ISSN 2664-9837

PEDAGOGY

of Physical Culture and Sports

№04/2020

2 664983 720201 04

Pedagogy of Physical Culture and Sports

2020
04

© Iermakov S.S., 2020

Key title: Pedagogy of Physical Culture and Sports (Abbreviated key-title: Pedagogy phys. cult. sports; ISSN 2664-9837).
Previous title «Pedagogics, psychology, medical-biological problems of physical training and sports» (e-ISSN 2308-7269; p-ISSN 1818-9172; ISSN-L 2308-7269).

Founders: Iermakov Sergii Sidorovich (Ukraine); (doctor of pedagogical sciences, professor, Department of Physical Education, Kharkov National Pedagogical University).

Certificate to registration: KB 22063-11963P 16.05.2016.

Frequency – 6 numbers in a year.

Journal is ratified Ministry of Education and Science of Ukraine:
physical education and sport: (11.07.2019, № 975, "A" - 24.00.01, 24.00.02, 24.00.03; 017); (13.03.2017, № 374).
pedagogical sciences: (07.05.2019, № 612, "A" - 13.00.02; 011, 014); (07.10.2016 №1222).

Address of editorial office:
Box 11135, Kharkov-68, 61068, Ukraine,
Tel. 38 099 430 69 22
e-mail: sportart@gmail.com
https://www.sportpedagogy.org.ua

Journal is reflected in databases:

1) Web of Science Core Collection
[Emerging Sources Citation Index (ESCI)]
http://ip-science.thomsonreuters.com/mjl

DOAJ (Directory of Open Access Journals)
http://www.doaj.org

WorldCat – http://www.worldcat.org

SHERPA/RoMEO – http://www.sherpa.ac.uk

Open Science Directory (EBSCO information services) - http://www.opensciencedirectory.net

PBN (Polish Scholarly Bibliography)
https://pbn.nauka.gov.pl/journals/40688

ERIH PLUS (The European Reference Index for the Humanities and the Social Sciences)
– https://dbh.nsd.uib.no

IndexCopernicus http://journals.indexcopernicus.com

RISC – http://elibrary.ru

Scilit – http://www.scilit.net

ROAD – http://road.issn.org

2) BASE – http://www.base-search.net

Academic Journals Database
http://journaldatabase.org

CORE http://core.kmi.open.ac.uk

Elektronische Zeitschriftenbibliothek
http://ezb.uni-regensburg.de

OAJI – http://oaji.net/journal-detail.html?number=769

3) V.I.Vernadskiy National Library of Ukraine
http://nbuv.gov.ua

Scientific Periodicals of Ukraine
http://journals.uran.ua/olympicedu.org/pps

AcademicKeys
http://socialsciences.academickeys.com/jour_main.php

academia.edu – https://www.academia.edu

Google Scholar – http://scholar.google.com.ua

EDITORIAL BOARD

	Editor-in-chief:
Sergii S. Iermakov	Doctor of Pedagogical Sciences, Professor: Kharkov National Pedagogical University (Kharkov, Ukraine).
	Deputy Editor:
Wladyslaw Jagiello	Doctor of Sciences in Physical Education and Sport, professor, Gdansk University of Physical Education and Sport (Gdansk, Poland).
	Editorial Board:
Marek Sawczuk	Doctor of Biological Sciences, Gdansk University of Physical Education and Sport (Gdansk, Poland).
Michael Chia	PhD, Professor, Faculty of Phisical Education and Sports, National Institute of Education Nanyang Technological University (Singapore)
Marc Lochbaum	Professor, Ph.D., Department of Kinesiology and Sport Management, Texas Tech University (Lubbock, USA)
Romualdas Malinauskas	Doctor of Pedagogical Sciences, Professor, Lithuanian Academy of Physical Education (Kaunas, Lithuania)
Agnieszka Maciejewska-Karłowska	Doctor of Biological Sciences, Faculty of Physical Education and Health Promotion, University of Szczecin (Szczecin, Poland).
Tatiana S. Yermakova	Doctor of Pedagogical Sciences, Kharkov State Academy of Design and Fine Arts (Kharkov, Ukraine).
Oleg M. Khudolii	Doctor of Sciences in Physical Education and Sport, Professor, Kharkov National Pedagogical University (Kharkov, Ukraine)
Zhanneta L. Kozina	Doctor of Sciences in Physical Education and Sport, Professor, Private University of Environmental Sciences (Radom, Poland)
Andrew Abraham	MSc, PhD, Carnegie School of Sport, Leeds Beckett University (Leeds, United Kingdom)
Olga V. Ivashchenko	Doctor of Pedagogical Sciences, Associate Professor, H. S. Skovoroda Kharkiv National Pedagogical University, Ukraine (Kharkov, Ukraine)
Mykola O. Nosko	Doctor of Pedagogical Sciences, Professor, Chernigiv National T.G. Shevchenko Pedagogical University (Chernigiv, Ukraine)
Mourad Fathloun	Ph.D. Physical Education and Sport, Research Unit Evaluation and Analysis of Factors Influencing Sport Performance (Kef, Tunisia)
Bahman Mirzaei	Professor of exercise physiology, Department Exercise Physiology University of Guilan (Rasht, Iran)
Vladimir Potop	Doctor of Sciences in Physical Education and Sport, Professor, Ecological University of Bucharest (Bucharest, Romania)
Fedor I. Sobyanin	Doctor of Pedagogical Sciences, Professor, Belgorod State National Research University (Belgorod, Russia)
Leonid V. Podrigalo	Doctor of Medical Sciences, Professor, Kharkov State Academy of Physical Culture, (Kharkov, Ukraine)
María Luisa Zagalaz-Sánchez	Doctor in Psicopedagogy, Department of Didactics of Musical Expression, University of Jaén (Jaén, Spain)
Jorge Alberto Ramirez Torrealba	Ph. D. (Physical Education and Sport), Pedagogical University (Maracay, Venezuela)

CONTENTS

2020
04

ORIGINAL ARTICLE

The effect of blood flow restriction and plyometric training methods on dynamic balance of taekwondo athletes

Manolya Akin[1ABCDE], İnci Kesilmiş[2ABCDE]

[1] *Mersin University, Mersin, Turkey*
[2] *Osmaniye Korkut Ata University, Osmaniye, Turkey*

Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection

Abstract

Purpose: Taekwondo (TKD) is a combat sport emphasizing on kicking techniques and dynamic footwork. Specialized balance ability is crucial for Taekwondo practitioners. Nowadays balance could be improved with specific strength training such as blood flow restriction and plyometric training. Thus, the aim of this study was to understand the effect of blood flow restriction (BFR) and pliometric training methods on the development of dynamic balance at the martial art of Taekwondo.

Material: Totally 31 TKD athletes between 15-19 ages participated voluntarily and were divided into three groups as blood flow restriction (n=11), plyometric training (n=10) and control groups (n=10). In addition to normal taekwondo training, 8 week training programs were applied to the pliometric and blood flow restriction groups, and no training program was applied to the control group. At the beginning and after the trainings, dynamic balance ability measured with Prokin Tecnobody equipment for 30 seconds slalom test.

Results: The difference between pre-test and post-test values of BFR group's dynamic balance (antero-posterior sway) was found to be statistically different ($p<.05$) while according to the pliometric training results, there was no statistically significant difference ($p>.05$). Also, there was not any difference in terms of gender ($p>.05$).

Conclusions: Strength development is neccessary for dynamic balance improvement in athletes. Since taekwondo athletes use strength and balance ability for rapid kicking and change direction, these motor abilities are important for success. Based on the findings of this study; it is recommended that BFR method may be useful and so it can be included in training programs.

Keywords: blood flow restriction, plyometric training, dynamic balance, taekwondo.

