, G., Alexandrova, A., Mugandani, S. and Djaro-va, T. (2014) Salivary alpha-amylase, heart rate and heart-rate variability in response to an experimental model of competitive stress in volleyball players, *African Journal for Physical, Health Education, Recreation and Dance*. LAM Publications Limited, Vol. 20 No. 2, pp. 308–322.
- Richter, P., Hinton, J. W. and Reinhold, S. (1998) Effectiveness in learning complex problem solving and salivary ion indices of psychological stress and activation, *Int J Psychophysiol.*, Vol. 30 No. 3, pp. 329–337.
- Shimazaki, M., Matsuki, T., Yamauchi, K., Iwata, M., Takahashi, H., Sakamoto, K., Ohata, J., Nakamura, Y. and Okazaki, Y. (2008) Clinical Performance of a Salivary Amylase Activity Monitor During Hemodialysis Treatment, *Biomark Insights*, Vol. 3, pp. 429–434.
- Ullmann, Y., Klein, Y., Savulescu, D., Borovoi, I., Egozi, D., Gavish, M. and Nagler, R. (2010) Salivary monitoring related to major surgery, *Eur J Clin Invest.*, Vol. 40 No. 12, pp. 1074–1080.
- WMA (2013) WMA Declaration of Helsinki - Ethical Principles for Medi-

cal Research Involving Human Subjects.

Yamaguchi, M., Deguchi, M., Wakasugi, J., Ono, S., Takai, N., Higashi, T. and Mizuno, Y. (2006) Hand-held monitor of sympathetic nervous system using salivary amylase activity and its validation by driver fatigue as-

essment, *Biosens Bioelectron.*, Vol. 21 No. 7, pp. 1007–1014.

Yamaguchi, M., Kanemori, T., Kanemaru, M., Takai, N., Mizuno, Y. and Yoshida, H. (2004) Performance evaluation of salivary amylase activity monitor, *Biosens Bioelectron.*, Vol. 20 No. 3, pp. 491–497.

Correspondence:

Lubomir Petrov
National Sports Academy “Vassil Levski”,
Sofia Bulgaria,
E-mail: dr.lubomir.petrov@gmail.com

ON THE IMPORTANCE AND NEED OF FLEXIBILITY AND STRENGTH REFINEMENT AS AN ELEMENT OF DANCERS' TRAINING

Ina Vladova¹, Yiğit Hakan Ünlü²

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

² Sakarya University State Conservatory, Sakarya, Turkey

ABSTRACT

Contemporary professional dance art is close, to a great extent, to sport of excellence. The requirements to performers are constantly increasing and hence the need of properly organised specialised training, including a system of drills, stretching and dance exercise for developing their motor skills.

The aim of this empirical study is to establish the need of including a specialised methodology for the development of the motor skills in the dance practice in the Republic of Turkey – strength and flexibility for the dancers of Turkish folk dances. The tasks are: to study the dance practice in the Republic of Turkey and to explore the views of the future dance pedagogues on the implementation of a program in dance training for the development of motor skills.

The survey was conducted among dance students of Turkish folk dances with the help of a specially designed questionnaire.

Our sustained observations and the analysis of the existing literature show lack of exhaustive research in the field of the dance theory and practice in the Republic of Turkey. There is insufficient data on the existence of a uniform methodology for working in the dance groups for the development of flexibility and strength with the use of specially elaborated programs, including dance exercises. The results of the conducted survey confirm the absence of a unified and purposeful work in this area.

At present, in teaching dance, there is not enough emphasis put on the purposeful development of dancers' motor skills. Given the increasing requirements dancers face, we consider it unreasonable that the scientific achievements not be widely introduced in the pedagogic practice in Turkey. Such discrepancy between theory and practice may have serious consequences – an increased risk of injuries and lasting disabilities, shorter career as a dancer and a debased professional satisfaction.

Keywords: *dance, motor skills, strength, flexibility*

INTRODUCTION

During different time periods, peoples have encoded in their dances the habitual cultural and ethnic characteristics reflecting the spirit of the respective epoch. After the Renaissance dance art in Europe gradually became more professional. This process demanded a more specialised training of the performers. The emergence and development of classical dance, i.e. ballet, came as a solution to this issue. Various complexes of dance exercises were elaborated for development of dancers' motor skills and training.

The main motor skills required for dance performers are strength, flexibility, jumping ability and endurance. These qualities are developed through specialised training that includes a system of drills, stretching and dance exercises. By applying such a complex during the training process muscle groups are strengthened and physical qualities are developed, such as: proper body and head position; coordinated functioning of all parts of the body; improved physical training of the dancers. The improvement of physical training is necessary because it is of particular importance that the body and the whole organism of the dancer be adequately prepared as dance is realised by the body. The good performance depends not only on the talent and sensation of the dancer but also on some physiological characteristics, namely the optimal development of motor skills. So, one of the main tasks of dance pedagogy is to develop the individual skills of dance practitioners and to improve their physical condition.

All those skills are also vital to anybody who practices folk dances which have been "revived" and have become

more popular since the 20th century. Before that time those dances (Irish, Balkan, Asian, African, provincial English, etc.) were "almost lost" for the wide public. Their popularity is growing, both in their endemic areal and in the West (Mackrell, 2015). In its turn, this is a prerequisite for the professionalisation of folk dances, which implies the need of specific training of the performers. It is important for dancers to possess appropriate physical qualities, based on a complex of developed motor skills as well as on the good body space orientation. Over the time, the requirements to folk dancers gradually and constantly have increased. For this reason, the attention towards the physical and technical training of dance performers is growing steadily in choreographic practice. According to Zl. Kostov (2005) the necessary complex of skills (athletic, performing and artistic) should be developed in stages, while the dances themselves also influence the development of motor skills.

Contemporary professional dance art is close to a great extent to sport of excellence. The requirements to performers are constantly increasing and hence the need of properly organised specialised training. In this context *"from pedagogical view point, sport and dance practice are identical. And like some authors, who place certain sports on the border between sport and art, we can conclude that on the stage dance is an art (stage art), while before the performance, during the stage preparation, during rehearsals or dance lessons – it is a sports practice"* (Ünlü, Vladova, 2016). In dancers' physical training, exercises (for warming up the organism and prevention of traumas and also for improving the very perfor-

mance) are of particular importance, as well as the specialised stretching program and the set of exercises for development of motor skills.

It is obvious from the theory and practice that all motor skills are subject to development.

Strength is the motor skill that lies in the base of all other motor skills and of the good dance technique and it leads to the improvement of the dancer's performance. It is developed through systematic and purposeful training of particular muscular activity and different methods for strength training: repeated effort method, dynamic effort method and maximal (next to the limit) effort method. The included exercises can be performed by the overcoming of the own weight (self-weight), by overcoming external resistance (weights, elastic bands, springs, etc.) or by performing structured special-strength exercises, which develop power in a mode close to the main motion action in the muscle groups that are involved in its performance (Nikolov, 2014). In dance practice, in order to develop the quality "strength" one should mainly use self-weight exercises in isometric, isotonic and auxotonic mode.

Flexibility is also a very important quality for successful professional realisation of dancers. Flexibility is a function of the resiliency of the different units of the locomotor system and is measured by the magnitude of the amplitude of the movements. This is the general mobility of the joints and the ability of movement in the joints. Critchfield (2011) studies flexibility in relation to the scope of movement in the respective joint. It is determined by the anatomical structure that provides stability and allows the movements in

the joint. The largeness of movement in the joint depends on several anatomical, biomechanical and physiological factors: shape and size of the bones participating in the movement; connective tissue; joint capsule and joint connections that in turn stabilise and at the same time restrict the movements in the joint; muscle mass and nerves; the strength of the muscle groups that perform the movements in the different joint ties. Flexibility is regarded as the ability of soft tissue structures (muscles, tendons and connective tissue) to extend smoothly and easily through the available capacity of movement (Hadjiev, Andonov, Dobrev & Petrov, 2011; Alter, 2004; Critchfield, 2011). Therefore, the magnitude of movement amplitude depends on the anthropometric features of joint surfaces, the elastic properties of joint ties and on the muscle tonus. The amplitude of motion is specific for each joint and its high level in one joint does not predetermine the same level in another joint (Zheliakov, Dasheva, 2011; Lorraine, Urmston, 2016; Butulis, 2016). It has been established that the flexibility and elasticity of the muscles and tendons is higher in women than in men of the same age. Despite this fact, male dancers should also work to develop this quality (Critchfield, 2011). Some authors explain these gender-based differences with the higher level of estrogen in the body of women. The development of this quality is influenced by gender, age, body morphology, genetics, bone-joint apparatus, nerves, muscles, tendons, connective tissue (Lorraine, Urmston, 2016). Zheliakov and Dasheva (2011) associate flexibility with the morpho-functional properties of the locomotor system, which are also "the limiting factors of its manifestation". They also

enumerate some additional factors such as: air temperature (the higher temperatures are more favourable); warming up of the motor system; suitable clothing that does not restrict movements; adequate recovery after fatigue or injury; part of the day – reduced flexibility during the morning hours. The level of flexibility depends also on the level of development of the other motor qualities but there should be a balance, especially between flexibility and strength (Zheliakov, Dasheva, 2011; Lorraine, Urmston, 2016).

Depending on the nature of the motor activity, flexibility can be: general; special and relative compensatory. According to the type of muscle extension it could be: static or isometric; dynamic or kinetic and the difference between the two is the backup (Zheliakov, Dasheva, 2011). To improve the elasticity of the muscles and the joint ties, respectively to improve flexibility, active and passive movements and exercises are recommended. Active exercises involve one's own muscular efforts and are performed without external resistance: these are different folds, stretches and general exercises, swings, tilts, etc. They are of great importance and application in dance practice and are included in the dance exercises.

Passive exercises to develop flexibility – with the help of external forces or resistances or by the own body mass; static restrained exercises. Ancillary exercises are used to increase the amplitude of movements by pushing or overcoming a resistance.

A group of passive-active exercises can also be distinguished (Zheliakov, Dasheva, 2011). The authors also talk about some recent trends of the so called stretching exercises in sports prac-

tice aimed at development of flexibility, which are actively used in dance schooling and training of the dancers. Stretching is considered passive flexibility in the slow extension of agonist muscles to the threshold of pain caused by the changes of muscle length by exciting nerve endings and muscle spindles. This, in turn, leads to “creating an additional tension in the muscle”, which is felt as a slight pain. Some of the stretching benefits are that the physical condition of the body is generally improved; the risk of injuries in the joints, joint ties and tendons is reduced; muscle tension and fatigue is decreased; tissue nutrition is improved (Zheliakov, Dasheva, 2011; Alter, 2004). It is important not to confuse stretching with warm up, because the warming-up is intended to increase the temperature of muscle tissue (Critchfield, 2011).

The issue of stretching is studied by researchers in the sphere of sports, dance, sports medicine and rehabilitation (kinesiotherapy). They explore its varieties and compare the advantages and drawbacks, which may be encountered when stretching is included in the practice of athletes and dancers. Usually the advantages and disadvantages are considered in view of increasing the range of movement in the joints and in view of its effectiveness in developing flexibility or in reducing the trauma risks (Zheliakov, Dasheva, 2011; Tanigawa, 1972; Moore, Hutton, 1980; Prentice, 1983; Condon, Hutton, 1987; Etnyre, Lee, 1988; Sullivan et al., 1992; Bandy et al., 1998; Alter, 2004; Sharman et al., 2006; Critchfield, 2011; Lorraine, Urmston, 2016). Some researchers try to refute the “myth” that stretching is the best prevention and strategy for avoiding sprains. It is known that through its

practicing the state of the joint-articular apparatus, the neuromuscular efficiency and the working capacity are improved. However, it is not absolutely proven that stretching prevents injuries (Sutton et al., 2012; Butulis, 2016). The physiology of stretching is complex and many authors associate it with the development of flexibility. However, according to Lorraine & Urmston (2016) the causal relationships between the extension during stretching and the greater levels of flexibility are not fully elucidated. Regardless of the above allegations, stretching is included in the dance practice precisely for the development of flexibility.

The types of stretching known in theory and practice are: passive (static); active (with varieties as dynamic and ballistic) and proprioceptive neuromuscular facilitation (PNF). Any of these types is effective and is more or less beneficial to the development of flexibility. It is important that the dance pedagogue not only know the different types but also be able to find the optimal stretching techniques for the respective training corresponding to the dance style, level of the dancers or the stage of the preparation.

We can summarise that the qualities strength and flexibility are in correlation, as strength depends on the muscle area and flexibility – on the extent of its stretching. In this regard, strength exercises should be performed alongside with those for flexibility (Yarali, 2016). From methodological point of view, it is important to find the balance between them. This is due to the fact that when working for flexibility the connective tissue both stretches and relaxes. When the connective tissue of some muscle is weak, the probability of trauma and overload is

greater. At the same time, strengthening of muscles prevents injuries. Lorraine & Urmston (2016) cite Julie Alter's words: "*Strengthen what could be stretched and stretch after strengthening*". At the same time, the percentage of work for strength and work for flexibility depends also on the dancers themselves or on their condition and body specifics. Dancers who are "more floppy" should do less stretching and more strength exercises than the others. There is also a reverse trend – dancers who have "tight" bodies are more stable and have a thicker connective tissue and their muscles are less elastic (Critchfield, 2011).

By taking into account the safety principles and searching for positive effects in the dance practice, the dance pedagogues should be able to judge when and how to apply productively the different types of exercise and techniques for development of motor skills.

Dance practice aims at maximal refining of the dancing movements (of dance as a whole), both by each dancer individually and by everyone participating in the activity or in the dance performance/stage production.

However, to ensure this, the main tasks of dance pedagogues (choreographers) should be:

- To develop, ensure and enhance the competence of dancers, which includes a complex of: optimal development of motor skills, the necessary skills and dexterity, that find expression in their dance culture and "literacy";

- To make systematic efforts to protect dancers' health as the most important factor for their physical and psychic well-being. This, in turn, is a prerequisite for ensuring dancing longevity.

According to Butulis (2016) injury prevention demands a holistic approach to the managing of numerous risk factors which he divides into: internal - determined by the characteristics of the individual (bone density, flexibility, muscle endurance, hormonal balance, nutrition, etc.) and external factors (hall and floor condition, shoes, workload, training schedule, etc.). Hyper-mobility, which also carries a certain risk of trauma, can be considered an internal factor too (Grahame, 1971; Klemp et al., 1984). According to Morris (2016), the healthy and safe dance practice involves much more than rules and norms. It is the best way to reduce the risk of injury to the dancers and improve the performance. It is a fact that the risk of injuries and traumas in the dance activity is great, but the safe dance practice actually means to minimise that risk without compromising the scope of the activity or diminishing its artistic and creative effect. It is important to support the dancers in getting the most out of their creative potential. For this purpose, it is necessary to perform a physiologically effective warming-up and improve the flexibility and strength. It is also necessary that the dance activities be physiologically correctly structured. Thus, training shall be safer and shall improve together with dancers' skills (Morris, 2016). When working on development of flexibility and strength, dance pedagogues should adhere to the principle of the individual approach to teaching which in its turn guarantees trauma prevention (Ünlü, Vladova, 2016). Dancers' bodies are different, even if they practice one and the same dance style. Some of them are less flexible and agile, have a dense connective tissue, and their muscles are not very elastic, un-

like other dancers who are more flexible by nature. Some are even hypermobile. This is good for flexibility, respectively for the performance, but is also a serious prerequisite for an increased risk of traumas and injuries. Dancers who have a greater range of movement volume are also more vulnerable to serious tendon injuries. Both excessive flexibility and insufficient flexibility can increase the danger and the risk of trauma. Consideration should be given to the fact that when the muscle has reached its absolute maximum length and is subjected to further stretching, it causes stress on the tendons. They could tear at tensile exceeding 6% of the normal length. Even if these adverse effects do not occur, it is likely that the joint stiffness will be reduced or the joint ties become loose. These are additional prerequisites for an increased/serious trauma risk (Lorraine, Urmston, 2016).

From injury prevention and performance improvement stand point, consideration is needed when and how stretching is done. As we have mentioned above, the temperature on the premises affects the development of flexibility. Even if it is warm, it is still not recommended to make a basic stretch before dancing (including stage performance) (Critchfield, 2011). Critchfield also recommends that when during stretching, a tingling in fingers or in toes is felt (which is a symptom of a neurological effect), the respective exercise should be avoided, especially if it is done before the performance of a more demanding choreography where the excellent control is of paramount importance. Such disturbing effects disappear over time. It is also recommended that before rehearsals or performances a dynamic stretching may be more appropriate,

which includes some dance movements and is less “harmful” than the static one (Viale, Nana-Ibrahim, & Martin, 2007; Critchfield, 2011).

Summarising we may affirm that one of the main tasks to be solved by the dance pedagogues, besides dance training, is to ensure above all a healthy and safe dance practice.

MATERIALS AND METHODS

Purpose and objectives of the study

Object of this study is the physical qualities “strength” and “flexibility” achieved by persons practicing Turkish folk dances.

The research on these qualities is not an end in itself, arbitrary or accidental. The optimal level of their development by the respective dancer is a factor for achievement of performance mastery. Dancers have a substantial long-term training which often resembles the training of athletes. In order to turn dance into art that “*brings aesthetic pleasure to the viewers, there are many advance hours and years of work*”, regardless of the dance style, age group or dancers’ level of the preparation (amateurs or professionals) (Ünlü, Vladova, 2016). Dances are combination of complex movements involving both artistry and good body skills. Dancers are expected to have simultaneously the creativity and originality of an artist and the strength and the body control of an athlete (McKinnon, Etlin-Stein, 2015). The modern dancer needs a complex of qualities that are necessary for a good performance. According to Judith Mackrell (2015), dancers are not just performers; their bodies are instruments of dance art. It is exactly the

motor skills and abilities of the dancers that determine the quality of the art performed. She concludes that the stronger and more flexible a dancer’s body is, the better he/she shall be able to perform a wider range of movements. The good dancer should be strong, agile and flexible, well coordinated (able to make all parts of the body work together well). He/she should perform balanced movements and have highly developed “kinetic consciousness”. Dancers need also to manage to control their body and to be able to control its weight. Besides the above qualities, the dancer should have a sense of rhythm and musicality, which are also of great importance (Mackrell, 2015). In dance performances ease of execution, plasticity and jumping ability are demanded and appreciated above all. Dancers’ movements often include various jumps and landings. But as Ambegaonkar, Caswell & Cortes (2014) assert, dancers need strength in the lower body part (LBP) in order to assure their safety, in the sense of preventing traumas and injuries when performing such explosive movements. According to them, 70% of all traumas, related to dances, happen in the lower body part. Several authors study what, for example, influences the height of the jumps. For the successful performance of jumps, along with the flexibility, age, some anthropometric indices (height and weight) and the experience of the dancers, the muscular mass and the isometric muscle strength play a role as well (Wyon et al., 2006; Golomer et al., 2004; Kraemer et al., 2004). A manifestation of this quality lies in speed endurance (the speed of performance of the movements). It has been established that in athletes who have better achieve-

ments, the quality “strength” is well developed. Analogically, in a study among 61 female dancer students Ambegaonkar, Caswell & Cortes (2014) search the same relation in respect of the link between the strength (in the LBP) and the balance during dancing. This is of interest to them because dancers are expected to have a better balance than non-dancers, and because in the contemporary development of the dance the aesthetic results and the jumping abilities are in a positive correlation with each other. They find out that balance and strength correlate, being positively linked. Stronger dancers have better balance. By these conclusions, the authors refute the myth that stronger dancers are more muscular and consequently the dance performance is deteriorated (Ambegaonkar, Caswell & Cortes, 2014).

The aim of this empirical study is to establish the need of including a specialised methodology for the development of the motor skills in the dance practice in the Republic of Turkey – strength and flexibility for the dancers of Turkish folk dances. The tasks we have set are:

1. To study whether a methodology for development of motor skills is applied in the dance practice in the Republic of Turkey, including special exercises for strength and flexibility, and stretching and dance exercises;

2. To explore the views of the future dance pedagogues on the implementation of such program in dance training on all levels: both with non-professional dancers and in professional dance groups.

Thesis and hypothesis of the research

In the Turkish scientific literature, we do not find information about a unified and specialised program for develop-

ment of motor skills, incl. also specialised stretching methodology and Turkish dance exercise.