Introduction

Taekwondo is a sport that requires a combination of many coordinative abilities. Strength, speed, balance, flexibility and coordination, are all important to be able to execute the highly dynamic kicking combinations utilised in taekwondo [1]. Postural control is crucial for taekwondo (TKD) practitioners due to its dynamic kicking nature techniques, in which unilateral stance stability is a determining factor of succes in competititons [2, 3]. The base of support decreases when performing technical strokes on one leg in taekwondo the balance protection become more important than the other biomotor abilities. Somatosensory and vestibular inputs support to maintain dynamic balance in TKD athletes [3, 4]. TKD trainings include high-speed rotations, repetitive actions involving weight-shifting actions and sudden strokes to support the somatosensory and vestibular systems [5, 6]. Therefore, strength development has significant effects on balance and coordination. The development of strength is not made just for the sake of being strong. On the contrary, the scope of strength development is to serve the specific needs of a given sport, to develop specific strength or its combinations in order to increase athletic performance to the highest possible level [7].

Plyometric training is an effective strength enhancer training method that develops branch-specific biomotor properties (jumps, strokes and direction changes) that require balance, strength and speed [8-10]. Agility is one of the fundamental motoric abilities can be improved by plyometric training movements like starting, stopping and sudden turning. Enhancement agility improves neuromuscular conditioning and strengthening motor functions of muscle fibers through neural adaptation of Golgi tendon organ and joint movement perception skills [11]. Therefore, balance development with plyometric training is a research interest that may be studied.

Another strength training method used in recent years is defined as blood flow restriction or Kaatsu. Popularity of Kaatsu training method is increasing worldwide to improve performance in many athletes [12]. The basic principle of kaatsu is performed by wrapping a restrictive bandage or specially designed pressure belts around the limb while exercising dynamically to restrict the circulation of the working muscle. This bandage is wrapped around the superior point of the extremity where the muscle to be work [13, 14]. The aim of blood flow restriction (BFR) is to obstruct venous flow without significantly affecting arterial circulation which provides appropriate superficial pressure. When restricting blood flow, the intention is to reduce the amount of arterial flow into the limb and restrict the venous flow out of the

© Manolya Akin, İnci Kesilmiş, 2020
doi:10.15561/26649837.2020.0401

limb. This type of exercise, when combined with low intensity, promotes muscle hypertrophy and provides various performance improvements [15]. Because of the ischemia that occurs, the body secretes growth hormone as a mechanism of self-protection and thus removes lactic acid and also fat metabolism is activated [13-15]. In recent years, traditional training methods have been applied together with blood flow restriction training [16].

The first two weeks of strength gain are attributed to the functioning of the muscle neuromuscular junction; maintaining balance support the development of strength by providing the neuromuscular junction transmission speed and muscle motor unit participation. Since taekwondo kicks are made from plantar and dorsiflexion, it is thought that the anteroposterior sway of the foot is more effective in taekwondo athletes. So the aim of this study was to understand the effect of plyometric training and blood flow restriction (BFR) methods on the development of dynamic balance at the martial art of Taekwondo.

Material and Methods

Participants

Research conduct with healty 15-19 years of ages total 31 TKD athletes who were training at the Zirve and Toros Taekwondo Sports Club in Mersin. There were choosen 10 (5 male, 5 female) plyometrics, 11 (8 male, 3 female) blood flow restriction and 10 (6 male, 4 female) classical taekwondo training group. They had practised TKD for at least two years and attained red belt level or above recruited from two local Mersin TKD associations. The study was approved by the science ethics review by Mersin University Scientific Ethical Committee (2017/03). The procedures were fully explained to the subjects and they all gave their written consents before testing and all procedures of this study were performed in accordance with the Declaration of Helsinki. None of the subjects had any diseases and took any medications. The training program was applied for 6 weeks. They were trained in TKD for two hours per week and they did not have any other physical training. Participants with musculoskeletal disorders, visual, vestibular or neurological disorders affecting balance ability, and any injuries affecting performance in the past six months were excluded.

Dynamic Balance Ability Measurement

Dynamic balance ability was measured by [Prokin Tecno Body, PKW 200 PL, Italy]. Bipedal dynamic balance measurements were conducted with monoaxial base for antero-posterior sway. Perimeter length (PL) measurement test started when participant provided the balance position with bare foot and thin sportswear. Measurement was conducted twice for each participant for 30 seconds and 60 seconds rest interval was given. Then the researcher recorded the results. For statistical analysis, the more successful dynamic balance score was taken from the three-recorded measurements. In this measurement the participant sees some balls-objectives that come against in the computer software. The participant's scope is to hit the objectives and follow the blue ideal line. At the end of the test the software provides two results: missing objectives and the perimeter length. The perimeter length shows the participants' ability to stay on the blue ideal line. The error is calculated on how much perimeter in more has been store clerk regarding the ideal perimeter (in percentage).

Blood Flow Restriction Protocol

Both sides of the participants' thighs had pressure applied at the proximal ends by Kaatsu Master belt. This method is similar as previous study protocols (fig. 1) [12, 15, 17].

Training Program

All of the Taekwondo trainees were divided into three groups after the pre-test. These three groups participated in the same training program that consist of the same number of strikes and techniques for 6 weeks, 3 days a week and 90 minutes per day. The athletes followed the common warm up period for 30 minutes and delivered 3 stirkes of palding chagi, dollyo chagi and naeryo chagi. In addition to this training; the pliometric training group participated in a 30-minute pliometric exercise program 3 times a week for 6 weeks and the Kaatsu training group participated in a 10-minute exercise program 3 times a week. After 6 weeks of regular training, post-test measurements were performed in the same protocol for three groups (Fig. 1, Fig. 2).

Pliometric Training Program (fig. 1).

Figure 1. Pliometric Training Program

Plyometric training program consists of; squat jump (The legs are spread over the shoulder width, the back is straight and the knees are slightly bent (Fig. 1). The hips are then lowered until they are parallel to the ground and then jumped up strongly at this point. It falls again after 1 second after falling onto two legs), jump to box (Legs are opened at the width of the hips and the body is leaning towards the box. Half-crouching and jumping into the box without waiting), lateral jump to box (Legs are opened at the width of the hips and the body is standing with the lateral facing towards the box. Half-crouched and jumping into the box without waiting. After landing in the box, take a step back down and move again), bounding with rings (It is descended into the rings arranged on the ground by jumping forward with the right and left feet respectively), box drill with rings (Starting from the half-crouching position, the double legs are jumping on adjacent lined rings, two forward and two rearward. Then

the one in front of it, the one next to it and the one behind it. The time remaining on the ground is kept as short as possible), lateral hurdle jumps (The legs are opened at the hip width and stand on the side of the box. From the half-crouched position, jump up and sideways to the side of the box and return to the starting position without waiting), split squat jump (Switch to the Lunge position. Jump from here with all the force and change the foot in the air to get back to the lunge position), tuck jump (The legs are shoulder-wide, the knees are slightly bent and then the whole force is jumped up and the knees are pulled to the chest, lateral box push offs (When one foot is on top of the box, use the leg on the ground to jump as much as possible and change feet in the air to descend so that the other foot is on top of the box and the movement is repeated), zig zag hops (Moving over a straight line of about 60 centimeters, bouncing forward and sideways with two feet and jumping left and right), single leg lateral hops (A straight and approximately 60 centimeter line is used to jump forward and sideways with one foot and jump left and right. After the set is finished, jump with the other foot) (Fig. 1).

Blood Flow Restriction Training (fig. 2).

Figure 2. Blood Flow Restriction Trainings

The tire is placed on the proximal part of thigh, and then the athletes performed the movements in 12 repetitions and 3 sets. BFR trainings consist of **squat** (Participants stand tall with their back straight, feet a little more than hip-width apart and in a straight line about 5-20 degrees. They look straight ahead, keep their back straight. They push the buttocks out, start bending knees and look straight ahead. Then they sit down with their body weight on the heels, hold this pose for 3 seconds and start getting back up), **forward lunge** (Participants stand tall with feet hip-width apart. They take a big step forward with right leg, start to shift their weight forward so heel hits the floor first. Lower their body until right thigh is parallel to the floor and right shin is vertical. They press into right heel to drive back up to starting position. They repeat the lunge on the other side) and **reverse lunge** (Participants take a large step backward with the left foot. Lower their hips so that the right thigh (front leg) becomes parallel to the floor with the right knee positioned directly over your ankle. Left knee should be bent at a 90-degree angle and pointing toward the floor with the left heel lifted. They return to standing by pressing the right heel into the floor and bringing left leg forward to complete one repetition (Fig. 2).

Statistical Analysis

For statistical analysis, firstly normality test was applied and then descriptive statistics and Mann Whitney U for gender differences. Also, Wilcoxon Signed rank tests were used for training group differences.

Results

The descriptive statistics of three groups were given in the Table 1. Then, Mann Whitney U test was conducted to compare the pre-test post test gender differences (Table 2). According to the results there wasn't any statistically

Table 1. Descriptive Statistics

Gender	Groups		N	Mean	Std. Deviation
		PL Pre-test	5	297.58	76.20
	Pliometric	PL Post-test	5	311.06	88.95
		Training Year	5	3.60	0.89
		PL Pre-test	3	164.50	6.51
Female	BFR	PL Post-test	3	163.47	16.13
		Training Year	3	6.00	3.00
		PL Pre-test	4	309.78	20.29
	Control	PL Post-test	4	309.38	29.05
		Training Year	4	4.00	1.41
		PL Pre-test	5	329.78	56.12
	Pliometric	PL Post-test	5	315.34	36.88
		Training Year	5	4.80	0.84
		PL Pre-test	8	240.53	72.68
Male	**BFR**	PL Post-test	8	202.14	53.61
		Training Year	8	5.88	3.23
		PL Pre-test	6	233.75	65.45
	Control	PL Post-test	6	267.87	53.17
		Training Year	6	4.67	2.34

Note. BFR=Blood Flow Restriction, PL=Perimeter Length

significant difference in terms of gender (p>.05).

The Wilcoxon Signed Rank test evaluated for three groups to show pre-test, post-test perimeter length difference (Table 3). There was statistically significant difference on dynamic balance ability in blood flow restriction groups (p<.05). Perimeter Length scores for the female blood flow restriction group is 163.47±16.13, whereas it is 202.14±53.61 for the males. This difference indicate that female participants have better dynamic balance results. There wasn't any difference in dynamic balance of plyometric training and control group pre-post test results (Table 3, fig. 3).

The mean values according to gender and research groups were given in Table 1. Female participants had better PL Post test mean values than male participants except control group (Table 1.). There was any statistically significant difference in Pre-Post test results for dynamic balance variable according to gender (Table 2). The BFR group post-test PL difference was statistically significant (Table 3). There weren't any statistically significant difference in plyometric and control groups according to Wilcoxon Signed Rank Test results.

Discussion

It is important that using effective dorsiflexion and plantar flexion in dollyo chagi and yopchagi techniques that the strength and balance ability work together. Therefore, different training methods that can improve antero-posterior sway are important for Taekwondo athletes. In this study, the difference between pre-test

Table 2. Dynamic Balance Ability According to Gender

PL	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-tailed)
PL Pre-test	111	301	-0.12	0.90
PL Post-test	96	286	-0.73	0.47

Note. PL=Perimeter Length

Table 3. Dynamic Balance According to Training Groups

Gruplar		n	$\bar{x}_{sira}$	$\sum_{sira}$	Z	p
Pliometric Group Pre Test-Post Test PL	Negative Rank	5[a]	5.6	28	-.051[a]	,959
	Positive Rank	5[b]	5.4	27		
	Equal	0[c]				
	Total	17				
BFR Group Pre Test-Post Test PL	Negative Rank	10[a]	6	60	-2.401[a]	**,016***
	Positive Rank	1[b]	6	6		
	Equal	0[c]				
	Total	15				
Control Group Pre Test-Post Test PL	Negative Rank	3[a]	5.67	17	-1.070[b]	,285
	Positive Rank	7[b]	5.43	38		
	Equal	0[c]				
	Total	10				

a pl2 < pl1; b pl2 > pl1; c pl2 = pl1

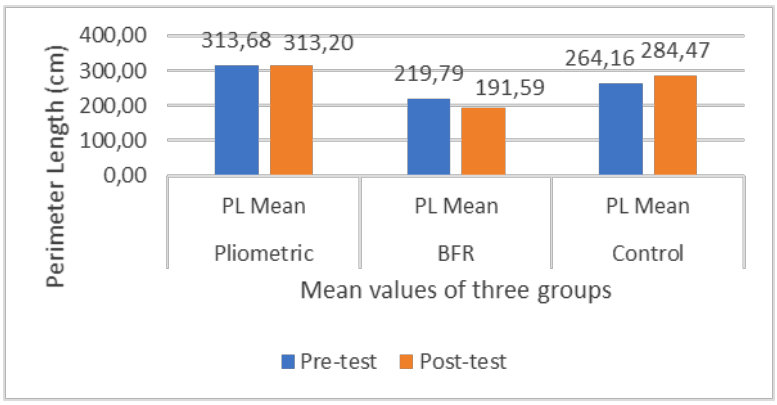


Figure 3. Pre-test Post-test Perimeter Length Differences

and post-test values of BFR group's dynamic balance was found to be statistically different (Table 3, Fig.3). No gender differentiation was observed (Table 1, Table 2). There are studies that support BFR training effect on increasing the amount of circulating growth hormone [12, 14, 18]. This may enhance lipolysis and bone formation, resulting in improving strength and inducing hypertrophy of muscle [19]. Abe et.al. reported that skeletal muscle hypertrophy and strength gain occurred even after two weeks of LIT-Kaatsu training. It also produced increases in skeletal muscle size (7-8%) that were similar in magnitude to traditional training of 3-4 months [20]. Similarly, eyes open and closed balance performance was better than peers in taekwondo players who participate low level 4 hours per week TKD training [3]. There are studies reporting that BFR improves strengthThe first two weeks of strength gain are associated with neuromuscular muscle conduction. Therefore, it is assumed that force development has an effect on balance development. Luebbers et al. reported that strength gain was higher in Kaatsu group and blood flow restriction bands on the knees are recommended to trainers [21].

In this study we measured dynamic balance ability for antero-posterior sway and there was no statistically significant difference on dynamic balance ability after plyometric training program (Table 3.). Similar to this study Benis et al. observed that national female basketball players enhanced their scores on the Y balance test in both postero-medial and postero-lateral but not in the anterior plane following 8 weeks of biweekly body-weight neuromuscular training [22]. But in contrast to this study Cherni et al. reported significant improvement in the ability of static and dynamic postural control after 8 week plyometric training program [23]. Also, Myer et al. reported that after 7 week of plyometric training high school female volleyball players decreased their medio-lateral center of pressure, despite the absence of change in the antero-posterior center of pressure [24].

Taekwondo athletes use strength and balance ability for rapid kicking and change direction, these motor abilities are important for success. As a conclusion, based on the research findings; it is recommended that BFR method can be useful and useable in taekwondo training programs.

Conclusions

Important and necessary strength in body balance required in taekwondo is practiced with different techniques in the literature. The first two weeks of strength gain is affected by neuromuscular muscle harmony. Therefore, the balance development that occurs in the strength training is important. Traditional strength exercise involves training with 80% of a repetitive maximal force. Therefore, a long time is required in the training period. However, Plyometric and BFR workouts are applied for a short time with lower intensity rates. Plyometric training method, on the other hand, contributes to the explosive strength gain. BFR method can be applied for only 10 minutes. In this study, the BFR training performed with a 20% intensity force that was not used before in the taekwondo and the balance gains in traditional plyometric training were investigated. As a result, bfr training with low intensity positively affected the dynamic balance. In our study, balance development was observed as a result of plyometric training, but it was not statistically significant. Therefore, bfr trainings are recommended in taekwondo branch in order to ensure dynamic balance development as well as strength enhancement.

Conflicts of Interest

The authors state no conflicts of interest.