The hypothesis of this study is that such practice has been absent in the training in Turkish folk dances. Although the folklore dance art in the country has actively entered the stage of its professionalisation there is still no unified specialised methodology for the training of the performers.

Undoubtedly, the unified, rigorous and infinitely stylised classical technique is necessary for the development of the basic motor skills (strength, flexibility, jumping ability, speed, endurance). In this sense, the pillars of the classical exercise are steady. However, the study and mastering of any folklore performance style, especially at professional level, requires a specialised technical training, which is as close as possible to the protoplast of the folk dance. Every nation has its own dance traditions, specific dance vocabulary, style and character of performing its regional dances. This makes the literally transferred classical exercise inapplicable to the folk dance. Its specificity necessitates a certain change in the content, arrangement and performance of the drills of the exercise. In folk dance, the exercise is intended not only to build up the muscles and develop the flexibility and the strength of the performer, but also to prepare him/her for the style and character of the dances, which will be rehearsed or performed on the stage.

We assume that the elaboration and introduction of such a program in the dance practice shall contribute to the overall development of the Turkish dance folklore in the process of its professionalisation.

Applied methodology and methods

The survey was conducted among dance students (n=64) with major “Turkish Folk Dances” at the Sakarya University State Conservatory, Department of Turkish Folk Dances, Republic of Turkey, with the help of a specially developed questionnaire.

The interviewed students are from all Bachelor’s degree courses (I to IV), and their number represents 80% of the total number of students with major “Turkish Folk Dances”. The distribution by gender is as follows: 33 (51,6%) of the interviewed students are male with mean age $M=23$ years (Min=19; Max=28; $SD=2,02$) and 31 (48,4%) are female with mean age $M=22$ years (Min=19; Max=25; $SD=1,55$).

The field of this study is the system of university dance education in the Republic of Turkey.

In order to achieve the objective and tasks of the study, we applied a complex methodology, which included: a theoretical-logical analysis of literary sources and methodology for collecting empirical information. The methodology was based on pedagogical observation (the purpose of which was to get a preliminary orientation in the problem) and a specially developed questionnaire. The questionnaire contains two subscales with five questions and information about the gender and the age of the interviewed students and about their dancing experience before enrolling in the Conservatory.

The first subscale is related to questions whether during the dancing practice before enrolling in the Conservatory the respondent worked on developing motor skills such as “strength” and “flexibility” and whether during the same period the

respondent worked independently in that particular field.

The second subscale (Cronbach’s Alpha $\alpha=0,803$) is related to another set of five questions. They focus on obtaining the students-dancers’ opinion about the inclusion of a motor skills development program in the dancing practice. A three-point Likert-type scale was applied: the answer “No” marked with 1, the answer “No opinion” – marked with 2 and the answer “Yes” – marked with 3.

RESULTS AND DISCUSSION

Our sustained observations and the analysis of the existing literature show lack of exhaustive research in the field of the dance theory and practice in the Republic of Turkey. There is insufficient data on the existence of a uniform methodology for working in the dance groups for the development of flexibility and strength with the use of specially elaborated programs, including dance exercise. Prior to joining the Conservatory, the interviewed students were engaged in dances, with an average duration of their dance practice before the university 9,6 years (Min=4; Max=18; $SD=3,21$). For women, the duration of the previous practice is shorter $M=8$ years (Min=4; Max=13; $SD=2,63$), while for men it is longer $M=11$ years (Min=7; Max=18; $SD=3,03$). We focused on establishing to what extent during that period their pedagogues had worked purposefully and in an organised manner for the development of their motor skills and namely the flexibility and strength. Regretfully, the results of the conducted survey confirm the absence of a unified and purposeful work in this area. The results from students’ responses are presented in Figure 1.

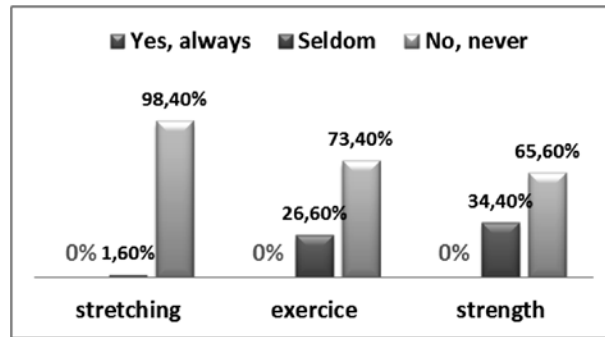


Figure 1. *Work for developing strength and flexibility, incl. stretching and dance exercise*

It was established that the respondents, by the time they enrolled in the Conservatory, practically had not worked purposefully and in an organised manner on developing the motor skills strength and flexibility during the Turkish folk dance activities. Their dance pedagogues had not included stretching, exercise and special strength exercises in the trainings, no matter how beneficial they are known to be for dancers. Only 26,6% of the respondents seldom did exercise while 34,4% of the interviewees rarely

did some strength exercises during their previous dance practice. We can summarise that these results are rather worrying.

A supplementary aspect of the survey is to establish to what extent the dancers worked independently for developing the motor skills “strength” and “flexibility” during the same time period. The results from their responses are shown in Figure 2 and Figure 3. The responses rebut our presumptions for a greater rate of self-sufficient training activity in the respective area.

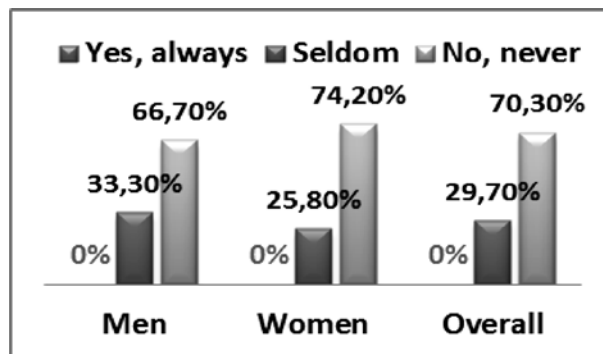


Figure 2. *Strength independently*

None of the interviewed dancers gave the answer “Yes, always” in respect of autonomous development of their strength. Only about one third of the interviewed students have done strength exercises rarely, resp. 33,3% of the male students and 26% of the female ones. The remaining respondents marked the answer “No”. As regards flexibility,

female respondents had the same attitude as that of the development of their strength, while male interviewees indicated a greater activity. We found out that of all respondents only one male student worked independently for developing his flexibility and 36,4% did this seldom. The remaining male respondents marked the answer “No”.

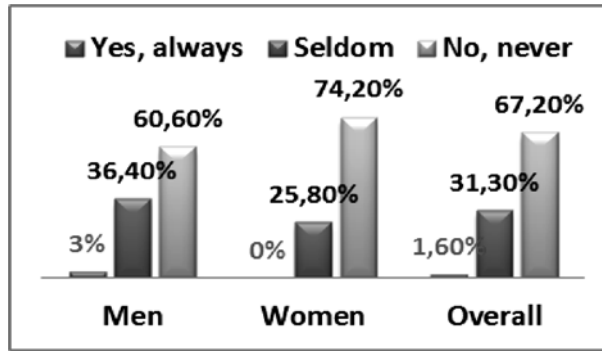


Figure 3. *Flexibility independently*

The obtained results about the independent activities are not surprising. Without methodological guidance or a good example on behalf of dance pedagogues, dancers could hardly be expected to reach some rational approaches regarding their self-training. The results support the thesis of Dragon (2014) that learners often expect to be trained and believe that there is only one way to learn, through the traditional authoritarian paradigms, like the “demonstration and reproducing” model. However, such expectation often poses many challenges both to dance pedagogues and to trainees themselves.

In the research, we also focused on studying the views of the future dance

pedagogues on the need and benefits of implementation of a special program for development of motor skills in the dance practice in the Republic of Turkey. The questionnaire included questions regarding the students’ opinion whether a specialised program with exercises for developing the motor skills – strength and flexibility, including also a dance exercise should be implemented in the dance classes (for professionals and amateurs). The results show that a significant part of the respondents share the opinion of the absolute need of introduction of these programs and their relative share is greater than the share of those who are of the opposite opinion. A summary of the responses (n=64) is presented in Figure 4.

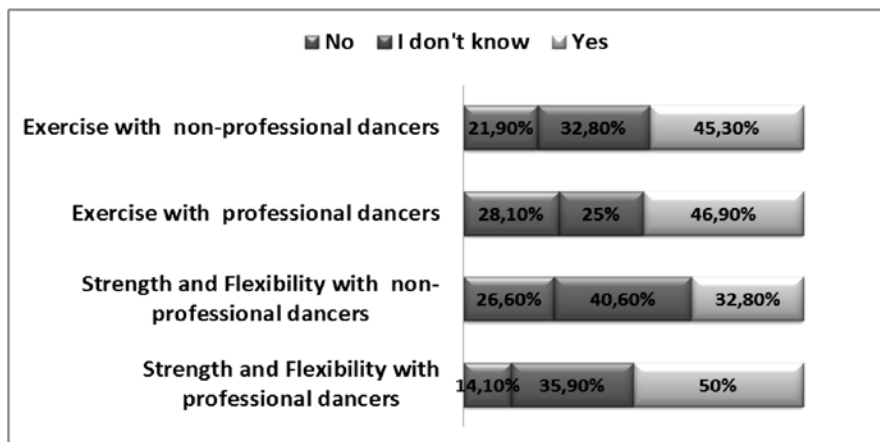


Figure 4. *Respondents’ opinion on the implementation of a program for developing motor skills in dance training*

According to 32,8% of the interviewees it is necessary to work for the development of motor skills of non-professional dancers, while in regard of professional dancers this opinion is firmly supported by half of the interviewed students. It is worth noting that a relatively great part of the respondents does not have an opinion on this issue both for professional and amateur dancers. Regarding the inclusion of the exercise in the dance training almost half of the respondents believe that this should be done for both groups, but still some of the interviewed students consider it unimportant (the negative answers and that of “no opinion” are almost balanced).

We received more encouraging answers to the question whether they would use a specialised motor skills developing program when they become dance pedagogues. Most of the interviewed students (57,8%) declare that they shall work to develop the motor skills of dancers; 31,3% of the future dance pedagogues do not intend to apply such program, while 10,9% still have no opinion on the issue.

The data from the questionnaire survey conducted among 64 dance students affirm the necessity of introducing a specialised program, including a dance exercise in the dance practice. If applied on the level of university dance education, it shall become a prerequisite for its gradual introduction into practice even among non-professional dancers. Once it is included in the university curriculum, later on, when students become dance pedagogues, they shall apply such program in their practice since they shall be aware of its positive effects.

CONCLUSION

The training in Turkish folk dances

in the Republic of Turkey should not be viewed only as a subject in the university curriculum. This is a specific subject that has the potential to build the personality of dancers. The properly organised training activities are an important and complex factor for achieving this. At present, in teaching dance, there is not enough emphasis put on the purposeful development of dancers' motor skills. Given the increasing requirements dancers face, we consider it unreasonable that the scientific achievements not be widely introduced in the pedagogic practice. Such discrepancy between theory and practice may have serious consequences – an increased risk of injuries and lasting disabilities, shorter career as a dancer and a debased professional satisfaction. This risk is more pronounced with male dancers, whose performances more often include jumps, squats and kneeling that additionally load the locomotor and joint-articular apparatus.

Traumas are inevitable due to the specifics of the activity. The issue is to avoid serious injuries and to keep them within acceptable limits.

The achievement of high dance mastery and the related increased physical workloads are a challenge to dance performers and their choreographers. The obvious need to avoid injuries and to preserve the health of professional dancers is directly related to providing an adequate workload regime. Establishing such a balance is the foundation of both personal development and refinement of the dancer and of the improvement of the quality of the artistic product as a whole.

The results of our research and the outlined generalisations allow affirm-

ing with conviction the necessity of adopting a unified teaching program in the curriculum of the major Turkish Folk Dances at the universities in the Republic of Turkey. A similar practice has already been established in Bulgarian schools and it gives its good results. The practical realisation of the idea of introducing a unified program involves a number of interrelated activities such as:

► Elaboration of the necessary methodological manuals (guides) with versions for professionals and for amateurs;

► Organisation of courses and seminars for the preparation of dance pedagogues;

► Promotion of the results achieved after the application of the programs and exchange of good pedagogical practices.

REFERENCES

- Alter, M. (2004), *The Science of Flexibility*, Champaign, Illinois, USA: Human Kinetics.
- Ambegaonkar, J., Caswell, S. and Cortes, N. (2014), *Relationships among lower body power measures and balance in female collegiate dancers*, Paper presented at the 24th Annual Meeting of the International Association for Dance Medicine & Science, Basel, Switzerland.
- Bandy, W., Irion, J. and Briggler, M. (1998), "The effect of static stretch and dynamic range of motion training on the flexibility of the hamstring muscles", *Journal Orthopedic Sports Physical Therapy*, Vol. 27, No. 4, p. 295.
- Butulis, M. (2016), *Caring for bony injury demystified! International Association of Dance Medicine and Science*, available at: www.iadms.org (accessed 12 December 2016).
- Condon, S. and Hutton, R., (1987), "Soleus muscle electromyographic activity and ankle dorsiflexion range of motion during four stretching procedures", *Journal Physical Therapy*, Vol. 67, pp. 24-30.
- Critchfield, B., (2011), *Stretching for Dancers. Resource Paper*. International Association of Dance Medicine and Science, available at: www.iadms.org (accessed 15 December 2016)
- Dragon, D. (2014), "Creating Cultures of Teaching and Learning: Conveying Dance and Somatic Education Pedagogy", *Journal of Dance Education*, Vol. 15, No:1, pp. 25-32.
- Etnyre, B. and Lee, J. (1988), Chronic and acute flexibility of men and women using three different stretching techniques, *Res Quart Exerc Sport*. Vol. 59, pp. 222-228.
- Golomer, E., Keller, J., Féry, Y. and Testa, M. (2004), Unipodal performance and leg muscle mass in jumping skills among ballet dancers, *Percept Motor Skills*, Vol. 98, No: 2, pp. 415-418.
- Klemp, P., Stevens, J. and Isaacs, S. (1984), A hypermobility study in ballet dancers, *Journal of Rheumatology*, Vol. 11, No:5, pp. 692-696.
- Kraemer, W., Nindl, B., Ratamess, N., Gotshalk, L., Volek, J., Fleck, S., Hakkinen, K. (2004), Changes in muscle hypertrophy in women with periodized resistance training, *Journal of Medicine Science and Sport Exercise*, Vol. 36, No:4, pp. 1124-1131.
- Lorraine, M. and Urmston, E. (2016),

- Stretching: Some thoughts on current practice*. Resource Paper. International Association of Dance Medicine and Science, available at: www.iadms.org (accessed 12 December 2016).
- Mackrell, J. (2015), "Dance." In: *Encyclopedia Britannica Online*, Encyclopedia Britannica. available at: <https://www.britannica.com/art/dance> (accessed 10 November 2016).
- McKinnon, M. and Etlin-Stein, H. (2015), *Pilates: A natural choice for dancers*, Resource Paper, International Association of Dance Medicine and Science, available at: www.iadms.org (accessed 12 December 2016).
- Moore, M. and Hutton, R. (1980), Electromyographic investigation of muscle stretching techniques, *Journal of Med Science Sports Exerc.*, Vol. 12, No:5, pp. 322-329.
- Morris, M., (2016), "What is Safe and Healthy Dance Practice?", available at: <http://www.safeindance.com/tag/dance-injury/>, (accessed 10 January 2017).
- Prentice, W. (1983), A comparison of static stretching and PNF stretching for improving hip joint flexibility, *Journal Athletic Training*, Vol. 18, pp. 56-59.
- Grahame R. (1971), Joint hypermobility: clinical aspects, *Proceedings of the Royal Society of Medicine*. Vol. 64, No:6, pp:692-694.
- Sharman, M., Cresswell, A. and Riek, S. (2006), Proprioceptive Neuromuscular Facilitation Stretching Mechanisms and Clinical Implications. *Journal of Sports Medicine*, Vol. 36, No:11, pp. 929-939.
- Sullivan, M., DeJulia, J. and Worall, T. (1992), Effect of pelvic position and stretching method on hamstring muscle flexibility, *Journal Med Science Sport Exerc.*, Vol. 12, pp. 1382-1389.
- Tanigawa, M. (1972), Comparison of the hold-relax procedures and passive mobilization on increasing muscle length, *Journal Physical Therapy*, Vol. 52, No:7, pp. 725-735.
- Ünlü, Y. & Vladova, I. (2016), *Dance lesson as a pedagogical process. E - Bildiriler Kitabı. 2 Uluslararası Müzik ve Dans Kongresi*, Muğla, pp. 355-362.
- Viale, F., Nana-Ibrahim, S. and Martin, R. (2007), The effect of active recovery on acute strength deficits induced by passive stretching, *Journal Strength Cond Research*, Vol. 21; No:4, pp. 1233-1244.
- Wyon, M. Allen, N., Angioi, M., Nevill, A., and Twitchett, E. (2006), Anthropometric Factors Affecting Vertical Jump Height in Ballet Dancers, *Journal of Dance Medicine & Science*, Vol. 10, No:3&4, pp. 106-110.
- Wyon, M. (2010), Stretching for Dance, *IADMS Bulletin for Dancers and Teachers*, Vol. 2, No:1, pp.9-12.
- Желязков, Ц. & Дашева, Д., (2011), *Основи на спортната тренировка*. Трето допълнено издание ред. София: ГЕРА-АПТ. (Zheliakov, C., Dasheva, D. (2011), *Osnovi na sportnata trenirovka*, Treto dopulneno izdanie, red. Sofia: GERA-ART)
- Костов, З., (2005), *Теория и практика в учебно-тренировъчния процес по спортни танци*. Ръководство за студенти IV курс специалност „Спортни танци“ ТФ. София: НСА ППЕС. (Kostov, Z. (2005), *Teoriya i praktika v uchebno-trenirovachnyja proces po sportni tanci*. *Rakovodstvo za studenti IV kurs specialnost "Sportni tanci" TF*, Sofia: NSA PRES)
- Николов, Е., (2014), Силата като фактор на спортното постижение.

От: *Лека атлетика*, София: НСА ПРЕС. (Nikolov, E. (2014), *Silata kato faktor na sportnoto postijenie. Ot: Leka atletika*. Sofia: NSA PRES)

Хаджиев, Н., Андонов, К., Добрев, Д., Петров, В., (2011), *Гимнастика – физическа подготовка*. София: НСА ПРЕС. (Hadjiev, N., Andonov, K., Dobrev, D., Petrov, V. (2011), *Gimnastika – phisicheska podgotovka.*, Sofia, NSA-PRES)

Яралъ, С., (2016), *Изследване на физическото развитие и дееспособност на момичета, занимаващи се с фолклорни танци в Република Турция*. Дисертация. София: НСА. (Yarali, S. (2016), *Izsledvane na fizicheskoto razvitie i deesposobnost na tomicheta, zanimavashti se s folklorni tanci v Republoka Turcija*. Disertacija. Sofia: NSA)

Correspondence:

Ina Vladova
National Sports Academy “Vassil Levski”,
Sofia Bulgaria,
E-mail: vladova_ina@abv.bg

COPE WITH SUCCESS IN SPORT

Tatiana Iancheva, Milena Kuleva

National Sports Academy "Vassil Levski", Sofia

ABSTRACT

A number of scientific studies in the field of sports psychology are aimed at revealing the reasons, factors and conditions, which lead to success. The other side of the problem – how we cope with success – remains underestimated. The effect of the subjective experience of success can lead to different behavior effects - from mobilization and psychic upsurge to self-reassurance, disorganization, and loss of activity. The consequences of success make the researchers examine their connection with different coping strategies.

The aim of the present study is to examine how success is defined, how its determinants and consequences are interpreted, and what their connection with the applied coping strategies is.

The research was done among 115 athletes, practicing different kinds of sport, divided into groups depending on their gender, age, and qualification.

We used: 1) Specially developed scale for surveying the attitude to success; 2) Coping Orientation s to Problems Experienced scale – COPE –1 (Carver, et al., 1989), adapted for Bulgarian conditions and optimized for sports practice (Georgiev et al., 2003).

Athletes define success mainly as confidence and assertiveness. Mobilization and belief in one's abilities is dominant. The most important factors for success are good preparation and input efforts. There are some negative consequences with some of the athletes – remissness, insufficient efforts, enhanced emotional reactions. The leading ones are cognitively engaged coping strategies. There are significant differences depending on age, gender, and qualification. The dependences between the researched indexes were given.

The obtained results and established regularities direct the attention to possibilities of control and regulation of the negative consequences in the process of preparation with appropriate purposeful, scientifically proven influences, part of which are the coping strategies.

Keywords: *success, cope with success, sport, coping strategies.*

INTRODUCTION

Success, striving towards victory, towards achievement, towards improving sports result, towards physical perfection is an essential feature of sports activity.

“Agon” – the struggle to be the first, to get a prize, the aspiration to be the best, the competitiveness have been the essence of sport since ancient times.

Success is most often viewed as a positive result from a preliminarily set intention, and is connected with:

- The achievement of an objective, result, victory.
- Social recognition, approval, fame.

The subjective experiences of athletes during their sports-competitive activity are complex, various, and influenced by multiple factors. A number of scientific studies in the field of sports psychology are aimed at revealing the reasons, factors and conditions, whose complex influence leads to achieving or not achieving success in sport.

Another side of the problem, connected with the competitive realization of athletes, remains in the background – the specific influence of success on efficiency of sports behavior, on the level of activities, experiences, and consequences for the athletes during their further sports-competitive activity. At the same time, our observations of the sports career of numerous elite competitors show that the way athletes perceive, interpret and cope with success or failure in competition determines to a great extent their future successful or not successful realization, as well as their overall sports and professional career.

The psychological analysis of the phenomenon “success in sport” reveals its complicated and multi-direction con-

ditionality. A lot of questions, related to the problem, appear in this aspect and in the context of the connection between the preceding and future behavior of an athlete. A few aspects of interpretation are to be expected:

- Success as an outcome – result or “product” of a competition.
- Success as subjective experience.
- Success as a cognitive evaluation of the result of one’s own activities and efforts.
- Experiencing success.
- Success as a motivator or disincentive of future behavior.
- Coping with success. Influence on the overall career.

The effect of the subjective experience of success can lead to different behavior effects - from mobilization and psychic upsurge to self-reassurance, disorganization, and loss of activity.

The experience could be of great emotional intensity and could have both positive and negative personal effect.

Sports life is intense, competitive, and elite.

The trend toward lowering age boundary in most sports leads to an early appearance and early publicity, and that is why the idea of self-dressing in power comes too soon.

Facing and solving the problems related to fame and publicity is an ordeal for the athlete. It requires the development of certain personal qualities and mechanisms, high level of development of self-control and self-regulation of one’s behavior and actions. Success inspires, motivates, and brings satisfaction to athletes. But at the same time, it could become their most serious challenge. The problems, related to “fame vanity” concern, to the greatest

extent, the field of sport and art, i.e., the areas with the biggest publicity and the widest social assessment. Sports fame could be dangerous because it might lead to certain distortions of the Self, which may create a number of problems both during sports-competitive career and after its completion.

As T. Strudwick (2016) points out, referring to young football players, they will very quickly receive attention and recognition on behalf of their peers, media, agents, scouts, and bigger clubs. "The decisive question is whether those young players can continue to work hard and focus on the right things" (T. Strudwick, 2016, p.381).

In a research done among coaches Millsetal (2012) reports that they often meet players whose lack of emotional maturity prevents them from developing as efficiently as their potential allows (Millsetal, 2012).

Some authors (Tracy and Robins, 2007a, 2007b) mention some potentially destructive or debilitating psychological processes caused by success, such as arrogance, narcissism, and hubris. The authors make a distinction between the authentic pride and hubristic pride. The authentic pride seems to be an adaptive emotion that is correlated with higher self-control, and concentration of one's efforts towards achieving a goal, while hubristic pride often refers to impulsiveness and aggression, weaker ability to adapt, and becoming self-centered (Carver and Johnson, 2011).

Other authors highlight the ability of world-class athletes to respond to success with an increased drive for more success, realistic expectations and willingness to move out of their comfort zone and seek

fresh ideas from coaches and specialists (MacNamara, Button and Collins, 2010 a, 2010 b).

There is a specific connection and interrelation between the subjective experience of success and the characteristics of athletes' competitive behavior. It is based on the peculiarities of the personality, the mechanisms for personal regulation and self-regulation, the applied coping strategies, etc.

In most cases, the researchers deal with the problems referring to coping with failure and success seeking. The other side of the problem – how we cope with success – remains underestimated. Every athlete, coach, team that achieves success should adapt to it and cope with their personality and with the situation. As D. Haglind (2003) points out, the abilities of athletes to cope with their way of thinking and their behavior are especially important for the outcome of a certain competition, season, and overall sports-competitive career.

Sports-psychological literature has persistently set the problem for coping with success – definition of success, how it is perceived and what the consequences of success are, how the coach helps his athletes cope with success, how the competitors react to success (Haglind, 2003; Conroy, Poszwardowski, and Henschen, 2001). Regardless its big practical significance, the problem of coping with success in sport still does not receive enough attention on behalf of the specialists.

Discussing the problem of coping with success in sport, authors face a seemingly paradoxical problem for sport – fear of success, phobia of success. While fear of loss and fear of failure are regarded

as one of the most common problems in sport and have been repeatedly surveyed and analyzed, fear of success can be accepted as natural to sport with difficulty. Research by Conroy, Poszwardowski and Henschen (2001) among 16 elite athletes and actors reveals that the consequences of success with some athletes are connected not only with achieving the desired result, improved image of oneself, and better relation with the others, but also with fear of success – the pressure of the greater expectations, the desire to be liked, the surprising “price” for achieving success.

The term “fear of success” was introduced in sport by Ogilvi (1968), Ogilvi and Tutko (1966). The authors define fear of success as a problem related to the result and outline some peculiarities of this phenomenon:

- Fear of social and emotional isolation;
- Difficult acceptance on behalf of former friends and alienation from the social group;
- Doubts about the value of their success;
- „Guilt“ about the things achieved;
- Fear about whether they will succeed again, whether they will reveal their true potential, whether they will repeat their previous achievement, etc.

It is the consequences of success that make researchers study their connection with different coping strategies.

Coping is defined by many scientists in the field of sports science as a complex, dynamic, and multidimensional process (Anshel, Jamieson & Raviv, 2001; Crocker & Graham, 1995; Crocker & Isaak, 1997; Eklund, Gould & Jackson, 1993; Gould, Udry, Bridges &

Beck, 1997). Coping aims at regulating emotions and changing behavior, so that we can deal with a particular situation. Coping with a certain situation requires change in behavior and/or in cognitions, so that we could manage the situation better. Lazarus and Folkman (1984) define it as “process of constantly changing cognitive and behavioral effort to manage specific external and/or internal demands or conflicts appraised as taxing or exceeding one’s resources” (Lazarus & Folkman, 1984, p.141). Coping is a response to the perception of threats which appear in sports environment. Most authors agree that coping consists of conscious psychological and psychical efforts to improve one’s resourcefulness in dealing with stressful events or to reduce external demands (Anshel et al., 2001). But, of course, the implementation of certain coping strategies supposes awareness of the problem or knowing that the situation could raise problems.

Significantly important for the character of the experience of success or failure is the explanation which a person has about the reasons which have caused it. Whether one will attribute one’s success or will account one’s failure to internal or external reasons depends on the way one perceives oneself and determines the behavior in similar situation in the future. In a certain situation one may attribute one’s actions to ability, effort, difficulty of the task, or luck (Weiner, 1986; Weiner, Frieze, Kukla, Reed, Rest, Rosenbaum, 1971). Thus, the mechanism of causative attributions plays role in the subjective interpretation of a particular result as success or failure and the reasons for it. It is of great importance for the sports activities and should be given special emphasis

in the preparation of athletes.

The cognitive interpretation of success and its secondary evaluation determines to a great extent how the athlete would feel and react under similar circumstances in the future.

John Nicholls was the first to argue that success and failure are not concrete events but instead depend on an athlete's perception of whether he or she has reached his or her personal goals.

In this sense, there are a number of questions whose practical solution influences greatly the efficiency of competitive behavior and realization of an athlete: how success is defined and experienced, how the reasons for it are interpreted, what the consequences of success and the effects on further activities and competitive behavior are, how we cope with success.

PURPOSE AND OBJECTIVES OF THE STUDY

The aim of the present study is to examine how success is defined, how its determinants and consequences are interpreted, and what their connection with the applied coping strategies is.

MATERIALS AND METHODS

Participants

The research was done among 115 athletes, practicing different kinds of sport, aged between 12 and 34 years. They were divided into four groups: 12-18 years old; 19-24 years old; 25-30 years old; over 30 years old. The average age of the subjects is 21.1 years old. There are 66 men and 49 women. The researched individuals were divided into two groups depending on their qualification: 1) medalists from international and

national competitions – 46, 2) engaged in sports without significant sports results – 69.

At the beginning of the research all participants were informed about the aim of the survey and their consent was obtained.

Methods

In order to fulfill the aim of the research we used:

1. Specially developed scale for surveying the attitude to success, which comprises three parts – definition and experience of success, interpretation of the reasons for success, behavior after success. Each of them includes two scales, as follows:

- Confidence, assertiveness.
- Prestige.
- Mobilization and belief in one's abilities.
- Emotional reactions, remissness.
- Preparation, efforts.
- Expectations.

The scale includes 33 items. The evaluation is given along a five point Likert Scale.

2. Coping Orientations to Problems Experienced scale – COPE –1 (Carver, et al., 1989). The test is adapted for Bulgarian conditions and it is optimized for sports practice (Georgiev et al., 2003). It includes 52 items, organized in 14 subscales. These fourteen strategies have been joined together through factor analysis into three generalized secondary factors: cognitive engagement, emotional engagement, cognitive and emotional disengagement.

Statistical Analysis

The software package used to analyze the final data from the research was SPSS

21. The analyses made are the following: alternative analysis (to establish the relative shares of different responses in the questionnaires, as well as to assess the personal information – gender, age, sports experience, sports achievements), correlation analysis (the summation method χ^2 with high level of statistical reliability $\alpha \leq 0,01; P_t \geq 99\%$), reliability analysis, regression analysis (to check the statistical significance of the model and the parameters of the functions), and comparative analysis (U-criteria of Mann Whitney and Criteria of Kruskal Wallis).

RESULTS AND DISCUSSION

The obtained results from the research of the attitude toward success are present-

ed in table 1.

The data reveal that athletes define and experience success mainly as confidence and assertiveness ($M = 4.26$; $SD = .43$). The obtained results (Table 1) show that the predominant part of the subjects accept success as an incentive to prove themselves in future competitions, as confidence in their own qualities and abilities, assertiveness, a logical result from their own efforts and gaining necessary experience. We should point out that success is the least perceived as accidental.

Part of competitors define success as a source of prestige ($M = 3.49$; $SD = .77$). They believe they will prove themselves before others, will gain their trust and that

Table 1. *Results from the variation analysis of the data*

Parameters	N	Min	Max	Mean	Std. Deviation	Variance
Confidence, assertiveness	115	2.33	5.00	4.26	.59	.301
Prestige	115	1.40	5.00	3.49	.77	.593
Mobilization and belief in one's abilities	115	2.60	5.00	4.16	.49	.239
Emotional reactions, remissness	115	1.00	4.25	2.08	.71	.505
Preparation, efforts	115	2.00	5.00	4.51	.58	.340
Expectations	115	1.00	5.00	3.18	.99	.979
Cognitive engagement	115	1.08	3.90	2.88	.43	.188
Emotional engagement	115	1.00	3.83	2.48	.52	.272
Cognitive and emotional non engagement	115	1.08	2.63	1.76	.31	.094

will lead to a psychic upsurge (Table 1).

Special emphasis of our research is made on the consequences of success. The analysis of the results, connected with behavior after success, reveals that mobilization and belief in their abilities dominate with most of the athletes ($M = 4.16$; $SD = .49$). Success leads to mobilization, to greater desire to train and to an increase in the belief in one's abilities, to expectation of series of wins. However,

with part of the athletes, success leads to enhanced emotional reactions ($M = 2.08$; $SD = .71$) – overestimation of oneself or remissness and insufficient efforts.

The research into reasons for success is also interesting for sports practice and individual counseling, in so far as the secondary assessment (explanation of success) determines to a great extent how the competitor will act under similar circumstances in the future. The results show

that the leading one is the scale “Preparation, efforts” ($M = 4.51$; $SD = .58$). The athletes regard good preparation, input of enough efforts and mobilization as the major determinants of success (Table 1). The scale “Expectations” shows lower values ($M = 3.18$; $SD = .99$). These results are of great practical significance. The results indicating the least significant factors for success also have big practical application. They are: too strong desire for success, too high expectations on behalf of

the others, and no expectations from the athlete. They reflect the attitude to view success as a temporary phenomenon, as something related to luck, which also leads to decrease in activity.

The comparative analysis of the results along the factor gender does not reveal significant differences among the scales.

There are significant differences along the factor qualification between the scales Mobilization and belief in one's abilities (Table 2) and Preparation,

Table 2. Results from the comparative analysis along the factor qualification

	Confidence, assertiveness	Prestige	Mobilization and belief in one's abilities	Emotional reaction and remissness	Preparation, efforts	Expectations	Cognitive engagement	Emotional engagement	Cognitive and emotional non engagement
Mann-Whitney U	1317.500	1356.500	1234.000	1542.000	1192.500	1441.500	1479.500	1393.000	1514.000
Wilcoxon W	3732.500	3771.500	3649.000	2623.000	3607.500	2522.500	3894.500	3808.000	2595.000
Z	-1.547	-1.322	-2.033	-.259	-2.373	-.842	-.614	-1.109	-.417
Asymp. Sig. (2-tailed)	.122	.186	.042	.796	.018	.400	.539	.267	.676

efforts. Elite athletes, to a greater extent, perceive success as an incentive to prove themselves, as confidence in their own qualities and abilities, as assertiveness and gaining necessary experience. They view success more as a consequence of good preparation, input efforts and mo-

bilization.

The data reveals specific age dynamics (Fig. 1).

The analysis of the results, connected with coping strategies (Table 1), reveals that the leading one is the strategy cognitive engagement, which comprises active

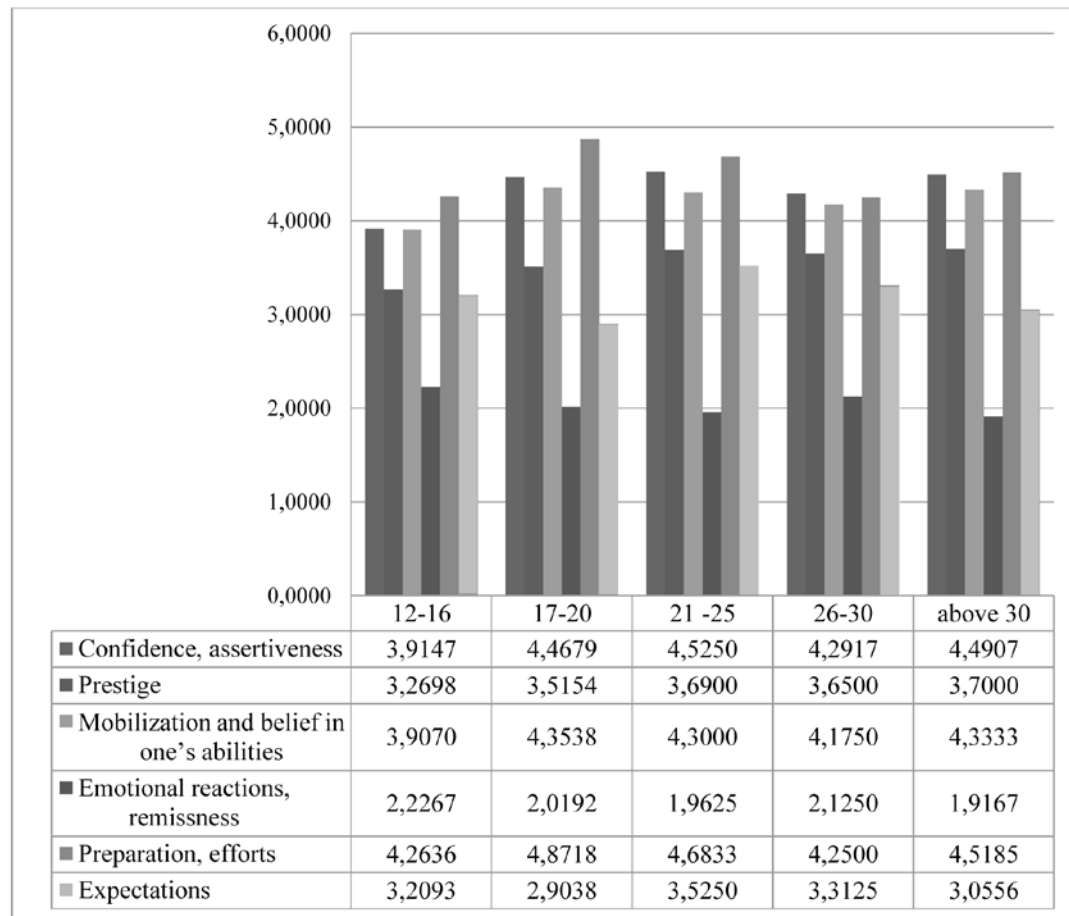


Figure 1. Mean values for the different age groups

There are significant differences depending on age among the scales Confidence, assertiveness; Mobilization and belief in one's abilities; Preparation, efforts (Table 3).

Table 3. Results from the comparative analysis along the factor gender

	Confidence, assertiveness	Prestige	Mobilization and belief in one's abilities	Emotional reaction and remissness	Preparation, efforts	Expectations	Cognitive engagement	Emotional engagement	Cognitive and emotional non engagement
Chi-Square	28.305	8.071	18.413	2.965	24.082	4.875	17.692	5.382	.881
df	4	4	4	4	4	4	4	4	4
Asymp. Sig.	.000	.089	.001	.564	.000	.300	.001	.250	.927

coping, planning, suppressing competitive activities, positive rethinking, developing and restraining ($M = 2.88$; $SD = .43$). It is followed by the strategy emotional engagement ($M = 2.48$; $SD = .52$) – seeking advice and help, need of emotional response, compassion and mutual experience (Table 1).

The least preferred is the strategy cognitive and emotional non engagement ($M = 1.76$; $SD = .31$), which comprises denial and non-acceptance, behavioral and psychic non engagement, alcohol and drug abuse, reconciliation with what has happened, turning to religion.

The results from the comparative analysis reveal significant gender differences regarding emotionally engaged strategies. Women tend to resort to this type of coping strategies more often than men.

There are expected differences between the cognitively engaged strategies with the age groups (Table 3).

There are no significant differences regarding the coping strategies used depending on qualification.

The correlation analysis of the data reveals some significant relations between the applied coping strategies and the different scales of success. There is a significant correlation between cognitively engaged strategies and the scales Preparation, efforts ($r = 0.452$; $p = .000$), Confidence, assertiveness ($r = 0.480$; $p = .000$), Mobilization and belief in one's abilities ($r = 0.537$; $p = .000$),

and Prestige ($r = 0.452$; $p = .002$). This dependence is logical, in so far as cognitively engaged strategies are connected with active coping, planning, development leading to mobilization, a sense of control over the situation, and a rise in confidence. There is a significant dependence between emotionally engaged strategies and the scale Prestige ($r = 0.257$; $p = .005$); and a moderate one with Emotional reactions and remissness ($r = 0.194$; $p = 0.038$). There is a significant correlation between the emotional reactions after success and the strategy Cognitive and emotional non engagement ($r = 0.345$; $p = .000$), and a moderate negative dependence with Preparation, efforts ($r = -0.202$; $p = .030$).

The question regarding the extent to which the components of success influence the coping strategies is also interesting. In order to measure the impact of these factors we used step by step regression analysis. The results reveal that Mobilization and belief in one's abilities ($\beta = .560^{***}$) and Confidence, assertiveness ($\beta = .238^{**}$) stimulate the use of cognitively engaged strategies. At the same time, Confidence, assertiveness ($\beta = -.307^{**}$) influences emotionally engaged strategies (Table 4).