References

1. Lystad RP, Pollard H, Graham PL. Epidemiology of injuries in competition taekwondo: A meta-analysis of observational studies. *Journal of Science and Medicine in Sport*. 2009; 12(6): 614-621. https://doi.org/10.1016/j.jsams.2008.09.013
2. Taekwondo PW. In: Kordi R, Maffulli N, Wroble RR, editors. *Combat sports medicine.* [chapter 15] London: Springer Science; 2009.
3. Leong HT, Fu SN, Ng GY, Tsang WW. Low-level Taekwondo practitioners have better somatosensory organisation in standing balance than sedentary people. *European journal of applied physiology*. 2011; 111(8): 1787-1793. https://doi.org/10.1007/s00421-010-1798-7
4. Jagiello W. Differentiation of the body composition in taekwondo-ITF competitors of the men's Polish national team and direct based athletes. *Archives of Budo*. 2015;11:329-338.
5. Fong SS, Fu SN, Ng GY. Taekwondo training speeds up the development of balance and sensory functions in young adolescents. *Journal of Science and Medicine in Sport*. 2012; 15(1): 64-68. https://doi.org/10.1016/j.jsams.2011.06.001
6. Kalina RM, Jagiello W, Barczynski BJ. The method to evaluate the body balance disturbation tolerance skills-validation procedure of the 'Rotational Test'. *Archives of Budo*. 2013;9(1):59-80. https://doi.org/10.12659/aob.889208
7. Bompa TO. *Sporda çabuk kuvvet antrenmanı* [Quick strength training in sports]. Ankara: Bağırgan Yayımevi; 2001. (In Turkish)
8. Foran B. *High Performance Sports Conditioning.* Human Kinetics; 2001.
9. Matavulj D, Kukolj M, Ugarkovic D, Tihanyi J, Jaric S. Effects of plyometric training on jumping performance in junior basketball players. *Journal of Sports Medicine and Physical Fitness*. 2001; 2: 41-45.
10. Reyment CM, Bonis ME, Lundquist JC, Tice BS. Effects of a four week plyometric training program on measurements of power in male collegiate hockey players. *J. Undergrad. Kin. Res*. 2006; 1(2): 44-62.
11. Atacan B. *Effect of an 8-week specially arranged plyometric training on the power and agility of young male soccer players*. [Master Thesis]. Kırıkkale University, Health Sciences Institute, Department of Physical Education and Sports, Kırıkkale; 2010.

12. Takarada Y, Nakamura Y, Aruga S, Onda T, Miyazaki S, Ishii N. Rapid increase in plasma growth hormone after low-intensity resistance exercise with vascular occlusion. *Journal of Applied Physiology*. 2000 [cited 2000; 88(1): 61-65. https://doi.org/10.1152/jappl.2000.88.1.61
13. Fujita T, Brechue WF, Kurita K, Sato Y, Abe T. Increased muscle volume and strength following six days of low-intensity resistance training with restricted muscle blood flow. *Int J KAATSU Train Res*. 2008; 4: 1–8. https://doi.org/10.3806/ijktr.4.1
14. Sato Y. The history and future of KAATSU training. *International Journal of KAATSU Training Research,* 2005; 1(1): 1-5. https://doi.org/10.3806/ijktr.1.1
15. Abe T, Kearns CF, Sato Y. Muscle size and strength are increased following walk training with restricted venous blood flow from the leg muscle, KAATSU-walk training. *J Appl Physiol,* 2006; 100: 1460-1466. https://doi.org/10.1152/japplphysiol.01267.2005
16. Luebbers PE, Witte EV, Oshel JQ, Butler MS. Effects of practical blood flow restriction training on adolescent lower-body strength. *The Journal of Strength & Conditioning Research*, 2019; 33(10): 2674-2683. doi: 10.1519/JSC.0000000000002302
17. Nakajima T, Takano H, Kurano M, Iida H, Kubota N, Yasuda T. et al. Effects of KAATSU training on haemostasis in healthy subjects. *International Journal of KAATSU Training Research*, 2007; 3(1): 11-20. https://doi.org/10.3806/ijktr.3.11
18. Takano T, Ohe Y, Sakamoto H, Tsuta K, Matsuno Y, Tateishi U. et al. Epidermal growth factor receptor gene mutations and increased copy numbers predict gefitinib sensitivity in patients with recurrent non–small-cell lung cancer. *Journal of Clinical Oncology,* 2005; 23(28): 6829-6837. https://doi.org/10.1200/JCO.2005.01.0793
19. Beekly MD, Sato Y, Abe T. KAATSU-walk training increases serum bone-spesific alkaline phosphatase in young men. *Int. J. KAATSU Training Res*, 2005; 1:77-81. https://doi.org/10.3806/ijktr.1.77
20. Abe T, Yasuda T, Midorikawa T, Sato Y, Inoue K, Koizumi K, Ishii N. Skeletal muscle size and circulating IGF-1 are increased after two weeks of twice daily "KAATSU" resistance training. *International Journal of KAATSU Training Research,* 2005; 1(1): 6-12. https://doi.org/10.3806/ijktr.1.6
21. Luebbers PE, Fry AC, Kriley LM, Butler MS. The effects of a 7-week practical blood flow restriction program on well-trained collegiate athletes. *The Journal of Strength & Conditioning Research*, 2014; 28(8): 2270-2280. https://doi.org/10.1519/JSC.0000000000000385
22. Benis R, Bonato M, Torre AL. Elite female basketball players' body-weight neuromuscular training and performance on the Y-balance test. *Journal of athletic training,* 2016; 51(9): 688-695. https://doi.org/10.4085/1062-6050-51.12.03
23. Cherni Y, Jelid MC, Mehrez H, Shephard RJ, Paillard TP, Chelly MS, Hermassi S. Eight weeks of plyometric training improves ability to change direction and dynamic postural control in female basketball players. *Frontiers in Physiology*, 2019; 10: 726. https://doi.org/10.3389/fphys.2019.00726
24. Myer GD, Ford KR, McLea SG, Hewett TE. The effects of plyometric versus dynamic stabilization and balance training on lower extremity biomechanics. *The American journal of sports medicine*, 2006; 34(3): 445-455. https://doi.org/10.1177/0363546505281241

Information about the authors:

Manolya Akin; Assoc. Prof.; https://orcid.org/0000-0002-2101-073X; manolya66@gmail.com; Faculty of Sport Sciences, Department of Physical Education and Sports, Mersin University; Mersin 33343, Mersin, Turkey.

İnci Kesilmiş; (Corresponding Author); Assist. Prof.; https://orcid.org/0000-0002-2382-2205; incikesilmis@osmaniye.edu.tr; School of Physical Education and Sports, Osmaniye Korkut Ata University; Osmaniye, Turkey.

Cite this article as:
Manolya Akin, İnci Kesilmiş. The effect of blood flow restriction and plyometric training methods on dynamic balance of Taekwondo athletes. *Pedagogy of physical culture and sports*, 2020;24(4):157-162.
https://doi.org/10.15561/26649837.2020.0401

This is an Open Access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited (http://creativecommons.org/licenses/by/4.0/deed.en).

Received: 17.12.2019
Accepted: 12.01.2020; Published: 30.08.2020

2020
04

ORIGINAL ARTICLE

Comparing the hand grip power and creatine kinase levels of U-17 judo national team athletes before and after a 6-week strength training

Nuri M. Çelik[1ABCDE], Mehmet Soyal[2ABCDE]

[1]*Batman University, Batman, Turkey*
[2]*Istanbul Gelisim University, Istanbul, Turkey*

Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection.

Abstract

Purpose: The aim of this study is to compare the hand grip power and creatine kinase levels of male and female U-17 National Team Athletes before and after a 6-week strength training.

Material: 15 female and 15 male U-17 athletes, who previously participated in international competitions, participated in our study. Besides the hand grip power and creatine kinase values, age, height, weight, and BMI (body mass index) values of the athletes were measured before and after the training. As the conclusion of the measurements, the mean age of the female participant athletes was determined as 14,93 years, their mean height was 158,3 cm, and the mean age of the male athletes was 15,73 years, while their mean height was 173,1 cm.