CONCLUSIONS

The obtained results allow a serious analysis and set a number of questions, related to the specificity of psychical load in

Table 4. Results from the regression analysis

Dependent variables	Cognitive engagement coping strategies		Emotional engagement coping strategies	
	B (t)	ΔR^2	B (t)	ΔR^2
Mobilization and belief in one's abilities	.560 (7.18) ^{***}	0.313		
Confidence, assertiveness	.238 (2.41) ^{**}	0.347	-.207 (-2.25) ^{**}	0.43

sport, the peculiarities of the pedagogical influences, as well as the very nature of the activities.

As a whole, the results from the research into the determinants of success and its influence on the efficiency of competitive behavior outline some important common regularities of great practical value.

The fact that most of the athletes perceive success as an incentive to prove themselves in future competitions, as a logical result from their efforts is something optimistic and leads to an increase in their own confidence. They develop a maximum attributive style, where success is a premise for mobilization of their efforts and an aspiration for improvement of their future performance.

Our results support the findings of other authors – personal expectations and confidence in one's own abilities for organizing and applying actions needed for achievement of a preliminarily set level of performance influence its efficiency.

On the other hand, the negative consequences of success with some of the athletes – remissness, insufficient efforts could lead not only to negative influence on the efficiency of sports-competitive ac-

tivity, but also, very often, to resignation from active sports activities. This, in turn, has an impact on the overall personal development and future way of life.

The excessive desire for success and too high expectations on behalf of the others, often prevalent in elite sport, are the least significant for success and reduce the efficiency of sports activities. This fact is also important for practice.

Big social expectations create additional premises for high psychic pressure in sport. Combined with high intrinsic motivation, they make the athlete face serious psychic ordeals. At the same time, they could be controlled and regulated, to a great extent, in the process of preparation, with appropriate purposeful, scientifically proven influences, part of which are the coping strategies.

There are a number of questions which remain unanswered:

► To what extent does cope with success influence sports career and consequently professional and life career?

► Which personal qualities are related to cope with success?

► How can coaches help their players to cope with success?

REFERENCES

- Anshel, M.H., Kim, K-W., Kim, B-H., Chang, K-J., Eom, H-J. (2001), A model for coping With stressful events in sport: Theory, application, and future directions, *International Journal of Sport Psychology*, 32(1), 43-75.
- Carver, C., J. Weintraub, M. Scheier (1989), Assessing coping strategies: a theoretically based approach, *Journal of Personality and Social Psychology*, 56.
- Carver, C., and Johnson, S., (2011), Authentic and hubristic pride: Differential relations to aspects of goal regulation, affect, and self-control. *Journal of Research in Personality* 44: 698-703.
- Conroy, D., Poszwadowski, A., Henschen, K. (2001), Evaluating criteria and consequences associated with failure and success for with athletes and performing artists.
- Crocker, P.R.E., Graham, T.R.

- (1995), Coping by competitive athletes with performance stress: Gender Differences and relationships with affect, *The Sport Psychologist*, 9, 325-338.
- Crocker, P.R.E., Isaak, K. (1997), Coping during competitions and training sessions: Are Youth swimmer consistent?, *International Journal of Sport Psychology*, 28, 355-369.
- Eklund, R., Gould, D., Jackson, S. (1993), Psychological foundations of Olympic wrestling excellence: Reconciling individual differences and nomothetic characterization, *Journal of Applied Sport Psychology*, 5, 36-47.
- Duda, J., & Nicholls, J. (1993), The relationship of goal orientation to beliefs about success, perceived ability and satisfaction in sport, In: J. R. Nitsch & R. Seiler (Eds.). *Motivation, emotion, stress*. (pp. 43-47), *Proceedings of the VIII European congress of sport psychology Academia*, Verland, Sankt Augustin.
- Georgiev, M., Domuschieva-Rogleva, G., Tosheva, I., (2003), Vtorichni faktori i optimizirane na testa za izsledvane na predpochitanite strategii za spravyane sys stresa - COPE - 1. - V: *Lichnost, Motivaciya, Sport*, Knigi 1- 3. Prosport.S. (in Bulgarian).
- Gould, D., Udry, E., Bridges, D., Beck, L. (1997), Coping with season-ending injuries, *The Sport Psychologist*, 11, 379-399.
- Haglund, D. (2004), Coping with success and failure – Among Swedish and Portuguese track and field athletes and coaches, (European Master Dissertation in sport psychology), School of Social and Health Sciences, Halmstad University.
- Iancheva, T., (2005), *Zagubata i pobedata v sustezatelната realizaciya na sportista, Prilozna Psihologia i socialna praktika*, S. 73-81. (In Bulgarian)
- Lazarus, R.S., & Folkman, S. (1984), *Stress, appraisal and coping*, Springer.
- MacNamara, A., Button, A., and Collins, D. (2010a), The role of psychological characteristics in facilitating the pathway to elite performance, Part 1: Identifying mental skills and behaviors, *Sport Psychologist* 24:52-73.
- MacNamara, A., Button, A., and Collins, D. (2010b), The role of psychological characteristics in facilitating the pathway to elite performance, Part 2: Examining environmental and stage-related differences in skills and behaviors, *Sport Psychologist* 24:74-96.
- Mills, A., Butt, J., Maynard, I., and Harwood, C. (2012), Identifying factors perceived to influence the development of elite youth football academy players, *Journal of Sports Sciences* 30 (15): 1593-1604.
- Ogilvi, B. (1968), The unconscious fear of success, *Quest*, 10, 35-39.
- Ogilvi, B., Tutko, T. (1966), *Problem athletes and how to handle them*, Pelham, London
- Strudwick, T. (2016). *Soccer Science*, Human Kinetics.
- Tracy, J., and Robins, R. (2007a), The psychological structure of pride: a tale of two facets, *Journal of Personality and Social Psychology* 92:506-525.
- Tracy, J., and Robins, R. (2007b), Emerging insights into the nature and function of pride, *Current Directions in Psychological Science* 16:147-150.
- Weiner, B. (1986), *An attributional theory of motivation and emotion*, Springer-Verlag, New York

Weiner, B., Frieze, I., Kukla, A., Reed, L., Rest, B., Rosenbaum, R. (1971), Perceiving the causes of success and failure. In Attribution: Perceiving the causes of behavior, E. Jones, D. Kanouse, H. Kelley, R. Nisbelt, S. Valins, B. Weiner, eds. Morristown, NJ: General Learning Press.

Correspondence:

Tatiana Iancheva
National Sports Academy "Vassil Levski",
Sofia, Bulgaria
E-mail: tiancheva@prosport-bg.net

PHYSICAL THERAPY AND SWIMMING INFLUENCE ON FEMALE TYPE OF ADIPOSE DEPOSITION AND CELLULITE

**Ivan Maznev, Nikolay Izov, Milena Nikolova,
Antoaneta Dimitrova, Kristin Grigorova-Petrova**

National Sports Academy "Vassil Levski"

ABSTRACT

Cellulite is a very common problem with women of all ages, and many of them try to solve it using various methods.

To evaluate the effect of swimming and physiotherapy on subcutaneous fat in overweight women with female type of adipose deposition. The research was done among 38 women aged between 22 and 48 years, with gynoid accumulation of fat and cellulite II, III-A and III-B classes. For one month, a complex of fifteen procedures was applied every other day. The procedures included a combination of the following methods: free style intermittent swimming for 20 min in a pool, a vacuum massage - 30 min, a lymphatic press massage - 20 min, a manual massage with anti-cellulite creams - 20 min. The combination of exercises for the muscles of the abdominal wall, hip muscles and thighs had to be performed at home daily. Five circumferences and ten skin folds were measured before and after the treatment. We found out that a total of ten skin folds was an integral indicator of the nutritional obesity degree and level of subcutaneous fat.

At the end of the study, subcutaneous fat was reduced from 222.4 mm to 209.9 mm (10.34%). The reduction of the skin folds, typical for gynoid type deposition of fat and cellulites, was the most pronounced in the following zones: a fold over anterior superior iliac spine, a fold over the patella, a fold in the popliteal fossa and a fold on the medial side of the cruris.

The results of the complex therapeutic approach revealed a reduction in the examined indicators within the first month. It is suitable to apply swimming and physiotherapy in the comprehensive treatment of cellulite with women who have female type of adipose deposition.

Keywords: cellulite, female type of fat deposition, swimming, massage techniques

INTRODUCTION

According to medical classification, obesity is divided into two main types – androgenic and gynoid. The androgenic obesity is most common with men, and it is characterized by accumulation of fat in the upper part of the body – abdomen, breasts, dewlap and hands. The gynoid type of obesity is typical with women. It is accompanied by adipocytes and fat cells which primarily compose adipose tissue, increasing in size in the hypodermis of the thighs, hips, and abdomen, where triglycerides are stored in large quantities. This leads to increasing fat stores and body circumferences in the relevant areas. Subcutaneous fat in those areas can be removed with much more difficulty when one tries to lose weight. This explains the weak effect of hypocaloric diets. Some studies show that women devote more attention to those parts of their bodies, and they often want them to be corrected with aesthetic purpose, without having an established disease and any pathological abnormality (Greenway et al., 1995).

For that reason, many authors pay particular attention to local treatment and equipment-assisted influence in these zones. In the beginning, gynoid fat distribution, and cellulite were perceived only as cosmetic defects. However, they develop progressively and influence fat metabolism, connective tissue structure, micro-circulation, antioxidant activity, and other important functions in the affected body areas. That is why, during the first month of treatment, our methodology consists of procedures that induce maximum drainage of the affected areas (Topuzov, 2000; Goranova, 2001; Goranova et al., 2001; Gavriel et al., 2010).

METHODS AND METHODOLOGY

This study was conducted at Skin Systems Medical Center in Sofia. The research was conducted among 38 women aged between 22 and 48 years, with gynoid accumulation of fat and cellulite II, III-A and III-B classes. Fifteen procedures were applied every other day within a month. The procedures included a combination of the following methods: swimming for half an hour, a vacuum massage - 30 min., a lymphatic press massage - 20 min., a manual massage with anti-cellulite creams - 20 min.

One advantage swimming has over other forms of exercise is the water pressure. Water is denser than air, and it squeezes the body gently during exercising and swimming. The use of the muscles of thighs, calves and buttocks is extensive in swimming, particularly in breaststroke and improves the circulation in cellulite-prone areas. Increasing blood circulation improves skin tone and health, and toned muscles smooth the areas where cellulite still exists. Swimming helps to burn calories, but diet also plays a role in losing weight and removing cellulite. Gradual and steady weight loss gives lasting results. Interval swimming provides good mechanical stimulation and enhanced calorie burning, so it is also a great anti-cellulite exercise (Nikolova et al., 2012; Nikolova et Lyubenova, 2016)

Vacuum massage is the first of the procedures applied. During this procedure, an SPM-apparatus (suction pump massage) made by the German company Weyergans is used; it supports up to 50 mbar of negative pressure. The vacuum massage is made with different sizes of cups, depending on the size of the treated area and a cel-

lulite type. All problematic zones including lower limbs, bottom, abdomen, waist, arms, and dewlap are treated. Hydro gel is used to slide the suction cup from the periphery to the center. The main goal of this massage is to create a negative pressure by improving the blood circulation and lymphatic circulation in the affected areas. The lymph fluid flows slowly through the lymph system, but by means of a vacuum massage, it starts to move directly to the regional lymph nodes, releasing tissue tension. The vacuum massage reduces stagnant phenomena, improves microcirculation, and evacuates the metabolic products of the metabolism in the lymph. The negative pressure also leads to withdrawal of blood from the upper dermal layers. In turn, the improved blood supply opens the additional capillary network, increases oxygen, and leads to better tissue nutrition and reduced tissue hypoxia. This procedure is painful, therefore in the beginning the pressure is lower (15-20 mbar.), the movement of the suction cup is faster, and the vacuum is not retained for a long time within one zone. The total duration of the SPM is 30 min. distributed over various cellulite areas, depending on the degree to which they are affected.

Lymphatic press massage is applied immediately after the vacuum massage. Covers with built-in heating filaments are wrapped around problem areas of the body: upper and lower extremities, abdomen, bottom, etc. In order not to burden the heart, the inflatable cuff is wrapped around the abdomen and under the breasts. In addition to heating, the cuffs also inflate and deflate (resembling a blood pressure device). The effect on problem areas includes excessive sweating and activation of metabolic processes in combination with lymphatic

drainage. As a result, hypodermic areas with an increased pressure due to poor drainage, are relieved. Moreover, through the lymphatic press massage, the cold and tense cellulite formations are heated and softened, enabling unnecessary fluids and metabolites to move back into the bloodstream. The lymphatic press massage lasts from 20 to 30 minutes. The time gradually increases. After the procedure, patients take a shower and then are made a manual cellulite massage (Nikolova et al., 2012; Nikolova et Lyubenova, 2016; Lyubenova, 2006).

Manual cellulite massage is used in combination with anti-cellulite cream which enhances the drainage and strengthens blood vessels. Rubbing and squeezing massage techniques make up for 70%-80% of the procedure. During the manual cellulite massage, both subcutaneous tissue and deep underlying tissues of the skin are displaced and stretched and lymph drainage is gained. In order to achieve this, we apply almost all massage squeezing techniques and some stroking methods applied with more pressure and force, as in squeezing. These massage techniques affect the tissues in depth, causing local drainage of the lymph and the blood vessels, followed by their rapid filling. This leads to fast redistribution of blood and lymph fluid in the treated areas, to elimination of stagnant phenomena, and to evacuation of metabolic products. The massage techniques always follow the direction of lymphatic and venous blood flow. The following rubbing techniques are used: spiral, 'zig-zag', 'impulsion', 'brush', 'filing', 'planing' and 'rake' rubbing. Through these techniques, the skin is stretched, unstuck, and comes off the underlying tissues. The rubbing massage technique supports the

normal skin mobility, softens pathological depositions in the tissues, and significantly increases blood circulation and lymphatic circulation. Unlike the rubbing technique in the ordinary classic massage, the rubbing technique in this massage follows the direction of the venous and lymphatic flow.

The following kneading massage techniques for lower limbs are most often used: 'double-ring', 'double fingerboard' and 'rolling'. For the abdominal and bottom areas, additional techniques such as 'stratification' and 'mixing' are used. The striking techniques that are applied include: 'patting', 'chopping', 'smacking', 'spanking', and 'slapping'. The duration of the manual anti-cellulite massage is 20-30 min. After its completion, the massaged areas are wrapped tightly with a thick stretch wrap for 30-40 minutes. This is done to keep the heat caused by the massage, and induce sweating in the treated areas. This, in turn, promotes better absorption of anti-cellulite balm nutrients (Goranova, 2001; Goranova et al., 2001; Gavriel et al., 2010; Nikolova et Lyubenova, 2016; Lyubenova, 2006).

The physical activity recommended to our patients includes a combination of exercises for the muscles of the abdominal wall, hip muscles, and thighs. The exercises must be performed at home daily or every other day (Nikolova, Lyubenova, 2016; Lyubenova, 2006; Stefanova et al., 2007).

Cellulite is a very common problem with women of all ages and many of them try to solve it with long-term SPA procedures (Tasheva, 2007).

RESULTS

We found out that a total of ten skin folds was an integral indicator of the nutritional obesity degree and level of subcutaneous fat. In the process of the study, subcutaneous fat was reduced from 222.4 mm to 209.9 mm, i.e. with 12.5 mm or 10.34%.

The reduction of the skin folds, typical for gynoid type deposition of fat and cellulites, was the most pronounced in the following predilection zones: a fold over anterior superior iliac spine, a fold over the patella (kneecap), a fold in the popliteal fossa (kneepit) and a fold on the medial side of the cruris.

Table 1. *Changes in the mean values of skin folds and circumferences before and after treatment*

Indicators	Initial measurement X1	Final measurement X2	X1 - X2	X1 - X2 (%)
The sum of 10 skin folds (mm)	222.4	209.9	12.5	10.34%
Waist circumference of 4 cm above the umbilicus (cm)	79.32	77.17	2.15	2.7%
Waist circumference through umbilicus (cm)	86.85	84.59	2.26	2.6%
Waist circumference of 4 cm below the umbilicus (cm)	95.37	91.63	3.74	3.93%
Circumference through the hips (cm)	102.98	99.22	3.76	3.65%
Circumference of the upper 1/3 of thigh (cm)	63.27	60.31	2.96	4.65%

The three circumferences of the abdomen area decreased by an average of 2.72 cm. or 3.08%. The reduction in the circumference through the hips was 3.76 cm. or 3.65%. The reduction in an upper 1/3 of the thighs was with 2.96 cm. or 4.65%.

CONCLUSIONS

The results of this complex approach demonstrate a decrease in body circumferences and reduction in the skin folds within the first month of combined therapy with interval swimming, exercise therapy and massage.

REFERENCES

Gavriel, P., Kraïdzhikova, L., Stoïkov, S. (2010), Dvigatelna programa za reduktsiya na telesnata masa pri nadnormeno teglo i zatlŭstyavane, *Sport i nauka*, Vol. 6, pp. 28-33.

Goranova, Z. (2001), Nov metod za lokalno vŭzdeïstvie pri obezitas i tselulit, *Sport i nauka*, Vol. 5, pp. 17-21.

Goranova, Z., L. Angelova, K., Krahtova K. (2001), Aparaten masazh za lokalno vŭzdeïstvie pri tselulit i obezitas, *Kineziterapiya i rekhabilitatsiya*, Vol. 2, pp. 11-15.

Greenway, Fr., Bray, G., Heber, D. (1995), Topical fat reduction. *Obesity*

Res., Vol 3, Suppl 4.

Lyubenova, D. (2006), Kineziterapiya pri obmenni zabolyavaniya. V: Popov N. (red) *Kineziterapiya v sportnata praktika. Obshta metodika*. NSA-pres, Sofiya, pp. 160-166.

Nikolova, M., Geshev, P., Izov, N. (2012), Evropeïska obrazovatelna politika za profesionalna podgotovka po spetsialnostta „Adaptirana fizicheska aktivnost i prinosŭt na NSA „V.Levski”, *Sport i nauka*, Vol. 6

Nikolova, M., Lyubenova, D. (2016), Vliyanie na fizicheskite uprazhneniya vŭrkhu samochuvstviето na zheni s tselulit, *Sport i nauka (izvŭnreden broj 1)*, Vol. 1, pp. 177-182.

Stefanova, D., Lyubenova, D., Dimitrova, A., Grigorova, K. (2007), Vliyanie na kineziterapevtichna protsedura vŭrkhu posturalniya kontrol i podvizhnostta pri zheni v naprednala vŭzrast, *Sport i nauka (prilozhenie)*, Vol. 1, pp. 229-238.

Tasheva, R. (2007), SPA&wellness-sŭshtnost i prilozhenie. *Medicsina i sport*, Vol.1, pp.16-20.

Topuzov, Iv. (2000), Tselulitŭt – etiopatogeneza i lechenie, *Sport i nauka*, Vol. 3, pp.13-16.

Correspondence:

Milena Nikolova

National Sports Academy

“Vassil Levski”, Sofia, Bulgaria

E-mail: milenanikolova78@gmail.com

OPTIMIZATION OF TEACHING METHODS IN SPORTS CLASSES WITH STUDENTS WITH VISUAL IMPAIRMENTS

Mariana Albert¹, Evald Albert²

¹Medical University- Sofia, Medical College “J. Filaretova”

²National Sports Academy “Vassil Levski”

ABSTRACT

The motivation for conducting the present research is the creation of kinesitherapeutic algorithms adapted to visually impaired student so that they can achieve greater autonomy and activity in motor skills during sports classes.

The aim of the study is to develop a kinesitherapeutic program to improve the physical fitness of students with visual impairments during their sports classes.

Tasks: To explore the peculiarities of the students' adaptation to regular physical workload; To analyze the students' social behavior and attitude within and outside the group; To optimize the methods of teaching sport.

The research was done among 105 people (male and female) with major Vision-impaired Masseurs. The Kinesitherapeutic Program included five successive stages: 1. Improving coordination 2. Training proper breathing. 3. Investigating and practicing Chi gon exercise. 4. Learning and applying yoga exercises. 5. Filling in a questionnaire.

The survey shows that 82.86% of students believe the kinesitherapeutic program improves their autonomy and locomotion activity, increases their motor skills and physical fitness.

The kinesitherapeutic program is applicable to pupils as well as students with visual disturbances with different majors.

For the first time, sports classes combine Chi gong and yoga exercises with static-strength workouts and balance exercises to increase physical activity as well as to prevent and treat clinical conditions associated with visual disturbances.

Keywords: *students with visual disturbances, sports classes*

INTRODUCTION

Blindness ranks among the gravest sensory lesions as a condition, accompanied by functional losses of physical, mental and social aspect. Absence of vision or its extreme reduction causes very serious limitations in all possible spheres of human activities (Houwen et al., 2009). Numerous studies have shown that depending on the character of the process of vision loss, the age of acquiring the defect and the extent of vision limitations there is an additional psychic trauma, leading to serious psychic lack of adaptation and aggravated mental health (Gal, Dyk, 2009), (Radulov, Tsvetkova-Arsova, 2011). The difficulties and inconveniences that a visually impaired child encounters while playing games, attaining various motor habits or studying bring about complicated experiences and negative reactions. They are expressed by uncertainty, inertness, self-isolation with tendencies to autistic disturbances, inadequate behavior and sometimes aggressiveness (Deniskina, 2012). Visual problems influence attention due to disturbances in the mental pictures, and due to children's insufficient knowledge (Gurkova, 2006). Attention is lowered as a result of emotional-volitional problems. Absent-mindedness and chaotic state are observed. Tiredness occurs faster as a result of the long lasting irritation caused by the acoustic analyzer (Wiskochil et al., 2007).

One of the characteristic features of the sightless' physical development is the insufficient growth of the muscular system. It is considerably weaker compared to that of the sighted because of the lower motor activity (Lyudmilova, Dimitrova, 2010).

One of the most important factors for the blind's development and realization is overcoming isolation from their very close social circles (Vidolov, 2002). Most people with damaged vision are constantly looked after by their families. They are used to being surrounded by their relatives, parents and friends. That is why an abrupt change will be a difficult obstacle for them. Upon enrolling at a university, they have to become autonomous in their activities and adapt to the new way of life. They have to cope with the whole education process themselves and to socialize with the other students at the university.

Many students with visual impairments tend to have a reduced willingness to work, nervous tension, and increased fatigue. All these can cause emotional disturbances, feelings of discomfort, breaches of balance between the stimulus and suppressive processes in the cerebral cortex. There are some individuals with impressive will and others who do not display it at all, who have impulsive behavior, suggestibility, obstinacy and negativism (Litvak, 2006). Students' main task is to learn the teaching material which is also their lecturers' responsibility because they should prepare qualified specialists, capable of adequate realization in the health system.

In our work with people with visual problems we apply all pedagogical methods, admitting some differences in their apprehension.

We modify them, according to students' physical abilities, knowledge and skills, their previous visual and motor experience, spatial orientation and ability to use residual vision. The application of phonic, tactile, olfactory, and other

reference points are of priority importance.

The emotional aspect of classes depends on the variety of drills, the teacher's tone, intonation and commands. The pitch of the voice changes (loud, quiet, gentle, strict). It depends on the mental state of the learners, their condition, and the perception of the material.

Non-traditional sports equipment is used: sound balls (goal balls); balls with handles; flavored apparatuses (odor of vanilla); steppers; cones for the development of the vestibular apparatus.

For the development of **tactile sensitivity** devices for finger manipulations and mastering fine motor skills are used (massage balls and small rings of the type "hedgehog", manual expanders, elastic bands etc.).

For the development of **spatial orientation** exercises for coordination and synchronization with a partner are applied (Tsarova, Andonov, Alexandrova, 2012).

The distant method is particularly appropriate when working with visually impaired young people. Students' motions during performance of practical drills are directed with commands ("push down harder", "a step forward", "come nearer").

The knowledge perception method is built on the basis of information perception during training through the sensory organs (audition, sense of touch, olfaction, and vision). The method aims at practitioners' becoming aware of the muscle-motor feeling, appearing in the muscles or joints when performing a certain movement or technique, so that they could apply it in practice.

The method of visualization is very important when training the blind and the purblind (Tolmachev, 2004). Demonstrativeness is a training method with the most specific peculiarities in the process of getting to know objects and actions. During their acquaintance with certain objects (sports or massage equipment), students first touch them and then have to define their shape, type of surface, color, features. Later a question is asked about the entire perception of the object or action. For a better comprehension of the teaching material, it is advisable that all apparatuses be in very bright colors – red, yellow, green, orange.

It is obligatory to present the activity with verbal description in order to activate learners' mental activity. (Albert, 2015).

Method of stimulated motor activity – The absence of clear visual images reduces emotional life of people with visual disturbances (Anfilatova, 2005). These students need to be encouraged to get rid of their inferiority complex, of their uncertainty and fear of space. Under their trainer's guidance they play highly emotional games for mastering their motor skills.

Visual impairments are always connected with disturbances in the locomotive activity. Years of experience have shown that the improvement of such students' possibilities of doing locomotive activity leads to improvement of their autonomy and is a prerequisite for more adequate acquisition of professional knowledge and skills.

PURPOSE AND OBJECTIVES OF THE STUDY

The aim of the study is to develop a

kinesitherapeutic program for optimization of sports classes and improvement of the physical fitness of students with visual impairments.

Tasks:

1. To explore the peculiarities of the students' adaptation to regular physical workload.
2. To analyze the students' social behavior and attitude within and outside the group.
3. To optimize the methods of teaching sport.

Our research studies the implementation of new means in sports classes, such as the Chinese healing gymnastics Chi Gong, asanas and elements from yoga, as well as special respiratory exercises. The designed program can be used when training students in unequal condition at different universities.

On the basis of the literary survey and the analysis of the data from a number of studies on education and professional realization of people with visual problems, we presume that *an appropriate kinesitherapeutic program will stimulate the adaptation of visually impaired students with major Massage to a regular physical workload and they will achieve greater autonomy and improve their motor skills.*

MATERIALS AND METHODS

Participants

The present study was held during the period 2002-2014 with students of „Y. Filaretova” Medical College, Sofia among 105 visually impaired students (male and female), divided into two groups:

I group – experimental group (EG) - 75 students;

II group – control group (CG) - 30 students.

During the classes with both groups in the gymnasium we very often worked with students without visual disturbances at the same time.

The subjects (randomly chosen) were first- and third-year students with major Visually Impaired Masseur.

The experimental group consisted of students who did sport regularly in the form of kinesitherapeutic schemes, combined with yoga and Chi Gong elements, modified and complemented by us. All students had submitted medical documents and permits by their doctors in order to participate in the experiment.

The EG consisted of 35 women (46.6%) and 40 men (53.4%). In the CG women and men were equal in number - fifteen, which represented 50% of the group. In both groups women's average age was 20 years. Men's average age was 22, and they represented 53.4% of EG and 50% of CG. The carried out studies showed that the respondents in both groups were evenly and not deliberately distributed.

The students with major Visually Impaired Masseur had to be with a certain degree of disablement (Table 1). In EG, 27.9% of the men and women were categorized as having first degree of disablement and 71.9% as having second degree of disablement. In CG, they were respectively 26.6% and 73.3%. This fact required an individual approach, *differentiated work* and taking into consideration the various degrees of vision disturbance with each of them.

Table 1. *Characteristics of the subjects by their degree of disablement*

Degree of disablement (TELC)*	EG			CG		
	Women	Men	Number	Women	Men	Number
First degree of disablement	13 (17.3%)	8 (10.6%)	21 28.%	5 (16.6%)	3 (10%)	8 26.6%
Second degree of disablement	22 (29.3%)	32 (42.6%)	54 72%	10 (33.3%)	12 (40%)	22 73.3%
Total	35	40	75	15	15	30

*TELC = Medical expert committee for work capacity

The distribution of first and second degree of disablement was even in the groups

Organization of the work

At the very beginning of *the experiment*, the researched individuals from EG and CG were treated under equal conditions. That way, their social affiliation was studied and its effect on their efficient education

The classes were held *twice a week* – the regular two classes of the sports program.

The duration of each class was from 45 to 60 minutes.

The period of study was 3 years for each student during the entire course of training at college.

Optimization of teaching methods with students with visual impairments

If students with visual disturbances are not given the chance to express themselves and do not join the society of other students, they will become social invalids. This is a serious challenge to lecturers' professional skills.

Practice work with visually impaired people has proven that they are good lis-

teners, but they do not always understand what they are told or explained. In connection with that, we paid greater attention to perceptions by explanation and image. Both in regular and sports classes a *story* is the most often used type of lecture. In our practice we specified the following *requirements to the lecturers*:

First, they have to be good psychologists to predispose the students with visual disturbances to the environment, in which they are taught; to have good diction without speech disorders in order to be able to speak correctly and present the educative material in a way suitable for the students. They should conform to the possibilities of the students as regards the syllabus.

The questions during training must be asked in a suitable pitch of the voice that does not suppress students. When working with blind students, one should leave some time for reflection due to the fact that they need to think about and “depict” the question.

During our work with the students we abided by the following methodical rules:

- Teachers have to ask accurately and

exactly all types of questions to avoid incorrect interpretation and receiving wrong answers;

- Teachers do not ask general questions and reasoning, which would stress on the students' vision problems, during specific learning process, such as: "Do you know what a ball is?", "Do you see how sunny the weather is outside?", "When you look at your right hand, you will see..." Questions of such type emphasize on their anomaly (visual disturbance) and would lead to students' withdrawal and to a breach in the education environment;

- The gymnasium should be quiet and students are seated in front of the teacher at a close distance;

- The light in the gymnasium is in compliance with their visual comfort;

- Eye gestures should be avoided as they will not be noticed;

- Students should be motivated to take active part in the lesson;

- Teachers should know and apply law frames when working with visually impaired people.

Another important peculiarity with the blind is that ***we work with them in small groups***, and in each group there are not only entirely blind students but also ones with different degrees of visual disturbances.

Teachers facilitate socializing while students acquire new skills and knowledge.

The methods of kinesitherapy consist of **five stages** performed in strict sequence. Keeping this order is a guarantee for developing and increasing practitioners' physical qualities. The drills are explained in details because the students

have various extents of visual damage, zero vision included, and they cannot observe a demonstration. Each drill is explained and played by the teacher, then a student does it with some help and if he/she manages to do it by himself/herself, does it unassisted.

We gave names to the drills to call forth associations in the blinds' minds and to help their comprehension. In this way only by giving the name, the drill is set and done.

The applied kinesitherapeutic methods with EG differ from the ones used during sports classes with CG in the following indices:

- the density of the class is bigger;
- the speed of the execution of the kinesitherapeutic exercises is average;
- specific means of kinesiotherapy (adapted yoga complex, Chi Gong exercises, specific poses etc.) are included.

Workload: The specific classes were of average to submaximal workload. They were chosen according to the extent of students' physical development, functional capacity, and peculiarities of their psychomotor activity.

After the kinesitherapeutic complexes were implemented and learnt, we held a **physical fitness test** (Albert, 2015)

First stage: a special complex for developing and improving coordination and spatial orientation. The exercises for eye focus increase the ability of the crystalline lens to focus vision at different distances; accommodation is improved. The exercises increase and develop the power of the oculomotor muscles. Skills for focusing the attention on a certain object are acquired. (Albert, 2014).

This stage lasted for **three months**,

but some of the exercises were also used in the next stages.

Second stage: training proper breathing. There is a special yoga complex for improving breathing and increasing functional capacities of the spinal column, tendons, joint ligaments and viscera. Before practicing yoga exercises, the practitioner should empty his/her urinary bladder and intestines. The exercises should not be done quickly, but precisely and correctly to have good healing effect. To be remembered more easily, the exercises were given characteristic names, which facilitated trainers' work with the blind.

This stage lasted for *five months*.

Third stage: development of quality flexibility. On this level, students played a complex of exercises from the Chinese gymnastics Chi Gong, *adapted by us* for visually impaired people. Specific exercises for balancing the energy in the body and aiding the visual analyzer were executed. They were also present in the successive stages.

This stage lasted for *five months*.

Chi Gong exercises for eyes, included in the kinesitherapeutic program, increase vital forces of the organism. Before doing the exercises, in a brief lecture course, the students were presented with the essence, principles and philosophy of the healing method.

The healing Chi Gong complexes included a combination of movements, breathing exercises and meditation techniques (work of thoughts, consciousness), point massages and self-massages. When working with the blind, the trainer aids their arm movements during the first performance and reminds for the directions during the implementation of each exer-

cise. During training the teacher corrects the posture and helps the students with spatial orientation, only if he/she has perception or zero vision. If necessary, he/she performs the movement passively, so that the practitioner could feel it.

When applying the Chi Gong complexes, we took into consideration the following *instructions*:

- Special attention is paid to relaxation of all parts of the body, achieving maximum relaxation of the muscles of the neck, shoulders and waist, reaching a state of mental peace, calming down consciousness.
- Movements are done slowly without extra efforts.
- Each movement passes easily into the next one.
- Breathing is calm and even, slowed down.
- Students are informed that before classes they should empty their urinary bladders and intestines.
- Exercises are not executed in less than 30 minutes time after eating (the practitioner should not be very hungry or thirsty before the start of the training).

Contraindications

People with mental diseases must not practice Chi Gong. The other contraindications coincide with the ones in kinesiotherapy.

Fourth stage: increasing muscle strength. We developed a complex of poses in static isometric-isotonic contraction, necessary for building up muscle power without considerable loading of the visual analyzer (Table 6). This stage lasted for *two months*.

Fifth stage: drills, combined with

meditation. This stage is the most important for building up visual memory (Albert, 2014). It lasted for *six months*.

The entire program lasted for 21 months.

We developed example schemes and complexes to be included in the kinesitherapeutic methods (Albert, 2015).

METHODOLOGY OF THE STUDIES

The emphasis was on the following components: observation and a questionnaire for evaluation of the extent of students' adaptation to the physical workload; the influence of the complex program on students' way of learning and perception.

Questionnaire

Each participant had to fill in the questionnaire at the end of the three-year period of training, after receiving their final grades. This was done to avoid subjectivism and suggestion on the answers. The questions covered all areas (communication, concentration, orientation, psycho-emotional status, physical fitness) (App. 1).

RESULTS

The data from the questionnaire were analyzed with the χ^2 method. It is a statistical method for verification of hypotheses (a nonparametric class of method). Cramer's coefficient was used to measure the degree of connection among the variables (within limits from 0 to 1). When this coefficient gets values between 0.00 and 0.30 the connection is weak, between 0.30 and 0.70 - average, and from 0.7 to 1 - strong. The explanation of this coefficient is possible only if its level of signifi-

cance is lower than the admissible error $\alpha = 0.05$.

As an answer to the first question 52.38% of all students stated that they wished to do sport every day. In EG 46.67% showed their wish to train every day, and 48% of the interviewees – three times a week. The results for the CG were the following: 16.67% would train every day, 63.33 % - three times a week and 20.00% once a week. The coefficient of variation V (0.354) for EG is less than V (0.378) for CG, which means equal distribution of the replies in EG (Tables 2 and 3). The results showed that the whole group, with the exception of 5.33%, wished to do sport regularly. These data prove that young people have accepted and approved the KT program as means for improving their functional condition. It helped them to get used to doing regular physical activities and to get satisfaction of the achieved results. In CG 32.87% did not show interest in sports training. This percentage included students with zero vision who have difficulty in doing sport, and students who are overweight. It is harder for them to overcome the mental barrier to participate more actively in sports events.

The answers to the second question (How does noise influence you during classes?) showed - 81.33% from EG and 63.33% from the CG, or 76.19% of all – that noise had disturbed them considerably. 23.81% of all participants - respectively 18.67% from EG and 36.67% from CG noise were slightly influenced by the noise. The coefficient of variation V (0.154) for EG is less than V (0.240) for the CG (Tables 2 and 3). These data showed that the answers are homogenous

and noise is a basic barrier for the normal doing of common activities by the visually impaired, because they receive most of their necessary information through their visual analyzers (Fig. 1a and 1b).

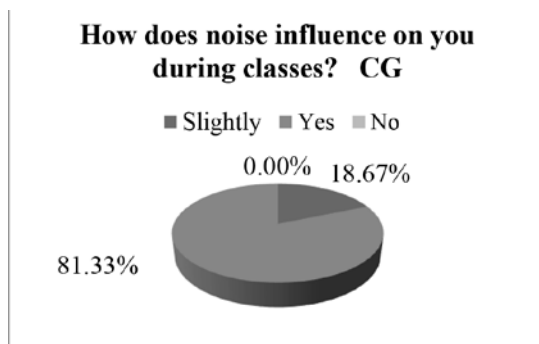


Figure 1^a. *Answers in CG.*

To the third question 84.76% of all students replied with “Yes”, 13.33% with “satisfactory” and only 1.90% did not like sports classes. For the EG the „Yes” results were 90.67%, and for the CG - 70% and with “satisfactory” 9.33% and for the CG - 23.33%. Only 6.67% from the CG replied that they did not like sports classes. The coefficient of variation V for the EG (0.086) is considerably lower than that for the CG (0.378). That shows the homogenous attitude of the experimental group. We believe that the implementation of numerous drills and different techniques contributed to the positive answers. The successful combination of Chi Gong and yoga exercises as well as the smooth transition among them, eye exercises and self-massage on certain acupuncture points are the reason for the high results of the EG

In the answer to the question „Does sport contribute to improving your health?” the EG was unanimous about the favorable role of sport on healing processes. There the coefficient of variation is zero and with the CG - V is (0.064).

These students require silence during lectures because lots of them use Dictaphones to record them. None of the students marked that noise did not influence him/her.

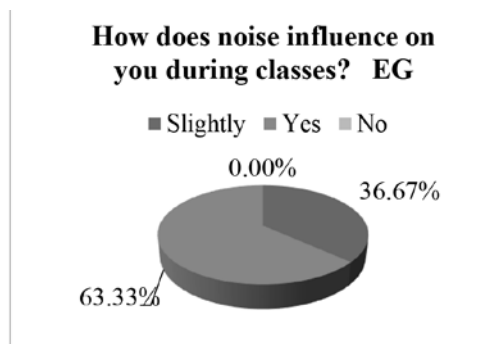


Figure 1^b. *Answers in EG*

93.33% of the CG answered with “Yes” and 6.67% - slightly. The data showed considerable homogeneity in both groups. Only one student stated that sport had had slight effect on his health (1.90%). Students in unequal condition willingly participate in sports classes, take active part, depending on the extent of their disabilities. Much more young people care about their health, pay attention to their physical qualities and look for appropriate programs for regular training.

The opinion of 89.52% of the students, concerning the question „Does sport increase your efficiency?” was that regular sports trainings increased their working capacity. 6.58% of them considered that the role of the drills was insignificant. 76.67% of the CG and 95% of the EG reported positive results. 16.67% for the CG and 5 % for the EG thought that sport had slightly influenced their efficiency; and 6.67% had negative attitude (Fig. 2a and 2b). When we compared the coefficients of variation V (0.51) of EG and V (0.335) of CG we saw there was a considerable statistical difference.

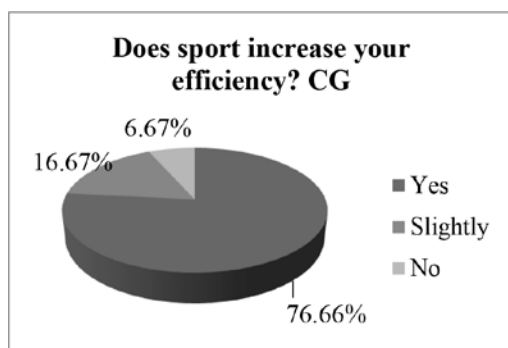


Figure 2^a. *Answers of CG*

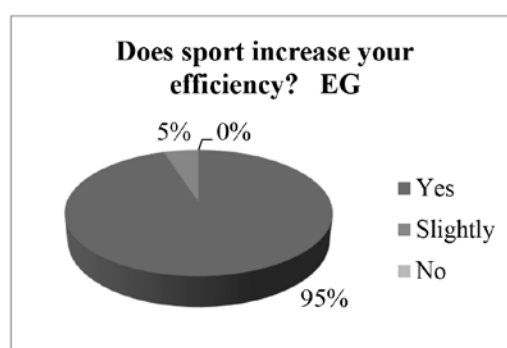


Figure 2^b. *Answers of EG*

Sports events create favorable conditions for new acquaintances and social contacts – this was the answer of 87.62% of the students to the question „Do sports activities improve your contacts with other students?”. Of them only 9.52% thought they had insignificant role and 2.86% - the events did not contribute to their social contacts. In the EG 90.67% stated that sport helped their socialization, respectively 80% in the CG. 8% in the EG and 13.33% in the CG believed its role was insignificant; and only 1.33% of the CG answered with „No”. The coefficient of variation is 0.124, and of the CG- V is 0.340. The data displayed bigger homogeneity in the EG, nevertheless various answers were observed. We noticed that it was more difficult for women to get into contact during sports training.