Results: As the conclusion of the measurements, it was determined that there were statistically significant differences between the right hand grip power and left hand grip power parameters of male and female participant athletes measured before and after the 6-week training. Moreover, it was determined that there were statistically significant differences between the pre-test and post-test measurements of creatine kinase values of both male and female athletes ($p > 0,05$).

Conclusions: As the conclusion, it was determined that the 6-week strength trainings applied to U-17 Judo National Team athletes caused significant changes in their hand grip power and creatine kinase values. The significant results obtained from our study are considered to be originated from the duration, scope, frequency, severity, and content of the training.

Keywords: training, judo, creatine kinase, hand grip power.

Introduction

In our age, sports has become an educational tool as well as a lifestyle for human beings. It can be performed in each level of society and conducted in different levels. Many motives have emerged encouraging people to sport. Some of these are popularity, financial gain, opportunity to be recognized in one's country and worldwide, and to become mediatic. Sports is now seen as a professional means of financial gain rather than a recreational activity.

The impact of strength on success in all sports branches is accepted by everyone. In particular, the quality and quantity of strength in the weight sports is gaining more importance. Nowadays, the evaluation of strength and strong athletes is employed in proportion to the strength the athletes produce per body weight as well as by their body structures [1, 2, 3].

Judo, among the weight sports, is one of the branches in which the highest importance attributed to the strength produced per body weight. The body parts also need to have sufficient level of muscle strength for movement skills and techniques applied in sports branches. Since the isometric strength development is particularly based on branch, it is expected to be better in judo players. The general strength development of a judo player is the isometric strength. The isometric strength of hand, finger, and forearm muscles are measured through a dynamometer.

Since in weight sports, particularly in Judo branch, it is needed to apply techniques by holding the collars and cloth of the opponent, isometric strength is quite important. The higher a Judo player has isometric strength, in other words hand grip power, the higher becomes one's technique capacity, thus, the higher one's probability to win the competition. Even, for this reason, kumi-kata trainings are implemented particular to Judo and directly proportional with hand grip power.

Strength.

The strength, from a biological standpoint, is defined as the ability to move a mass, to overcome a resistance or to influence it with muscle function. Muscle strength is closely related to the environmental factors such as nervous system, endocrine system, age and gender [4]. Without the general strength, the development of other strength units, especially the special strength, will not be at the desired level. A low level of general strength is the most important factor that restricts the entire development of the athlete. The general strength is the strength of all muscles without particular tendency to any sports branch and it is the basis of the entire strength program [5].

The special strength is the strength that is particular to any sport branch [6]. The strength has a different meaning for each other branch. Therefore, comparing the strength

© Nuri M. Çelik, Mehmet Soyal, 2020
doi:10.15561/26649837.2020.0402

levels of athletes in different sports branches is an invalid approach. The special strength must be developed up to the highest level and combined with other motoric features in a gradual manner towards the end of the preparatory phase for all elite athletes [7].

Pure strength is the highest strength that an athlete can apply without considering one's body weight [6]. Relative strength is the result obtained through dividing the pure strength by the body weight, which is a parameter of the strength measurement. The relative strength is the highest possible strength that an athlete can develop against one's own body weight [8].

Isometric strength; when the muscles remain motionless during muscle contraction and having no change in the neck during contraction is a static force and no movement is observed in the joints.

A comprehensive investigation over the physical and physiological characteristics of athletes will provide great improvements in sports particularly in terms of science of training. In addition, it is necessary to be at high levels in terms of both technical and motoric features. In Judo, particularly because of the techniques of holding the opponent with bare hands, having a high hand grip power becomes an advantage for the athlete. All of these hand grip techniques are called as kumi-kata and it progresses in line with the hand grip power. The stronger the athlete has the hand grip power, the stronger and better one can implement the kumi-kata and get an edge over the opponent.

What is Creatine Kinase?

The basic motoric features of human are the elements determining the strength skill of the body and mixed sports performance degree [9].

Judo is a far eastern sport that requires athletes to have a high level of personal skill, technical-tactical knowledge as well as certain physical and physiological parameters to reach the level of success. Therefore, the main goal of Judo training is to ensure that athletes achieve their highest performance. Today, Judo, which is one of the most common branches in the world, relies on the development of basic motoric properties such as endurance, speed, mobility, coordination, and particularly on general strength and the strength particular to Judo.

Muscle damage is an acute condition that causes fatigue, loss of function, loss of strength and pain in muscles as a result of unconventional and intense exercise [10]. The metabolic damage to the muscle occurs during the submaximal operation, which is conducted up to prolonged exhaustion [10]. When there is muscle damage, the activity of Creatine Kinase (CK) increases, which is the intracellular enzyme in plasma and serum. Creatine kinase, which is an indicator of muscle damage, also increases after exercise [10, 11]. In particular, the direct loading on muscle can cause damage to muscle, and this metabolic change may further aggravate the damage [12]. In previous studies, it was determined that unusual eccentric contractions caused exercise-induced muscle damage [13, 14]. It was revealed that eccentric and concentric contractions lead to muscle damage, but majority of muscle damages were generated from eccentric exercise based on the muscular structure [12, 15]. The pre-training of the muscle is one of the factors preventing the occurrence of exercise damage. It is observed that the high serum CK levels reached right after the first exercise are decreased in pre-trained athletes. This is interpreted as the exercise adaptation of the muscles and as an indication of the physical fitness level of the athlete [16].

After repeated exercise practices, rapid recovery in the strength, smaller limitation of joint range of motion, decreased muscle edema and pain, and fewer abnormalities in MRI and ultrasound imaging are observed [17]. It was reported that the first severe eccentric exercise will prevent, for a month, the damage possibly arising from further severe eccentric exercises [18]. If the body is engaged in a constant struggle with a careful and progressive approach, adaptations will be observed and the body will become stronger [19]. It is observed that regular strength trainings cause an increase in muscle endurance, muscle mass, and muscle strength in young athletes, while decreasing [20].

The aim of this study is to compare the hand grip power and creatine kinase levels of male and female U-17 National Team Athletes before and after a 6-week strength training.

Material and Methods

Participants.

15 female and 15 male U-17 athletes, who previously participated in international competitions, participated in our study. Besides the hand grip power and creatine kinase values, the age, height, weight, and BMI (body mass index) values of the athletes were measured before and after the training. As the conclusion of the measurements, the mean age of the female participant athletes was determined as 14,93 years, their mean height was 158,3 cm, and the mean age of the male athletes was 15,73 years, while their mean height was 173,1 cm.

Research Design.

The height and weight measurements of the participant athletes were conducted through a tape with 1 cm sensitivity and an electronic scale. Subsequently, the maximum hand grip power measurements of the participant athletes were employed through a hand dynamometer adjusted to the hand size, starting from the dominant hand while the athlete was standing upright and the arm straight making a 10-15 degree angle on the side. Two measurements were employed for each subject and the better one was recorded. Creatine kinase measurements of the participant athletes were analyzed in Selçuk University Medical Faculty Hospital Laboratory. These measurements were repeated in the same way after the 6-week strength training and all measurements were recorded.

The Training Program.

The strength trainings were applied 2 hours a day, 5 days a week, and totally for 6 weeks. For each movement of each athlete, 6 repeated maximals (6 RM) were employed, and the 6 RM was determined as one repetition in two weeks. All athletes conducted joggings, gymnastic

movements, and stretching exercises at sufficient level for warming up. 6 movements were determined for the athletes. The movements in the strength training were comprised of bench press (6 repetitions at the 50%, 75%, and 100% of the 6 RM, 3 sets), squat (6 repetitions at the 50%, 75%, and 100% of the 6 RM, 3 sets) military press (6 repetitions at the 50%, 75%, and 100% of the 6 RM, 3 sets), Barbell Shoulder Press (6 repetitions at the 50%, 75%, and 100% of the 6 RM, 3 sets) Barbell curl (6 repetitions at the 50%, 75%, and 100% of the 6 RM, 3 sets) and Pushdown (6 repetitions at the 50%, 75%, and 100% of the 6 RM, 3 sets).