The answer to the question „Do bright colors of apparatuses and aids help you?” showed the substantial role of bright colors for their perception by the visually impaired people - 98.10% of all students. The answer „slightly” (1.90%) was given by people with zero vision. The utilization of brightly colored apparatuses supports sports activity of the visually disturbed, for example when they play table-tennis with a yel-

low ball, they play much better and for a longer time.

„Do you cope with terminology?” – This question provided information about the level of the acquisition of teaching material. Most of the students (89.52%) thought that they had mastered medical terminology, partly - 8.57, and 1.90% stated that they had not coped with it. The data by groups are: in the EG 95% - „Yes” answers and respectively 76.67% in the CG; insignificantly” - 5% in the EG and 16.67% in the CG; and „No” answers - 6.67% in the CG. The coefficient of variation is 0.51, but in the CG (V = 0.355). The results showed greater homogeneity in the EG (Table 2).

The question of visually impaired concentration is of particular importance. 78% of them admitted the role of the yoga exercises for their better results. The rest 19.05% believed that their concentration had been slightly influenced by them, and 2.86% gave negative answers. By groups the results are: with positive answers 88% in the EG and 53.33% in CG; slight influence – 10.67% in the EG and 40% in the CG. Only 6.67% in the CG and 1.33% in the EG denied the positive effect of these exercises. The coefficient of variation is

($V = 0.144$) in the EG and ($V = 0.395$) in the CG. This shows that students from the EG shared one and the same opinion

about the effect of yoga on concentration and there is a statistically significant difference (Fig. 3a and 3b).

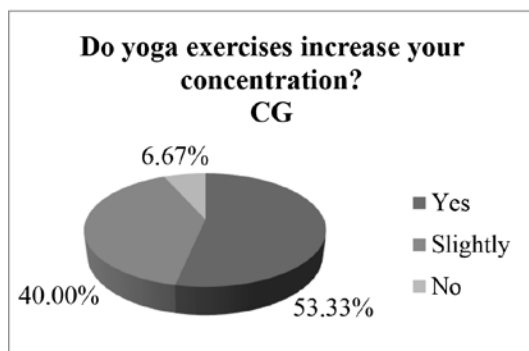


Figure 3^a. *Answers in the CG*

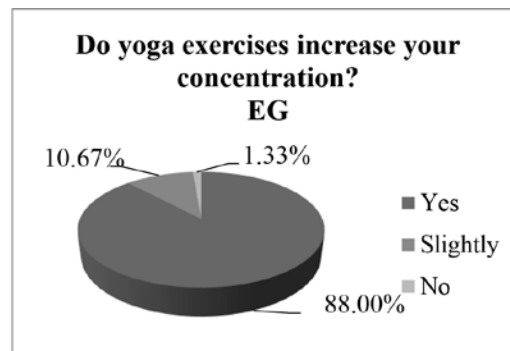


Figure 3^b. *Answers in the EG*

The responds to question 10 („How does eye gymnastics influence you?") do not include the control group (CG), because the students from this group did not perform that complex during the experiment. 90.67% of the EG reported these drills had contributed to the improvement of their condition and only 9.33% indicated a slight betterment. The positive assessment of the students is the result of precisely selected eye exercises combined with self-massage at certain acupuncture points affecting the visual analyzer. With students with zero vision, included in the EG, the results were insignificant because they considered only the influence on their emotional condition.

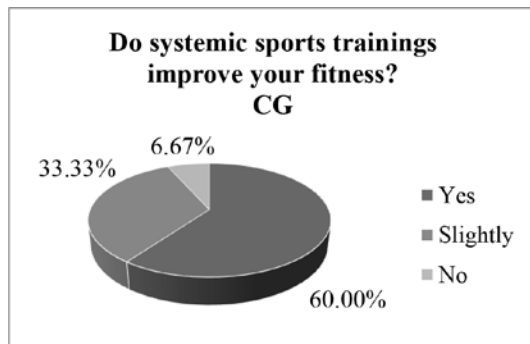
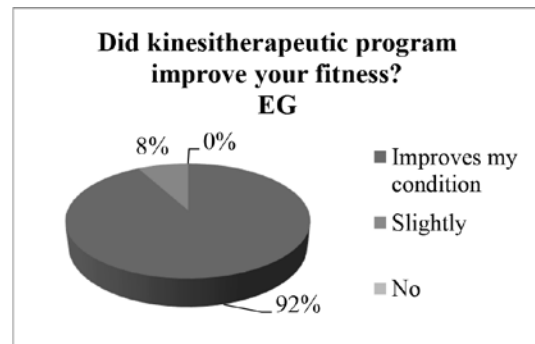
For visually impaired people orientation in the surroundings is vital. Of all the students 86.67% replied that the complex of exercises had improved their orientation, 11.43% - it had been slightly improved and only 1.90% indicated a negative result. By groups the data are: with „Yes" answers 95% in the EG and 66.7% in the CG; 5% marked slight effect in the EG and 26.67% in the CG; 6.67% - without any change in the CG

(Figure 4a and 4b). The coefficient of variation is ($V = 0.51$) in the EG and ($V = 0.386$) in the CG, and that shows a statistically considerable difference.

The questionnaire has proven that 66.67% of all students wish to do the complex of exercises, 3.81% would do it sometimes, but 29.52% do not think it is necessary to do it. In the EG 67% replied with „Yes", 29% would play sometimes and 4% do not want to do it.

To the question „What is the effect of sport on your psycho-emotional status", 95.24% of all students replied positively, with 2.86% the result was satisfactory and only with 1.90% it was negative. The opinion of the whole EG was that sport had considerably affected their psycho-emotional status and that is why the coefficient of variation is ($V = 0$). In the CG 83% supported the opinion of the EG, 33.33% thought that sport had affected their psyche insignificantly, and 6.67% denied its influence (the coefficient of variation V is 0.323).

KT program has improved physical fitness to 82.86%, satisfactory results have been achieved 15.24%, and with 1.90% there have not been any changes.

**Figure 4^a.** *Answers in the CG***Figure 4^b.** *Answers in the EG*

In EG 92% and 60% in the CG admitted betterment in their physical fitness as a result of the regular sports classes. Only 8% in the EG and 10% in the CG reported slight result, and 6.67% in the CG had not had improvement in

their condition (Fig. 4a and 4b). The coefficient of variation is ($V = 0.75$) in the EG and ($V = 0.395$) in the CG. The results have displayed statistically considerable differences between both groups (Tables 2 and 3).

Table 2. *Replies of the EG*

Descriptive Statistics ^a	N	Range	Min	Max	Mean	Std Dev	Var	Skewness	Kurtosis		
Group = Experimental	Stat	Stat	Stat	Stat	Stat	Stat	Stat	Stat	Std Error	Stat	Std Error
1. How many times a week would you do sport?	75	2	1	3	1,59	,595	,354	,44	,27	-,65	,54
2. How does noise influence you during classes?	75	1	1	2	1,19	,392	,154	1,64	,27	,71	,54
3. Do you like sports classes?	75	1	1	2	1,09	,293	,086	2,85	,27	6,30	,54
4. Does sport contribute to improvement of your health?	75	0	1	1	1,00	,000	,000	.	.	.	,54
5. Does sport increase your efficiency?	75	1	1	2	1,05	,226	,051	4,05	,27	14,8	,54
6. Do sports activities improve your contacts with other students?	75	2	1	3	1,11	,352	,124	3,50	,27	12,8	,54
7. Do bright colors of apparatuses and aids help you?	75	0	1	1	1,00	,000	,000	.	.	.	
8. Do you cope with terminology?	75	1	1	2	1,05	,226	,051	4,05	,27	14,8	,54
9. Do yoga exercises increase your concentration?	75	2	1	3	1,13	,380	,144	2,93	,27	8,63	,54
10. How does eye gymnastics influence you?	75	1	1	2	1,09	,293	,086	2,85	,27	6,30	,54
11. Did the applied exercises improve your orientation?	75	1	1	2	1,05	,226	,051	4,05	,27	14,8	,54
12. Would you keep on doing the complex of exercises?	75	2	1	3	1,08	,319	,102	4,35	,27	20,2	,548
13. What is the effect of sport on your psycho-emotional status?	75	0	1	1	1,00	,000	,000	.	.	.	
14. Did kinesitherapeutic program improve your fitness?	75	1	1	2	1,08	,273	,075	3,16	,27	8,20	,548

Table 3. *Replies of the CG*

Descriptive Statistics ^a	N	Range	Min	Max	Mean	Std Dev	Var	Skewness	Kurtosis		
Group/ Control	Stat	Stat	Stat	Stat	Stat	Stat	Stat	Std Error	Stat	Std Error	
1. How many times a week would you do sport?	30	2	1	3	2,03	,61	,37	-,016	,42	-,092	,83
2. How does noise influence you during classes?	30	1	1	2	1,37	,49	,24	,583	,42	-1,78	,83
3. Do you like sports classes?	30	2	1	3	1,37	,61	,37	1,50	,42	1,33	,83
4. Does sport contribute to improvement of your health?	30	1	1	2	1,07	,25	,06	3,66	,42	12,2	,83
5. Does sport increase your efficiency?	30	2	1	3	1,30	,59	,35	1,90	,42	2,74	,83
6. Do sports activities improve your contacts with other students?	30	2	1	3	1,27	,58	,34	2,14	,42	3,74	,83
7. Do bright colors of apparatuses and aids help you?	30	1	1	2	1,07	,25	,06	3,66	,42	12,2	,83
8.Do you cope with terminology?	30	2	1	3	1,30	,59	,35	1,90	,42	2,74	,83
9.Do yoga exercises increase your concentration?	30	2	1	3	1,53	,62	,39	,758	,42	-,321	,83
10.How does eye gymnastics influence you?	30	0	3	3	3,00	,00	,00
11.Did the applied exercises improve your orientation?	30	2	1	3	1,40	,62	,38	1,33	,42	,831	,83
12.Would you keep on doing the complex of exercises?	30	0	3	3	3,00	,00	,00
13.What is the effect of sport on your psycho-emotional status?	30	2	1	3	1,23	,568	,323	2,428	,427	5,036	,83
14.Did kinesitherapeutic program improve your fitness?	30	2	1	3	1,47	,629	,395	1,025	,427	,113	,83

An integral system for improvement of physical fitness of visually impaired students has been developed, including special eye gymnastics combined with balance and coordination training. The chosen way of arranging exercises in a fixed order, dosage and consistency is a significant contribution in the theory and practice of kinesitherapy:

- The findings concerning the role of physical fitness on the psycho-emotional state of the students, the effect of the noise and colors on the visually impaired - all are in accordance with the results of other researchers.

- The optimized teaching methods are also applicable to students at schools and with visually disturbed students with

different majors.

CONCLUSION

The implementation of the kinesiotherapeutic program, designed by us, during the 3-year period of training of visually impaired massage students, has stimulated them to take part in regular physical workloads suitable for their health condition; has had an expressed positive psycho-emotional effect; has assisted their social adaptation and has increased their autonomy and activity in locomotion and their motor skills.

It can be recommended as part of the complex rehabilitation for the improvement of the quality of life of visually impaired people.

REFERENCES

Алберт, М., Маринов, Е., 2014, Изследване влиянието на комплекс „гимнастика за очите“ върху зрителните функции на студенти с нарушено зрение, *Научно списание „Доклади, изследвания, публикации“* с. 17-25. (Albert, M., Marinov, E., 2014, *Izsledvane vliyanieto na kompleks "gimnastika za ochite" varhu zritelnite funkzii na studenti s narusheno zrenie, Nauchno spisanie "Dokladi, izsledvania, publikazii"*, s. 17-25.)

Алберт, М., 2015, Изследване влиянието на кинезитерапевтичен комплекс върху слуховата памет на студенти със зрителни нарушения. *Сп. Здраве и наука*, с.4-9. (Albert, M., 2015, *Izsledvane vliyanieto na kineziterapevtitshen kompleks varhu sluhovata pamet na studenti sas zritelni narushenia. Sp. Zdrave i nauka*, с.4-9.)

Алберт, М., 2015, Кинезитерапевтична програма за подобряване на физическата дееспособност при сту-

денти със зрителни нарушения. Дис (Albert, M., 2015, *Kineziterapevtitshna programa za podobriyavane na fizicheskata deesposobnost pri studenti sas zritelni narushenia. Dis.*)

Анфилатова, О., 2005, Методика непрерывного адаптивного физического воспитания детей старшего дошкольного возраста с нарушением зрения, *Физическая культура*, 2, с. 50. (Anfilatova, O., 2005 *Metodika neprerivnovo adaptivnovo fizitsheskavo vozpitanie detei i adaptivnogo fizicheskogo vozpitanie detei starshevo doskolnovo vozrasta s narusheniem zrenia, Fizitsheskaj kultura*, 2, s. 50)

Видолов, Д., 2002, Представата за себе си – основен фактор в обучението по мобилност и ориентиране при зрительно затруднени, *Личност, мотивация, спорт*. София, с. 46. (Vidolov, D., 2002, *Predstavata za sebe si – osnoven faktor v obutshenieto po mobilnost i orientirane pri zritelno zatrudneni, Litchnost, morivazia, sport*. Sofia, s. 46.)

Гуркова, Е., 2006, Особенности адаптационных реакций организма на физические нагрузки оздоровительного характера у детей 8-10 лет с нарушением зрения. *Теория и практика физической культуры*. Москва, 8, с.45 (Gurkova, E., 2006, Osobnosti adaptationix reactii organizma nafizitsheskite nagruzkiozdravitelnovo haraktera u deca 8-10 let s narusheno zrenie, *Theorya i Practica, Fizitsheskaj kultura*. Moscow, 8, p.45.)

Денискина, В., 2012 Особые образовательные потребности, обусловленные нарушениями зрения и их вторичными последствиями, *Дефектология*, 5, с.56-64. (Deniskina, V., 2012 Educational Needs, Substantial Disorders and Secondary Impacts. *Defectology*, 5, pp. 56-64.)

Литвак, А., 2006, Психология слепых и слабовидящих. Учеб. пособие для студентов высш. Пед. Учеб. Заведений, СПб.: КАРО, с. 1-324 (Litvak, A., 2006 Psychologia slépix i slabovidiajshix. Learning, Pedd. Learning. Zavedenii, SPb.: KARO, pp. 1-324.)

Людмилава, И., Димитрова, Д., 2010, Влияние на спортната дейност върху силвата издръжливост на деца и младежи с увредено зрение, Спорт, стрес, адаптация. ч. 1, *Пети международен научен конгрес Олимпийски спорт и спорт за всички*, София с. 398. (Lyudmilova, I., Dimitrova, D., 2010, Vliyanie na sportnata aktivnost varhu silovata izdrajlivost na deca s uvredeno zrenie. Sports, stress, adaptaciya. 1, *Peti Internationalen Nautchen Congress Olimpiiski Sport i Sport za Vsichki*, Sofia p. 398.)

Радулов, В., Цветкова-Арсова, М. 2011, Психология на зрително затруднените. София, СИК Феномен, с. 38-107. (Radulov, V., Tsvetkova-Arsova, M., 2011 Psychologia na zritelno zatrudnenite, Sofia, *SIC Phenomen*, pp. 38-107.)

Толмачев, Р., 2004, Адаптивная физическа культура и реабилитация слепых и слабовидящих. Советский спорт, Москва, 2004, с. 108. (Tolmachev, R., 2004 Adaptive, Physical Culture and Rehabilitation, Slim and Weakening. *Sovetskii sport*, Moscow, p. 108.)

Църова, Р., Андонов, К., Александрова В., 2012 Специализирана методика за обучение на деца с нарушено зрение, *Спорт и наука*, София, извънбр. №6, с. 12-20. (Tsarova, R., Andonov, K., Alexandrova V., 2012 Specializirana methodika za obutuhenie na deca s narusheno zrenie, *Sport i nauka*, Sofia, izv. broi 6, pp. 12-20.)

Gal E., M. Dyk., 2009, Stereotyped Movements among Children who are Visually Impaired, *Journal of Visual Impairment and Blindness*, vol. 103,11, p. 754-765.

Houwen, S., Hartman, E., & Cisscher, C., 2009, Physical activity and motor skills in children with and without visual impairments, *Medicine & Science in Sports & Exercise*, 40(1), p. 103-109.

Wiskochil, B., Lieberman, L.J., Houston-Wilson, C., & Petersen, S., 2007, The effects of trained peer tutors on academic learning time-physical education on four children who are visually impaired or blind, *Journal of Visual Impairment and Blindness*, 101, p. 339-350.

Correspondence:

Mariana Albert
Medical University - Sofia,
Medical College "J. Filaretova", Bulgaria
E-mail: andial@mail.bg

GOAL-ORIENTED BREATHING EXERCISES IN ACUTE PERIOD AFTER STROKE

Kristin Grigorova-Petrova

National Sports Academy "Vassil Levski", Sofia

ABSTRACT

The respiratory function of patients with stroke becomes worse and may lead to restrictive disorders in ventilation and pulmonary complications.

The purpose of this study is to establish the ability to influence respiratory disorders through a feedback breathing device in the acute period after a stroke.

The research was done among 59 patients who were monitored in the acute period after an ischemic stroke. They were divided into two groups, exercise group (EG) and control group (CG), according to their consent to perform breathing exercises at home. Forced vital capacity (FVC), peak expiratory flow (PEF), forced expiratory volume at 1 s (FEV1) and inspiratory capacity (IC) were measured.

There were significant differences in the first month in the PEF and IC between the two groups. All spirometric parameters improved in the EG with significant increase in FEV1 and IC.

The conducted study and the results indicate that goal-oriented training by incentive breathing device provides informative feedback on inspiration, facilitates cognitive stage, and positively influences inspiratory capacity among patients with acute ischemic stroke. The self-control during breathing facilitates early involvement of the basic principles of motor learning.

Keywords: *physical therapy, stroke, breathing exercises*

INTRODUCTION

Respiratory dysfunction following cerebrovascular diseases depends on size, process localization, and collateral circulation, and has various manifestations including disturbances of breathing. It is known that breathing can be controlled volitionally by corticospinal pathways or involuntarily on bulbospinal pathways.

Cerebral cortex plays no significant role in calm breathing (Laniniet et al., 2003). The presence of respiratory muscle weakness was observed in many patients with stroke (Lanini et al., 2003; Sutbeyaz et al., 2010; Ward et al., 2010). Cerebral vascular maladjustments, including impaired motor control, may compromise the function and synergy of muscles involved in the respiratory cycle. The authors believe

that the abnormalities are associated with a decrease in the strength of the respiratory muscles, a reduction in the mobility of the chest, a change in the posture of the body, and a negative impact on the efficiency of the cough mechanism. The weakness of respiratory muscles is related to the development of pulmonary infections (Smith et al., 2009) and leads to a restrictive disorder in ventilation, hypoventilation, and hypoxemia (Ward et al., 2010). Respiratory dysfunction may be a consequence of both respiratory muscle weakness and impaired motor control, associated with the inability to perform a number of functional motor activities, as the body muscles also participate in the control of respiratory movements (Howard et al., 2001).

METHODOLOGY AND METHODS

Purpose

To establish the ability to influence respiratory disorders through goal-oriented breathing exercises in the acute period after stroke.

Subjects

Fifty-nine patients (33 men and 26 women) of average age $71,1 \pm 6,2$ years with light to moderate strokes (NIHSS scale $8,8 \pm 2,3$ points, 18 to 20 points Glasgow-Liege scale), voluntarily attended, were included. All the patients had experienced ischemic stroke (computed tomography scan confirmed), and 31 presented with right sided paresis. All the patients were able to understand instructions, perform commands, and participate in physical therapy after the neurologist had determined that mobilization was indicated.

Outcome measures

On the day of hospital discharge and one month after a stroke, the following functional respiratory indicators were monitored - FVC, PEF and FEV1, using a portable spirometer (Vitalograph Micro Spirometer). Inspiratory capacity was measured with the device Coach2 Incentive Spirometer (in ml, rounded to the nearest 50 ml). Both studies were conducted in supine lying with raised upper part of the trunk from 30° to 45° . All pulmonary function measurements were taken after three attempts, the best achievement is reported.