Statistical Analysis.

The analysis of the data was conducted through the SPSS 22.0 package program. The results of the measurements were displayed as mean (X) and standard deviation (SD). In order to compare the data taken before and after the training concerning the hand grip power and creatine kinase, the paired t test was implemented for the dependent groups. The significance level was accepted as $p<0,05$.

Results

The height and weight figures of the participant athletes and their hand grip power values, which were measured before and after the 28-day training program, are summarized in the following tables.

When Table 1 was examined, the mean age of the males was observed as 15,73 years, and mean height figure was 173,13 cm. The mean age figure of the females was 14,93 years and mean height figure was 158,3 cm.

When Table 2 was examined, it was determined that there were statistically significant differences in the body weight (kg) and body mass index (BMI) parameters of the female Judo players ($p<0,05$), there was statistically significant difference in the body weight (kg) parameter

Table 1. The Demographical Properties of the Participant Females and Males

Variables	Gender	N	X	SD	min	max
Age	Female	15	14.93	1.22	13	17
	Male	15	15.73	0.96	14	17
Height	Female	15	158.3	5.42	151	167
	Male	15	173.13	7.83	154	184

Table 2. The Pre-test and Post-test Results of the Participant Females and Males Concerning the Weight and BMI (Body Mass Index)

Variables	Gender	Measurements	N	X	SD	t	P
Weight	Female	Pre-test	15	53.33	7.3	-5.55	0.00
		Post-test	15	56.6	7.16		
	Male	Pre-test	15	66.2	8.09	-3.05	0.009
		Post-test	15	67	7.71		
BMI (Pre-Post)	Female	Pre-test	15	21.81	3.92	-4.95	0.00
		Post-test	15	22.28	3.86		
	Male	Pre-test	15	22.58	3.62	-2.82	0.14
		Post-test	15	22.83	3.59		

*p>0,05

Table 3. The Hand Grip Power Pre-test and Post-test Results of Participant Females and Males

Variables	Gender	Measurements	N	X	SD	t	p
Hand Grip Power	Males-right hand	Pre-test	15	29.73	2.15	-6.98	0.00
		Post-test		31.66	2.25		
	Males-left hand	Pre-test	15	29.06	2.31	-8.87	0.00
		Post-test		30.46	2.09		
Hand Grip Power	Females-right hand	Pre-test	15	24.86	2.26	-10.64	0.00
		Post-test		26.6	1.99		
	Females-left hand	Pre-test	15	23.73	1.98	-7.35	0.00
		Post-test		25.20	2.30		

*p>0,05

Table 4. The Creatine Kinase Pre-test and Post-test Results of Participant Females and Males

Variables	Gender	Measurements	N	X	SD	t	p
Creatine Kinase (CK) U/L	Female	Pre-test	15	158	1.07	-5.32	0.00
		Post-test		166	1.12		
	Male	Pre-test	15	176	1.04	-9.41	0.00
		Post-test		185	1.14		

*p>0,05

of the male Judo players, while there was statistically no significant difference in the body mass index (BMI) parameters of the male Judo players.

When Table 3 was examined, it was observed that there were statistically significant differences in the right hand grip power and left hand grip power parameters of females, and right hand grip power and left hand grip power parameters of males (P<0,05).

When Table 4 was examined, it was determined that there were statistically significant differences in the pre-test and post-test creatine kinase parameters of females and males (P<0,05).

Discussion

In this study, it was determined that there were statistically significant differences in hand grip power and creatine kinase values of the participant athletes measured before and after the 6-week strength training.

Considering the previous studies in the literature.

In a study conducted to examine the impact of an 8-week quick power training implemented to the junior wrestlers, [21] determined statistically significant differences concerning the pre-test and post-test values of right hand grip power, and similarly, statistically significant differences were determined concerning the pre-post test figures of left hand grip power.

In studies conducted by [22-25], it was determined that there were statistically significant decreases in the pre-test and post-test values of CK levels. It was concluded that these decreases were because of the adaptation of athletes to exercises [26] reported that there was statistically significant increase in the CK levels in the maximal strength trainings, and. [27] determined that there were statistically significant increases in the CK levels of 17 male beach handball players after competition. [28] determined that there was a high increase in the CK level just after a high-performance bicycle competition.

In a study conducted by [29] on 235 male athletes in the English Olympic team, it was determined that there was a statistically significant increase in the CK level 6 hours after the exercise. Anugweje and [30] concluded that the CK levels of athletes significantly increased after training, additionally, in their study conducted on basketball players, they determined that there were statistically significant increases in the CK and CKMB values after a 2-hour basketball training. Following a ski and bicycle competition, [31] determined that the post-competition CK levels of 16 athletes increased 7 times higher than those of before the competition.

There are studies in the literature conducted on the impacts of muscle damage on the athletic performance [32-36]. In a study conducted by [33] individuals conducted 100 deep jumps so that muscle damage was created. Following the muscle damage, they detected peak increases at the 48th hour in 5 m and 10 m sprint time values and agility test values. Additionally, they determined significant decreases at the 24th and 48th hours in the isokinetic torque. As the conclusion of this study, it was determined that the muscle damage created after 100 deep jumps influenced the sprint time values negatively.

In a study conducted by [37] study with 15 male football players. They applied the sprint protocol that created football-specific muscle damage to the subjects. Muscle pain, joint range of motion, muscle strength, CK and lactat dehydrogenase enzyme values as indicators of muscle damage; measured physical performance, speed, quickness, power and static and dynamic balance values before the sprint protocol (normal value) and after 24, 48, 72 hours. According to the research findings Muscle pain, CK and lactate values were significantly higher compared to normal values. In addition, the subjects' speed, quickness, strength and balance values were adversely affected by the application of the sprint protocol that was specific to create muscle damage.

In another the study [38] where they performed 45 minutes of eccentric bicycle exercise in untrained male individuals with training long-distance runners, they showed that CK values measured 5 days after the exercise reached the peak level and returned to basal level in 9 days compared to the rest level. On the contrary, they stated that the CK values of the athletes increased twice by one day after the exercise and returned to normal after 2 days.

Although, in the literature, there are cases with occasional decreases and significant differences in the CK levels based on the duration of the training and adaptation, in our study, it is considered that the CK levels increased based on the content and frequency of the training.

Conclusion

As the conclusion, when the pre-test and post-test hand grip power and creatine kinase values of the participant athletes were examined, it was determined that there were statistically significant differences. It is considered that the significant differences obtained in our study are based on the duration, scope, frequency, severity, and content of

the trainings.

Conflicts of Interest

The authors state no conflicts of interest.