Intervention

Individual feedback breathing device for inspiratory training (Coach2 Incentive Spirometer) was given (after instruction and training) to all patients. The instructions to patients were to apply goal-oriented breathing training from the day of discharge as a home-based training. In the hospital, the patients were educated to perform 5 inspirations in three positions – affected side lying, unaffected side lying and supine lying with raised upper body part with 1 to 3 minute rests between them, at least 3-4 times a day. In the course of the study we found out that only 44 of all patients performed breathing training at home. The rest of the patients declined to participate in inspiratory training. This gave us a reason to analyze the results of two groups: exercise group with inspiratory training and control group without breathing exercises. The baseline characteristics of the groups are presented in Table 1. All the patients performed physical therapy to achieve an optimal level of functional recovery according to the baseline status and the motor activity, previously described (Grigorova-Petrova et al., 2014; Grigorova-Petrova et al., 2014).

Table 1. *Baseline characteristics of two groups*

	EG	CG
Age	71,14±5,48	70,87±8,16
Gender male/female	24/20	9/6
NIHSS score	5,6±2,23	5,2±1,56
Paretic side left/right	18/26	10/5

EG – exercise group, CG – control group

RESULTS

The data obtained in this study was analyzed using SPSS version 19.0. To make comparisons between the pre- and post-test data for the 2 groups, Student's t-test for

paired and unpaired sample was performed and a p-value less than 0.05 was considered to indicate a statistically significant difference. Patients' results of respiratory indicators are shown in Table 2.

Table 2. *Comparison of changes in pulmonary function before and after treatment*

Variable		Pre	Post
FVC (l)	Exercise group	2,11±0,66	2,07±0,63
	Control group	2,08±0,67	1,83±0,64*
	p	0,869	0,218
FEV1 (l/s)	Exercise group	1,35±0,53	1,45±0,54***
	Control group	1,58±0,43	1,27±0,51*
	p	0,129	0,284
PEF (ml/s)	Exercise group	183,04±71,90	187,59±54,74
	Control group	193,66±52,17	154,30±45,95***
	p	0,601	0,039
IC (ml)	Exercise group	1567,82±595,32	1633,55±650,40*
	Control group	1559,70±623,42	1180,93±873,33***
	p	0,964	0,020

FVC - forced vital capacity, PEF - peak expiratory flow, FEV1 - forced expiratory volume at 1 s, IC - inspiratory capacity, StudentT-test *** $p < 0.001$, * $p < 0.05$

There were significant differences in the first month in the PEF and IC between the two groups. All spirometric parameters improved in the EG with significant increase in FEV1 and IC but significant decline of all dynamic indicators of the control group was observed.

DISCUSSION

Consequences of hemiparesis may include abnormalities in muscle tone and postural and motor control, which leads to inadequate functioning of the entire body and could compromise voluntary motor function. In the current study, we investi-

gated the effects of breathing exercises using an individual respiratory device on the pulmonary function in stroke patients. The respiratory function of patients with stroke becomes worse and may lead to restrictive disorders in ventilation and pulmonary complications (Ward et al., 2010). Preventing complications should be a top priority at all levels of risk (Wilson, 2012). On the other hand, the improvement in pulmonary function is associated with a reduced risk of future complications with patients with stroke (Britto et al., 2011).

We hypothesized that performing breathing exercises by using a personal device, which allows goal-oriented training to increase the inspiration by visual feedback, could influence and improve pulmonary function.

The visual feedback allows the early application of principles of motor learning and stimulates and facilitates the active response (through trial and error), supported by other authors (Langhorne, 2011). The involvement of visual stimulation allows adjustment feedback during inhaling and leads to improvement of motor control of respiratory muscles. Thus, implementation is facilitated by the inclusion of implicit processes, enabling automation and possibly contributing to long-lasting changes (Pohl, 2006). Other authors (Kim, 2011; Sutbeyaz, 2010; Britto et al., 2011) also used a targeted workout with an incentive breathing device to improve the respiratory function in neurological disorders, and report an improvement in the spirometric data in stroke patients. Their studies were conducted in a subacute or chronic period with duration of 4 to 8 weeks. Our findings suggest that the incentive breathing device might be applicable in the acute period for improving pulmonary function.

Breathing could be activated volitionally through corticospinal pathways, or automatically through bulbospinal pathways. Deep breathing is under control of the corticospinal pathways and it is voluntary and depends on patient's ability or willingness to activate breathing. Dysfunction of inspiratory muscles may lead to decreased lung volume at the beginning of expiration (e.g., cough), and the weakness of the expiratory muscles leads to decreased intrathoracic pressure and inadequate airflow (Pollock, 2013). This may cause ineffective cough mechanism, which worsens the protection against aspiration and chest infection (Widdicombe, 2011). The inspiratory capacity data in this study showed significant improvement in the EG due to training and improved motor control of respiratory muscles. Breathing exercises with an individualized respiratory device may improve pulmonary function and cough effectiveness, and reduce risk of pneumonia.

The reduced muscle strength and impairments in motor control after stroke lead to walking difficulties (Vasileva et al., 2017) which, in combination with deteriorated pulmonary function, limits the activities of daily living and obstructs the full recovery of bodily functions. Stroke patients often fail to sustain the minimum fitness level required to maintain independent living and are inclined to sedentary lifestyle (Sutbeyaz et al., 2010). This suggests that when a stroke becomes a chronic condition, a patient's lifestyle becomes more inactive, and pulmonary function continues to decline. This is confirmed by the results of CG one month later. On the other hand, the results obtained for the patients in EG confirmed the need of prolonged practice of breathing exercises in order to achieve long-lasting

changes, as some other authors also reported (Dimitrova et al., 2016). Inspiration training could be an effective intervention method to facilitate increase in overall physical activity. However, we need to emphasize that due to the short period of observation, it was difficult to examine the long-term effects of respiratory training.

REFERENCES

- Britto, R., Rezende, N., Marinho, K., Torres, J., Parreira, V., Teixeira-Salmela, L. (2011), Inspiratory Muscular Training in Chronic Stroke Survivors: A Randomized Controlled Trial, *Arch Phys Med Rehabil*, Vol 92, pp. 184-190.
- Dimitrova, A., Lubenova, D., Grigorova-Petrova, K., Maznev, I., Nikolova, M. (2016), The effectiveness of long term physical therapy in elderly patients with chronic obstructive pulmonary disease, *Eur Respir J*, Vol 48 Suppl. 60, PA 684.
- Grigorova-Petrova, K., Lubenova, D., Dimitrova, A., Baldaranov, D., Lozeva, J. (2014), Feasibility of Early Physical Therapy Program In-Hospital Patients with Acute Ischemic Stroke, *Macedonian Journal of Medical Sciences*, Vol 7 No.3, pp. 452-455.
- Grigorova-Petrova, K., Lubenova, D., Dimitrova, A. (2014), Pulmonary function - possibility of influence for in-hospital acute stroke patients. *Sport, Stress, Adaptation, Scientific Journal, Extra Issue*, pp. 640-643
- Howard, R.S., Rudd, A.G., Wolfe, C.D., Williams, A.J. (2001), Pathophysiological and clinical aspects of breathing after stroke, *Postgrad Med J*, Vol 77, pp. 700-2.
- Kim, K., Fell, D., Lee, H. J. (2011), Feedback respiratory training to enhance chest expansion and pulmonary function in chronic stroke: A double-blind, randomized controlled study, *J Phys Ther Sci*, Vol 23, pp. 75-79.
- Langhorne, P., Bernhardt, J., Kwakkel, G. (2011), Stroke rehabilitation, *Lancet*, Vol 377 No.9778, pp. 1693-702.
- Lanini, B., Bianchi, R., Romagnoli, I., Coli, C., Binazzi, B., Gigliotti, F., Pizzi, A., Grippo, A., Scano, G. (2003), Chest Wall Kinematics in Patients with Hemiplegia, *Am J Respir Crit Care Med*, Vol 168, pp. 109-113.
- Pohl, M., Filio, D.D., Richards, L.G., Stiers, W. (2006), Implicit learning of a motor skill after mild and moderate stroke, *Clinical Rehabilitation*, Vol 20, pp. 246 -253.
- Pollock, R.D., Rafferty, G.F., Moxham, J., Kalra, L. (2013), Respiratory muscle strength and training in stroke and neurology: a systematic review, *International Journal of Stroke*, Vol 8 No.2, pp. 124-130.
- Smith Hammond, C.A., Goldstein, L.B., Horner, R.D., et al. (2009), Predicting aspiration in patients with ischemic stroke: comparison of clinical signs and aerodynamic measures of voluntary cough, *Chest*, Vol 135, pp. 769-77.

CONCLUSION

Goal-oriented training by incentive breathing device provides informative feedback on inspiration, facilitates cognitive stage, and positively influences inspiratory capacity in patients with acute ischemic stroke. The self-control during breathing facilitates early involvement of the basic principles of motor learning.

Sutbeyaz, S., Koseoglu, F., Inan, L., Coskun, O. (2010), Respiratory muscle training improves cardiopulmonary function and exercise tolerance in subjects with subacute stroke: a randomized controlled trial, *Clin rehabil*, Vol 24, pp. 240-50.

Vasileva, D., Izov, N., Maznev, I., Lubenova, D., Mihova, M., Markovski, V., Cseppento, CN. (2017), Changes in Kinetic Parameters of Gait in Patients with Supratentorial Unilateral Stroke in Chronic Period, *Open Access Maced J Med Sci*, Vol 5 No.2, pp.201-206.

Ward, K., Seymour, J., Steier, J., Jol-

ley, C.J., Polkey, M.I., Kalra, L., et al. (2010), Acute ischaemic hemispheric stroke is associated with impairment of reflex in addition to voluntary cough, *Eur Respir J*, Vol 36, pp. 1383-1390.

Widdicombe, J.G., Addington, W.R., Fontana, G.A. et al. (2011), Voluntary and reflex cough and the expiration reflex; implications for aspiration after stroke, *Pulm Pharmacol Ther*, Vol 24 No.3, pp. 312–17.

Wilson, R.D. (2012), Mortality and cost of pneumonia after stroke for different risk groups, *J Stroke Cerebrovasc Dis*, Vol 21, pp. 61–67.

Correspondence:

Kristin Grigorova-Petrova
National Sports Academy “Vassil Levski”,
Sofia, Bulgaria
E-mail: kristin.grigorova@abv.bg

EFFECT OF SWIMMING AND PHYSIOTHERAPY IN PATIENTS WITH NEPHROLITHIASIS

**Nikolay Izov¹, Ivan Maznev¹, Milena Nikolova¹,
Dance Vasileva²**

¹National Sports Academy, Sofia, Bulgaria, ² Faculty of Medical Sciences,
Goce Delchev University, Shtip, Republic of Macedonia

ABSTRACT

Aim: *This research aims to evaluate the effect of swimming and physiotherapy in a complex treatment of patients with nephrolithiasis treated under sanatorium conditions.*

Materials and methods: *Twenty patients with nephrolithiasis who can swim, were surveyed and all of them were included in the experimental group (EG n=20). They performed swimming and physical therapy. Mean age of EG was 44.1 years. Swimming was not applied to another twenty-eight patients with the same disease, because they cannot swim. They were included in the control group (CG n=28). Mean age of CG was 49.5 years. For the purpose of the research changes in: body weight, vital capacity, abdominal muscle strength and elimination of the concretions visualized by ultrasound imaging were assessed. During their 15-day sanatorium stay, all patients performed daily physiotherapy for half an hour, tourist hikes and in addition patients of EG swam twice daily for 15 min.*

Results: *The results revealed that the applied physiotherapy and swimming significantly improved the monitored indicators. Targeted physical exercises were effective for increasing the effect of balneological treatment, leading to clearly expressed positive changes among patients with nephrolithiasis.*

Conclusion: *The study revealed that the rehabilitation program consisting of therapeutic exercises and swimming benefited the patients of the experimental group.*

Keywords: *nephrolithiasis, swimming, physiotherapy, SPA, balneology*

INTRODUCTION

Nephrolithiasis is a common disease and represents about 40% of the patients in urological clinics. Bulgaria is among the countries where it is widespread. By its importance, nephrolithiasis is not only a health problem, but also a social problem. Complex balneotherapy plays an important role in solving therapeutic problems of patients with nephrolithiasis and includes: medication, drinking mineral water, physiotherapy, swimming, SPA, underwater jet massage, fangotherapy (mineral-laden mud), lye saltwort-therapy, a vibrating belt, diet, and climato-therapy. Swimming and physiotherapy take an important place among the other methods in the complex treatment of patients with nephrolithiasis, both under balneo-sanatorial conditions, where medical results are optimal, and in terms of ambulant treatment and preventing kidney stone formation. The main goal of this study was to evaluate the effect of physiotherapeutic methods in complex treatment of patients with nephrolithiasis under sanatorium conditions.

MATERIALS AND METHODS

This research was conducted in “Kaleroya” in the town of Hissar, where twenty patients with nephrolithiasis were surveyed. Their mean age was 44.1 years (30-59) and all of them were included in the experimental group (EG) which performed swimming and therapeutic exercise sessions. Swimming was not applied to another twenty-eight patients with the same disease, who refused to swim. They were included in the control group (CG) who participated in the physical therapy sessions, their mean age was 49.5 years (36-60). All patients from EG

and CG were on standard analgesic and antispasmodic medication, that included the following medicaments: papaverine, atropine, santropine, spasmalgon, buscolysin and no-spa. In addition, drinking mineral water, in adequate intake, was administered to all patients of both groups (daily drinking mineral water from the spring “Momina banya” in amount 1500 ml-1800 ml, divided in 5-6 portions. The last portion was taken later, just before bedtime and even at night), water strikes twice a week, underwater jet massage and hydrotherapy (water temperature: 37°C - 38°C, duration of the procedure: from 5 to 15-18 min); fangotherapy or saltwort-therapy, a vibrating belt, and a diet.

Before starting the research and after its completion, in both groups changes were monitored in: body weight, strength of abdominal muscles, forced vital capacity and elimination of a concretion, which was visualized by ultrasound imaging and anamnestic.

Body weight was monitored by a medical scale with precision 50 gr, supports weight of 200 kg with standard method.

To assess the strength of abdominal muscles we used one of the test positions from the static part of the Krauss-Weber test. The retention time in the test position was recorded in seconds.

Examination of the forced vital capacity was carried out using a Vitalograph Micro Spirometer, Vitalograph Ltd, Ireland and the measurement was repeated 3 times, but only the highest score was recorded (Dimitrova et al., 2016; Grigорова-Petrova et al., 2014; Dimitrova et al., 2014). The size of the renal calculi in all patients was between 0.5 cm to 0.8 cm in diameter, which enables their sponta-

neous elimination. Medical ultrasound diagnostics is a noninvasive, accessible method of imaging, especially in establishing X-ray negative calculi. Commonly used are machines with dynamic scanning with transducers 3MHz and 5 MHz (Vasilev, 1990).

Physical therapy was applied to the patients from both groups during their 15-day sanatorium stay. The goals of physical therapy were to improve the renal function and general condition of the patients. For their implementation were the following tasks were set: improving the general blood circulation, improving blood circulation in the kidneys, increasing the micturition, improving and strengthening the peristalsis of the ureters, weight reduction, strengthening abdominal wall muscles, inducing spontaneous migration of the concretions. Physiotherapeutic methods are divided into two parts: physical exercises with overall effect and specific physical exercises. Specific tools included: relaxation exercises, diaphragmatic breathing, running and jumping exercises, strengthening abdominal wall muscles, and emotional mobile games. The pace of implementation was of slow to moderate intensity. In order to avoid sweating of the patients, the level of physical load was mild, and duration of sessions was 30 minutes daily. Physical therapy is divided into three basic periods. The preparatory period is 2-3 days, and it solves the following tasks: to introduce the patients to practicing exercises, to determine of their individual motor capabilities, assess of their functional status (mobility), and to teach some specific exercises. The tools of a complex physiotherapeutic treatment, included in this period, are mainly

developing ones, and exercises with emotional character. Some specific exercises were given in small doses, such as jumping, shaking, "bear" walking exercise, etc. Moreover, the dosage of these exercises depended on the individual health condition of every patient. Special emphasis was placed on proper breathing, especially diaphragmatic breathing. The physiotherapeutic complex in this period mainly consisted of exercises for upper and lower extremities in full range of motion, avoiding strength training and exercises related to exertion. Emotional parts of a complex contained less mobile and semi-mobile games. After the 3rd-4th day, the main period of treatment with physical therapy began. While in the preparatory period, special exercises occupied about 20%-25% of a whole complex, in a main period were included more complex and specialized exercises: stretching of the abdominal and chest muscles from different starting positions, mixed and free hanging of Swedish wall. The dosage of special exercises gradually increased to "bear" walking, shaking, jumping, exercises for lumbar region, flexion and extension of the lower limbs, trunk and pelvis combined with breathing exercises. During this period, the special exercises occupied 50% of the volume of the session. In order to avoid overload of the patients, which, relaxation exercises were generally given after jumps. This led to an increase in muscle spasm around the ureters. Upon completion of the treatment course in the sanatorium (final period) a non-supervised rehabilitation program at home was recommended, as special exercises must occupy 25-35% of the daily session. Both groups took participation in tourist hikes

with duration of 2-3 hours depending on their condition.

In addition, for the patients of EG, swimming was always carried out after the physiotherapy, so that they used the relaxing effect of the mineral water on the muscles. Swimming was performed twice daily, for 15 min, without rests, freestyle, slow pace.

Statistical analysis was performed

with the use SPSS 19 for Windows. Independent and paired sample t tests were conducted to determine effect of intervention. Statistical significance was set at $p < 0,05$.

RESULTS

The changes in the body weight in response to the treatment are presented in Table 1.

Table 1. Changes in the mean values and standard deviations of body weight in the two study groups before and after treatment

Parameter	Group	mean value \pm SD	mean value \pm SD	Difference (X2-X1)	P
Body weight (kg)	EG	67.35 \pm 10.06	66.30 \pm 9.92	- 1.05	0.001
	CG	77.71 \pm 8.38	77.39 \pm 8.60	- 0.32	0.059
	p	0.001	0.001		

EG-experimental group; CG-control group; SD - standard deviation; P-significant difference compared with values before treatment for each group (Student t-test); p-significant difference between the EG and CG (Student t-test)

Before the start of the treatment, the patients of the EG had a lower body weight ($p < 0.001$) compared to the control group. At the end of the treatment the reduction of the body weight with 1.05 kg was statistically significant ($p < 0.001$) compared to the minimal changes of only

0.32 kg found in the CG.

The changes in the forced vital capacity are shown in Table 2. Statistically significant ($p < 0.001$) higher forced vial capacity was found in the EG after treatment and no changes were registered in the CG.

Table 2. Changes in the forced vital capacity (mean value and standard deviation) in the experimental and control groups before and after treatment.

Parameter	Group	mean value \pm SD	mean value \pm SD	Difference (X2-X1)	P
FVC (l)	EG	3,25 \pm 0,6	3,38 \pm 0,6	0,13	0.001
	CG	3,15 \pm 0,6	3,18 \pm 0,6	0,03	>0.05

FVC - Forced vital capacity; EG-experimental group; CG-control group; SD - standard deviation; P-significant difference compared with values before treatment for each group (Student t-test); p-significant difference between the EG and CG (Student t-test)

The changes in the abdominal muscles strength are presented in Table 3. There are no significant differences in this indicator between the two groups at the start and at the end of the study.

Significant improvement ($p < 0.001$)

Table 3. *Changes in the abdominal muscle strength (mean value and standard deviation) in the experimental and control groups before and after treatment.*

Parameter	Group	mean value \pm SD	mean value \pm SD	Difference (X2-X1)	P
Abdominal muscle strength (sec)	EG	25.10 \pm 11.48	28.65 \pm 12.60	3.55	0.001
	CG	30.43 \pm 15.07	31.96 \pm 15.74	1.54	0.001
	p	0.191	0.434		

EG-experimental group; CG-control group; SD - standard deviation; P-significant difference compared with values before treatment for each group (Student t-test); p-significant difference between the EG and CG (Student t-test)

Data regarding spontaneous elimination of the renal concretion, confirmed by ultrasonography and anamnesis, was found in 50% (n=10) of the patients from EG and in 28% (n=7) of the patients from CG.