References

1. Castro MJ, Et All. Peak Torqueper Unıt Cross-Sectional Area Differs Between Strenght-Trained And Untrained Young Adults, *Med.Sports Exerc*. 1995;27: 397. https://doi.org/10.1249/00005768-199503000-00016
2. Winter EM, And Maughan RJ. Strenght And Cross-Sectional Area Of The Quadriceps, In Men and Women, *Journal of Physiology-London*. 1991; 438:175.
3. Petrov R. *Perfertionnenement De La Maitrise Technico-Tactigue De Lutteur Medicinai Fizkultura* [Improving the technical and tactical skills of a fighter of medical physical education]. Sofia; 1978. (In French)
4. Blimkie CJR. Resistance Training During Prand Early Puberty: Efficacy, Trainability, Mechanisms and Persistance. *Journal canadien des sciences du sport*; 1992; 17-14: 264-267.
5. Fidelus K, Kocjasz J. *Biomechanizma Analiza Podstawy* [Biomechanism Basics Analysis]. 1965. (In Polish)
6. Sevim Y. *Kondisyon Antrenmanı*. [Fitness training]. Ankara: Gazi Office Bookstore; 1991. (In Turkısh)
7. Bulca Y. Ritmik Jimnastikte Esnekliğin Geliştirilmesi. [Improving Flexibility in Rhythmic Gymnastics] *Jimnastik Federasyonu Dergisi,* 2000;1: 13-14. (In Turkısh)
8. Muratlı S. *Antrenman ve istasyon Çalışmaları,* [Training and Station Studies]. Ankara: Pars Printing House; 1976. (In Turkısh)
9. Sevim Y. *Basketbolda Kondisyon Antrenmanı* [Fitness Training in Basketball]. Ankara: Nobel Yayın Dağıtım; 2003.(In Turkısh)
10. Clarkson PM, Hubal MJ.Exerciseinduced muscle damage in humans. *American Journal of Physical Medicine and Rehabilitation*, 2002; 81(11): 252- 269. https://doi.org/10.1097/00002060-200211001-00007
11. Güzel NA, Eler S. Bir Müsabaka Süresinde Elit Erkek Plaj Hentbol Oyuncularının Kan Glikoz, Laktak ve Kreatin Kinaz Düzeylerindeki Değişimler [Changes in Blood Glucose, Lactak and Creatine Kinase Levels of Elite Male Beach Handball Players During a Competition]. *Fizyoterapi rehabilitasyon Dergisi*. 2003;14(1):23-27. (In Turkısh)
12. Bompa T, Pasqual MD, Cornacchia L. *Nitelikli Kuvvet Antrenmanı* [Qualified Strength Training]. Ankara: Spor Publishing House and Bookstore; 2014. (In Turkısh)
13. Lavender AP, Nosaka K. A light load eccentric exercise confers protection against a subsequent bout of more demanding eccentric exercise. *Journal Science and Medicine in Sport*, 2008;11(3): 291- 298. https://doi.org/10.1016/j.jsams.2007.03.005
14. Proske U, Allen TJ. Damage to skeletal muscle from eccentric exercise. *Exercise and Sport Sciences Reviews*. 2005; 33(2): 98- 104. https://doi.org/10.1097/00003677-200504000-00007
15. Seifert JG, Kipp RW, Amann M, Gazal O. Muscle damage, fluid ingestion and energy supplementation during recreational alpine skiing. *International Journal of Sport Nutrition and Exercise Metabolism*. 2005;15(5): 528- 536. https://doi.org/10.1123/ijsnem.15.5.528
16. Lastayo PC, Woolf JM, Lewek MD, Mackler LS, Reich T, Lindstedt SL. Eccentric Muscle Contractions: Their Contribution to Injury, Prevention, Rehabilitation, and Sport. *Journal of Orthopaedic & Sports Physical Therapy.* 2003; 33 (10): 557- 572. https://doi.org/10.2519/jospt.2003.33.10.557
17. Nosaka K, Sakamoto K, Newton M, Sacco P. The repeated bout of reduced load eccentric exercise on elbow flexor muscle damage. *European Journal of Applied Physiology*. 2001; 85: 34-40.
18. Armstrong RB, Warren GL, Warren JA. Mechanisms of exercise induced muscle fiber injury. *Sports Medicine* 1991;12(3): 184- 207. https://doi.org/10.2165/00007256-199112030-00004
19. Dündar U. *Basketbolda Kondisyon* [Conditioning in Basketball]. Ankara: Nobel Yayın Dağıtım; 2004. (In Turkısh)
20. Çetinkaya V, Yalçıner M. 8 haftalık intensif kuvvet çalışmalarının 14-16 yaş grubu bireylerde bazı fiziksel ve fizyolojik parametrelere etkisi [The effect of 8-week intensive force studies on some physical and physiological parameters in individuals aged 14-16]. *Spor Bilimleri Kongresi,* 200;48. (In Turkısh)
21. Kılıç R. Dairesel çabuk kuvvet antrenmanının 14-16 yaş grubu erkek grubu erkek güreşçilerin bazı özelliklerine etkisi [The effect of circular quick strength training on some characteristics of 14-16 age group male group male wrestlers] [Master Thesis], Ankara: Gazi University Institute of Health Sciences; 1993. (In Turkey)
22. Handziski Z, Maleska V, Dejanova B, Nikolik S, Handziska E, Dalip M. Changes ın plasma creatine kinase and free radicals ın professional soccer players throughout a half-season. *Spor Hekimliği Dergisi.* 2006; 41: 1-8.
23. Koga T, Umeda T, Kojima A. Influence of a 3 month training program on muscular damage and neutrophil function in male university freshman judoists. *The Journal of Biological and Chemical Luminescence*, 2013; 28(2): 136- 142. https://doi.org/10.1002/bio.2352
24. Okan İ, Savaş S, Şenel Ö, Çimen O, Aksu ML. Effect of speed training upon the blood parameters young male soccer players. *Ovidius University Annals, Series Physical Education and Sport*, 2010; 10(1). 44.(In Turkısh)
25. Wozniak EH, Lutoslawska G, Kusior A, Gajewski J. The effect of training on the activity of creatine kinase (CK) and lactate dehydrogenase (LDH) and acid concentration in plasma of elite boxers. *Human Movement*. 2004; 5(2): 89-94 (In Turkısh)
26. Hazar S, Erol E, Gökdemir K. Kuvvet antrenmanı sonrası oluşan kas ağrısının kas hasarıyla ilişkisi. [Relationship between muscle pain and muscle damage after strength training] *Gazi Üniversitesi Beden Eğitimi ve Spor Bilimleri Dergisi*. 2006; 11 (3): 49-58. (In Turkısh)
27. Güzel NA, Eler S. Bir müsabaka süresinde elit erkek plaj hentbol oyuncularının kan glikoz, laktat ve kreatin kinaz düzeylerindeki değişimler [Changes in elite male beach handball players' blood glucose, lactate and creatine kinase levels during a competition]. *Fizyoterapi Rehabilitasyon Dergisi*. 2003; 14 (1): 23-27. (In Turkısh)
28. Bircher S, Enggist A, Jehle T, Knechtle BEffect of an extreme endurance race on energy balance and body composition, *Journal of Sports Science and Medicine*, 2006; 5:154-162.
29. Robinson D, Williams PT, Worthing PT, Worthington DJ, Carter TJ. Raised creatine kinase activity and presence of creatine kinase mb isoenzyme after

exercise. *British Medical Journal*. 1982;4: 1619- 1620. https://doi.org/10.1136/bmj.285.6355.1619
30. Anugweje KC, Okonko IO. Effect of training on the serum Creatine Kinase (CK) levels of athletes. *Nature and Science*; 2012; 10 (9): 180-185.
31. Suarez VC, Valdivielso FN, Rave, JMG. Changes in biochemical parameters after a 20 hour ultra endurance kayak and cycling event. *Intrenational Sport Medicine Journal*, 2011; 12(1): 1-6.
32. Twist C, Eston R. The effects of exercise-induced muscle damage on maximal intensity intermittent exercise performance. *Eur J Appl Physiol*, 2005; 94: 652- 658. https://doi.org/10.1007/s00421-005-1357-9
33. Highton MJ, Twist C, Eston R. The effects of exercise-ınduced muscle damage on agility and sprint running performance. *Journal of Exercise Science and Fitness*. 2009; 7(1): 24- 30. https://doi.org/10.1016/S1728-869X(09)60004-6
34. Nguyen D, Brown LE, Coburn JW, et al. Effect of delayed-onset muscle soreness on elbow flexion strength and rate of velocity development. *The Journal of Strength & ConditioningResearch*. 2009;23(4): 1282- 1286. https://doi.org/10.1519/JSC.0b013e3181970017
35. Burt DG, Twist C.The effects of exercise-induced muscle damage on cycling time-trial performance. *The Journal of Strength & Conditioning Research*. 2011; 25: 2185- 2192. https://doi.org/10.1519/JSC.0b013e3181e86148
36. Akdeniz Ş, Karlı Ü, Daşdemir T. Impact of exercise induced muscle damage on sprint and agility performance. *Nigde University Journal of Physical Education and Sport Sciences*. 2012; 6(2):152-160. (In Turkısh)
37. Khan MA, Moiz JA, Raza S, Verma S, Shareef MY, Anwer S, et al. Physical and balance performance following exercise induced muscle damage in male soccer players. *J Phys Ther Sci*, 2016;28:2942–9. https://doi.org/10.1589/jpts.28.2942
38. Evans WJ, Meredith CN, Cannon JG, Dınarrllo CA, Frontera WR, Hughes VA, et al. Metabolic changes following eccentric exercise in trained and untrained men. *J Appl Physiol.* 1986; 61(5), 1864- 1868. https://doi.org/10.1152/jappl.1986.61.5.1864

Information about the authors:

Nuri M. Çelik; http://orcid.org/ 000-0001-6403-6262; nmcelik42@hotmail.com; School of Physical Education and Sports, Batman University, Batman, Turkey.