DISCUSSION

We were interested in monitoring the changes in body weight of the patients, as above-average weight is one of the etiological factors for the nephrolithiasis. Physical inactivity is common among stone clinic patients and lifestyle interventions is crucial for effective prevention (Soueidan, 2015). We believe that the positive change in body weight in both groups can be attributed to increased daily physical activity and ongoing diet. Thus, we can effectively combat obesity and sedentary lifestyle, which is typical of most of the patients and worsens their prognosis (Grigorova-Petrova et al., 2015).

The usual daily physical activity in the sanatorium environment also has a positive impact, but the combination of swimming, physical therapy and SPA potentiates the effect and leads to better results (Lubenova, 2014; Tasheva, 2007).

Changes were monitored in the forced

was observed in the abdominal muscle strength in all patients. The improvement was more noticeable in the EG (3.55 sec vs 1.54 sec) when compared with the values before treatment.

vital capacity of the patients. Improving respiratory function and general blood circulation respectively results in an improvement of the renal blood circulation. The presented results give us reason to link the application of focused breathing exercises and swimming at experimental group with the clear result on forced vital capacity among these patients (Dimitrova et al., 2007; Grigorova-Petrova et al., 2014).

Contractions of the abdominal muscles have mechanical effect on the ureteral peristalsis, which can be achieved with purposeful physical exercises on the abdominal wall, which would assist the spontaneous ejection of the stone. It is noteworthy to point out the low starting values of the contraction time of the abdominal muscles of the experimental group - 25.1 sec. and of the patients from the control group - 30.43 sec which is associated with low daily activity among these patients. These changes give us reason to assert that the exercises for abdominal muscles combined with swimming among EG patients are suitable, but a more prolonged period of time is likely to be needed for a more marked change.

Positive results of the renal calculi elimination, objectified by ultrasound examination among the patients from the experimental group, compared to the patients from the control group, is likely due to additive effect of swimming that further stimulates the general blood circulation and increases urine output. In turn, releasing of much urine leads to mechanical movement of concretion in the ureters and their elimination.

CONCLUSION

The results of the present study revealed that the implementation of swimming protocol of two short daily sessions has an additive positive effect to physiotherapy and enhances the outcomes of balneological treatment among patients with nephrolithiasis.

REFERENCES

- Dimitrova, A., Lubenova, D., Grigorova-Petrova, Kr., Maznev, I., Nikolova, M. (2016), The effectiveness of long term physical therapy in elderly patients with chronic obstructive pulmonary disease, *European Respiratory Journal*, Vol. 48 Suppl. 60, PA 684.
- Dimitrova, A., Lubenova, D., Grigorova-Petrova, Kr., Beizat A. (2014), Study on the effect of kinesitherapy on motor activity in patients with Parkinson's disease. In: *Congress Proceedings. Sport, Stress, Adaptation, Scientific Journal*, Extra Issue, pp. 633-639.
- Dimitrova, A., Lyubenova, D., Stefanova, D., Grigorova-Petrova, K. (2007), Kratkosrochna kineziterapevtichna programa pri bolni s khronichna obstruktivna belodrobna bolest, *Sbornik s dokladi ot XIV Balkanski kongres po sportna meditsina*. Albena: 21-24 septemvri 2006. Prilozhenie kŭm Sport i nauka, Vol. 1, pp. 51-159.
- Grigorova-Petrova, K., Dimitrova, A., Lubenova, D., Zaharieva, D., Vasileva, D. (2015), Feasibility of interactive video games for influence on balance in institutionalized elderly people. *Journal of Physical Education and Sport*, Vol. 15 No. 31, pp. 429 – 432.
- Grigorova-Petrova, K., Lubenova, D., Dimitrova, A., Baldaranov, D., Lozeva, J. (2014), Feasibility of Early Physical Therapy Program In-Hospital Patients with Acute Ischemic Stroke, *Macedonian Journal of Medical Sciences*, Vol 7 No.3, pp. 452-455.
- Grigorova-Petrova, Kr., Lubenova, D., Dimitrova, A. (2014), Pulmonary function - possibility of influence for in-hospital acute stroke patients, *Sport, Stress, Adaptation, Scientific Journal*, Extra Issue, pp. 640-643.
- Lubenova, D. (2014), Influence of hydrokinesitherapy in the treatment of lumbar disc disease in the chronic period. In: *Congress Proceedings. Sport, Stress, Adaptation. Scientific Journal*. Extra Issue, pp. 629-632.
- Soueidan, M., Bartlett, S., Noureldin, Y. (2015), Leisure time physical activity, smoking and risk of recent symptomatic urolithiasis: Survey of stone clinic patients, *Can Urol Assoc J*, Vol 9, pp. 257–62.
- Tasheva, R. (2007), SPA&wellness - sŭshtnost i prilozhenie, *Medicsina i sport*, Vol 1, pp. 16-20.
- Vasilev, T. (1990), Klinichna nefrologiya, *Medicsina i Fizkultura*, Sofiya.

Correspondence:

Milena Nikolova
National Sports Academy, Sofia, Bulgaria
Department of Physiotherapy and Rehabilitation
Email: milenanikolova78@gmail.com

AUTHOR'S GUIDELINES

GENERAL INFORMATION

Journal of Applied Sports Sciences accepts for review articles (original articles, reports, discussions, studies, editorial materials) in any of the following research areas: sport, sports excellence, sport medicine, sports physiology, biomechanics, nutrition, sports education, sports psychology, sports management and sports training, applied health and medical sciences related to the sports practices, social dimensions of sport and European dimensions in organizing modern sport.

The volume of the articles should not exceed 20 standard pages. Publications in Journal of Applied Sports Sciences should be written in English or Bulgarian languages (abstracts and bibliographic information in English and Bulgarian languages).

Submissions to Journal of Applied Sports Sciences are made using ScholarOne Manuscripts, the online submission and peer review system. Registration and access is available at <https://mc04.manuscriptcentral.com/jasportssciences> Full information and guidance on using Scholar One Manuscripts is available at the Emerald Scholar-One Manuscripts Support Centre: <http://mchelp.manuscriptcentral.com/gethelpnow/training/author/>.

REGISTERING ON SCHOLARONE MANUSCRIPTS

If you have not yet registered on ScholarOne Manuscripts, please follow the instructions below:

- Please log on to: <https://mc04.manuscriptcentral.com/jasportssciences>
- Click on Create Account
- Follow the on-screen instructions, filling in the requested details before proceeding
- Your username will be your email address and you have to input a password of at least 8 characters in length and containing two or more numbers
- Click Finish and your account has been created.

The proposed papers are submitted to the Editorial Board of the Journal of Applied Sports Sciences. Article submissions should be only made through electronic submission module on ScholarOne Manuscripts platform. To submit a paper for publication in the journal, authors need to create a new account and/or log in if they already have one. We kindly request authors to carefully read Instructions&Forms before submitting their articles for review. Once logged in, authors can see a chronology of submitted manuscripts and send a new one through **“Start New Submission”**. The process of sending a new manuscripts includes 7 basic steps:

- 1 Step: Select type of the manuscript, fill in the title and abstract in English lan

guage.

- 2 Step: Write and/or choose keywords. (The number of the keywords should not exceed 5 words).
- 3 Step: Add co-authors, if any.
- 5 Step: Specify the organization that funded your research, if any. Answer the addition questions.
- 6 Step: Upload your files.
- 7 Step: Final review of the completed information and files, conformation and sending the manuscript.

The received manuscripts are reviewed in accordance with Author's Guidelines by a member of the Editorial Board. Manuscripts that do not comply with the requirements shall be returned to the authors for revision. Manuscripts that meet the requirements shall be admitted for review.

For each of the submitted and approved articles the Editorial Board shall assign two reviewers. Reviews shall be made in terms defined by the Editorial Board and in accordance with its requirements to the reviewers.

Reviewing of articles shall be done in accordance with the standards for the evaluation of manuscripts through the double-blind peer review system. The reviewers give their assessment of the manuscripts in terms of the following criteria: scope of the research, novelty of the examined issues, originality, accuracy and clarity of the abstract describing the main text, logic structure and sequence of the submission, relevance of the methodology, validity of the results, proving the thesis, applicability of the results, validity of findings and conclusions, propriety and relevance of citations, accuracy and clarity of language.

The Editorial Board commits the final decision for publication, based on the conclusions of the reviewers. The decision can be: publish it without revisions, publish it after revision in accordance with the recommendations made in reviews, refuse to publish. If the Editorial Board commits a decision to publish the manuscript after revision upon recommendations, authors should review and answer to the Editorial Board's e-mails. The authors have to revise their manuscripts and present a report of the revisions they made in terms defined by the Editorial Board, upon which the Editorial Board commits a decision whether to publish it or refuse to publish the manuscript.

If there are contradictions of the reviews, the Editorial Board may determine an additional reviewer (reviewers).

SUBMISSION AND STRUCTURE REQUIREMENTS OF THE ARTICLES

The article submissions shall be provided in Microsoft Word format, as follows:

- Font: Times New Roman 12;
- Format of the pages: Page Setup: Top: 2,5 sm, Bottom: 2,5 sm, Left: 2,5 sm, Right: 2,5 sm
- Line Spacing: 1,5 lines; First Line: 1,5 cm; Paper Size: A4.

The main structure of the article shall include:

- First page;
- Introduction
- Main text
- Conclusion
- References

TITLE PAGE (PAGES)

The Title page/s includes:

Title of the article (it is recommended the title of the article be short (5-10 words) and present the main topic of the study);

Author Details: All contributing authors' names should be added to the ScholarOne submission, and their names arranged in the correct order for publication. All authors shall comply with the following information: correspondence address, including institutional affiliation (incl. University, institution, etc.), state/city and country. In co-authoring, one of the authors must be designated as lead author and write his/her e-mail address. It is the responsibility of the lead author to ensure that the list of authors and individual contribution to the study of each of them are clearly indicated.

Abstract. The abstract of the articles, whose main text is in Bulgarian language should be written in Bulgarian and English. For publications that are all in English language, the abstract should only be in English language. It should be short and clear and concisely contain the following elements:

- Introduction ("background" of the study) (required);
- Purpose and objectives of the study (required);
- Applied methodology ("staging of the research") (required)
- Achieved major results (required)
- Leads (conclusions) (required);
- Limitations of the research and consequences (if any)
- Practical implications (if any);
- Originality/Value (required);

The maximum length of the abstract should not exceed 300 words.

Keywords (specify up to 5 keywords in Bulgarian and English).

Article Classification. Authors must categorize their paper as part of the Scholar-One submission process. The category which most closely describes their paper should be selected from the list below:

- **Original Article/Research paper.** This category covers papers which report on any type of research undertaken by the author(s). The research may involve the construction or testing of a model or framework, action research, testing of data, market research or surveys, empirical, scientific or clinical research.

- **Reports.** These papers describe scientific research, presented on a scientific forum/conference.

- **Discussions/Conceptual paper.** These papers will not be based on research but will develop hypotheses. The papers are likely to be discursive and will cover philosophical discussions and comparative studies of others' work and thinking.

- **Studies.** The papers covered by this category shall analyze actual and important issues, the study should be with high scientific value and proven practical value.

- **Editorial Materials/General review.** This category covers those papers which provide an overview or historical examination of some concept, technique or phenomenon. The papers are likely to be more descriptive or instructional ("how to" papers) than discursive.

MAIN TEXT

Introduction

The purpose of the introduction is to convince readers that the published research contains novelty and it is applicable. It answers the following questions:

- What is the main problem?
- Are there any existing solutions (indicates the level of study the problem at the moment)?
- What are the best solutions according to the author/s?
- What is the main limitation of the research?
- What is expected to be achieved by the author of the research?

The main text is structured into separate sections, distinguished by their titles (headings should be brief, with clear indication of the differences between their hierarchy). The preferred format for writing the main titles is to be bold format and subtitles to be written in italics. font – Times New Roman 12, capitals, left alignment).

The main text should include:

Purpose and objectives of the study. The purpose and objectives of the study should ensure the understanding of the publication's focus and should justify its structure. After that, authors should specify:

- What is the significance of the publication?
- Why the publication is important and original?
- To whom is the publication designed?

Additionally can be discussed potential utility of practice, importance for future studies, detailed limitations of the study and others.

Main thesis and hypothesis of the research. Authors' arguments about their merit are presented.

Applied methodology and methods. The author should indicate the main methods used by him in a separate title. Author should demonstrate that the methodology is robust and appropriate to achieve the objectives. It is expected by the author to focus on the main theme, to point the main stages of his research, to show the used methods and influences that determine the chosen approach by him, to give arguments why he has chosen specific examples and others.

Achieved major results. When presenting the results, it is important that authors focus on the essentials. The publication must contain only the essential facts and those with a wider meaning, without giving many details of every possible statistics. If development is full of statistics, it is possible to prevail over the conclusions and after all the publication to be seen primarily as an enumeration of facts, not as a scientific study. The main thesis of the author must be clearly traceable and steadily established.

When describing the results author should seek answers to the following questions:

- Do you provide interpretation for each of the submitted results you want?
- Are the results consistent with what other researchers have found?
- Are there any differences? Why?
- Are there any limitations?
- Does the discussion logically lead the reader to your conclusion?

It is important when presenting the results not to make statements that go beyond what results can acknowledge.

Conclusion

The general rule is that the conclusion should not only contain a summary of the research (it can be found in the abstract). The conclusion should give answers to the set at the beginning of the publication questions and to indicate opportunities for further research. It would be better to reveal how the achieved results will be applied in practice and to identify constraints in this regard. While indicating how this research can be applied and extended in future studies, it is not accepted in the conclusion to introduce new material or state the obvious. In the conclusion it should be emphasized what is different in the research results, what stands out in the design or is unexpected.

Notes

Notes or Endnotes should be used only if absolutely necessary and must be identified in the text by consecutive numbers, enclosed in square brackets and listed at the end of the article.

Funding agencies

The funding agencies of the scientific research should be added in Step 5 of the submission process on ScholarOne system.

Figures

All Figures (charts, diagrams, line drawings, web pages/screenshots, and photographic images) should be submitted in electronic form.

All Figures should be of high quality, legible and numbered consecutively with arabic numerals. Graphics may be supplied in colour to facilitate their appearance on the online database.

- If possible, the figures should be made in graphical programs (Corel Draw, Adobe Illustrator, Adobe PhotoShop) or Excel. The figures should not be in Picture format. They should be numbered consecutively in order of citation in the text. Numbers and titles of the figures are placed below them. Authors should avoid many inscriptions inside the figures.

- Pictures and scanned images can be made into separate files, preferably in JPG or TIFF format, not embedded in the text. Photos must be of good quality and suitable for printing. Color illustrations are accepted in exceptional cases after special agreement and eventual additional costs!

- If authors make a blueprint they should use Word Equation. The numbers of formulas should be written in brackets in the left side of the page!

Tables

Tables should be typed in Word Table or Excel format. They should be numbered consecutively according to citation in the text. Each table should have a title. Numbers and titles of the tables are placed over them. It is preferable that it fit on the page without turning widest part of the sheet horizontally. The necessary explanations are given below by means of appropriate symbols / characters.

References

References to other publications must be in Harvard style and carefully checked for completeness, accuracy and consistency.

The cited authors should be presented in any of the following ways:

- Surname and year of publish (ex. Adams, 2006)
- Citing both names of two and year of publish (ex. Adams, Brown, 2006)
- When there are more than three authors, it is typed the surname of the first author and year of publish (ex. Adams et al., 2006)

At the end of the paper a reference list in alphabetical order should be supplied.

<i>For books</i>	Surname, Initials (year), <i>Title of Book</i> , Publisher, Place of publication. e.g. Harrow, R. (2005), <i>No Place to Hide</i> , Simon & Schuster, New York, NY.
<i>For book chapters</i>	Surname, Initials (year), Chapter title, Editor's Surname, Initials, <i>Title of Book</i> , Publisher, Place of publication, pages. e.g. Calabrese, F.A. (2005), The early pathways: theory to practice – a continuum, in Stankosky, M. (Ed.), <i>Creating the Discipline of Knowledge Management</i> , Elsevier, New York, NY, pp. 15-20.
<i>For journals</i>	Surname, Initials (year), Title of article, <i>Journal Name</i> , volume, number, pages. e.g. Capizzi, M.T. and Ferguson, R. (2005), Loyalty trends for the twenty-first century, <i>Journal of Consumer Marketing</i> , Vol. 22 No. 2, pp. 72-80.
<i>For published conference proceedings</i>	Surname, Initials (year of publication), Title of paper, in Surname, Initials (Ed.), <i>Title of published proceeding which may include place and date(s) held</i> , Publisher, Place of publication, Page numbers. e.g. Jakkilinki, R., Georgievski, M. and Sharda, N. (2007), Connecting destinations with an ontology-based e-tourism planner, in <i>Information and communication technologies in tourism 2007 proceedings of the international conference in Ljubljana, Slovenia, 2007</i> , Springer-Verlag, Vienna, pp. 12-32.
<i>For unpublished conference proceedings</i>	Surname, Initials (year), Title of paper, paper presented at Name of Conference, date of conference, place of conference, available at: URL if freely available on the internet (accessed date). e.g. Aumueller, D. (2005), Semantic authoring and retrieval within a wiki, paper presented at the European Semantic Web Conference (ESWC), 29 May-1 June, Heraklion, Crete, available at: http://dbs.uni-leipzig.de/file/aumueller05wiksar.pdf (accessed 20 February 2007).
<i>For working papers</i>	Surname, Initials (year), Title of article, working paper [number if available], Institution or organization, Place of organization, date. e.g. Moizer, P. (2003), How published academic research can inform policy decisions: the case of mandatory rotation of audit appointments, working paper, Leeds University Business School, University of Leeds, Leeds, 28 March.
<i>For encyclopedia entries (with no author or editor)</i>	<i>Title of Encyclopedia</i> (year) Title of entry, volume, edition, Title of Encyclopedia, Publisher, Place of publication, pages. e.g. <i>Encyclopaedia Britannica</i> (1926) Psychology of culture contact, Vol. 1, 13th ed., Encyclopaedia Britannica, London and New York, NY, pp. 765-71. (For authored entries please refer to book chapter guidelines above)
<i>For newspaper articles (authored)</i>	Surname, Initials (year), Article title, <i>Newspaper</i> , date, pages. e.g. Smith, A. (2008), Money for old rope, <i>Daily News</i> , 21 January, pp. 1, 3-4.

<i>For newspaper articles (non-authored)</i>	<p>Newspaper (year), Article title, date, pages.</p> <p>e.g. <i>Daily News</i> (2008), Small change, 2 February, p. 7.</p>
<i>For archival or other unpublished sources</i>	<p>Surname, Initials, (year), Title of document, Unpublished Manuscript, collection name, inventory record, name of archive, location of archive.</p> <p>e.g. Litman, S. (1902), Mechanism & Technique of Commerce, Unpublished Manuscript, Simon Litman Papers, Record series 9/5/29 Box 3, University of Illinois Archives, Urbana-Champaign, IL.</p>
<p><i>For electronic sources</i></p> <p>За източници на български език:</p>	<p>If available online, the full URL should be supplied at the end of the reference, as well as a date that the resource was accessed.</p> <p>e.g. Castle, B. (2005), Introduction to web services for remote portlets, available at: http://www-128.ibm.com/developerworks/library/ws-wsrp/ (accessed 12 November 2007).</p> <p>Standalone URLs, i.e. without an author or date, should be included either within parentheses within the main text, or preferably set as a note (roman numeral within square brackets within text followed by the full URL address at the end of the paper).</p> <p>For each source quoted in Cyrillic – in Bulgarian language should be given the same source, written in the regulations of the transliteration.</p> <p>e.g. Ерхард, Л., 1993. Благоденствие за всички, София, УИ „Стопанство”. Erhard, L., 1993. Blagodenstvie za vsichki, Sofia, <i>UI „Stopanstvo“</i>.)</p>

Notes:

JOURNAL of Applied Sports Sciences

International Scientific Journal

Published and financially supported by the National Sports Academy, Sofia, Bulgaria

Editor in chief:

Prof. Tatiana Iancheva, DSc

Cover Design: Stanislav Hristov;

Printing: BPS Ltd;

ISSN 2534-9597 (Print)

ISSN 2535-0145 (Online)