Mehmet Soyal; (Corresponding Author); http://orcid.org/ 000-0001-6528-0275; Mehmetsoyal3838@hotmail.com; School of Physical Education and Sports, Istanbul Gelisim University, Istanbul, Turkey.

Cite this article as:
Nuri M. Çelik, Mehmet Soyal. Comparing the hand grip power and creatine kinase levels of u-17 judo national team athletes before and after a 6-week strength training. *Pedagogy of physical culture and sports*, 2020;24(4):163-168. https://doi.org/10.15561/26649837.2020.0402

This is an Open Access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited (http://creativecommons.org/licenses/by/4.0/deed.en).

Received: 02.02.2020
Accepted: 09.03.2020; Published: 30.08.2020

2020
04

ORIGINAL ARTICLE

Acute effects of different stretching and warm up protocols on some anaerobic motoric tests, flexibility and balance in junior male judokas

Özgür Eken[1ABCDE], Mehmet Z. Özkol[2ABCD], Saadet R. Varol[2ABCD]

[1] *Inonu University, Malatya, Turkey*
[2] *Ege University, Izmir, Turkey*

Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection.

Abstract

Purpose: The aim of this study is to investigate acute effects of different warm-up and stretching protocols, on 30 m. sprint, flexibility, vertical jump, strength, balance and anaerobic power performances in junior male judokas.

Material: Twenty sub-elite 11-14 year old judokas who volunteered to participate in the study (age: 12,25±0,96 years; height: 1,52±0,11cm; body mass: 48,06±14,22 kg). This study consist of four different stretching and warm up protocols; without stretching (WS); static stretching (SS); dynamic warm up (DW); dynamic+static warm up (DSW).

Results: The effect of the four stretching and warm up protocols were analysed by an ANOVA for repeated measures (WS x SS x DW x DSW). After stretching and warm up protocols, 30 m. sprint values are statistically significance ($p<0.05$). There was find statistically significant between WS and DSW, SS and DW, DW and DSW ($p<0.05$). There were no significant difference is found on flexibility values between four stretching and warm up protocols ($p>0.05$). There was only significant difference is found between WS and SS ($p<0.05$). Altough leg strength performance wasn't statistically significant ($p>0.05$), there was found significant differences between WS and DSW, SS and DSW in favour of DSW ($p<0.05$). Other parameters like vertical jump, balance and back strength performance weren't statistically significant after four stretching and warm up protocols.

Conclusions: Consequently it is suggested for coaches and judokas that SS are required for developing flexibility performance and DSW can suggest for leg strength improvement.

Keywords: judo, performance, sprint, strength, vertical jump.

Introduction

Judo is a dynamic, physically demanding sport that requires complex skills and tactical excellence for success [1]. As judo athletes have to perform a great number of actions during each match, the physical demand of a single match is high. Typically, judo medalists perform five to seven matches during international competitions, with each match having a 4-minute time limit. If a judo athlete obtains an ippon (fullpoint), the match ends [2]. Although there is no clear scientific evidence, the use of stretching and warm up to improve performance is a common belief among coaches and athletes. Stretching is an integral part of the warm-up process and is placed between the general and specific warm-up prior to participation in training or competition [3]. Static stretching is commonly used because it has been reported to reduce muscle tension that causes increased range of motion and reduce the risk of injury on muscle tendon unite (MTU) [4]. Kay and Blazevich [5] reported that 60 s or more stretching are more likely to degrade performance and short-term stretching (30-45 s or less) have no detrimental effects. According to some researches, warm up protocol before training or competition has become one of the most important topics for coaches and practitioners and recent studies has shown some positive effects on performance [6, 7]. For decades, practitioners have prescribed warm ups to improve range of motion, decrease muscle soreness and enhance the performance of their athletes [7-10]. In addition, muscle temperature improves the efficiency of muscle glycolysis and high energy phosphate degradation during exercise, which may be from increasing the dependence on anaerobic metabolism and also markedly influence subsequent exercise performance via increases in adenosine triphosphate turnover, muscle cross bridge cycling rate and oxygen uptake kinetics, which enhance muscular function [11]. Besides, improved muscle temperature increases the transmission speed of nevre impulses and increases central-nervous-system function. Enhanced nervous-system function may be particularly critical for activities that require rapid reactions and complex body movements [12].

When we examine the literature, there are lots of studies about stretching and warm up protocols. In these studies different sports branches and different groups of subjects were examined [13- 15]. But there is only one study about warm up which include judokas performance [16]. In this study Lum [16] investigated the effect of various warm up protocol on judo specific fitness test performance. He found that during series one, number of throws performed in the upper and lower body PAP (ULB) and lower body (LB) were significantly greater

© Özgür Eken, Mehmet Z. Özkol, Saadet R. Varol, 2020
doi:10.15561/26649837.2020.0403

than usual competition (CON) ($p < 0.05$). Only ULB resulted in significantly greater number of total throws ($p < 0.01$) and higher peak power ($p < 0.01$) than CON. Both LB and ULB were significantly lower than CON ($p < 0.01$). Peak power was moderately correlated to total number of throws performed ($r=0.4$, $p < 0.05$). He suggest that performing ULB before SJFT can result in improved performance and peak power.

The importance of this study was to determine the effects of different stretching and warm up protocols on 30 m. sprint, flexibility, vertical jump, strength, balance and anaerobic power of male judokas aged 11-14 years. Other importance of this study included different warm up protocols like combine warm up (DSW). For this purpose, research hypotheses; (1) flexibility, 30 m. sprint, strength, balance and vertical jump would be affected by different stretching and warm up protocols, and (2) flexibility, 30 m. sprint and strength performance are expected to improve with DSW.

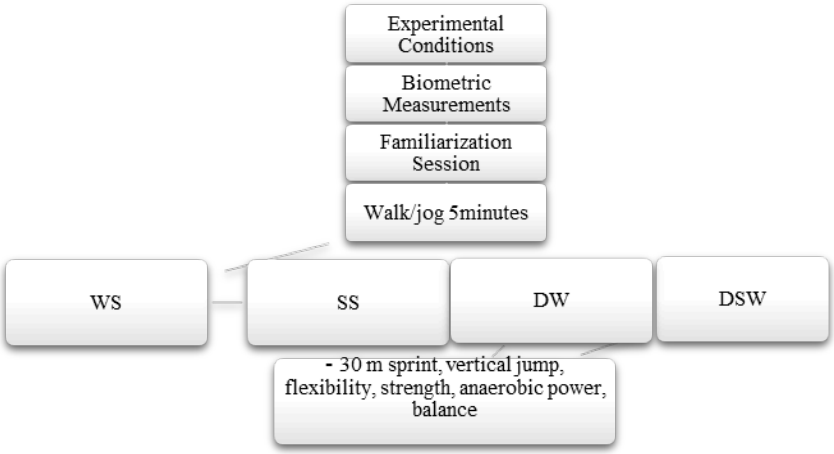
Material and Methods

Participants

Twenty healthy male active judokas who exercise three or five times in a week voluntarily attended to this research (age, 11-14 years; height, 152± ,11 cm; body mass, 48,06 ±14,22 kg). Judokas trained for more than two years. To be included in the study, the judokas should have had the following characteristics: (a) had at least 2 years of experience in the judo; (b) not have any functional limitation that could interfere in the tests performance; (c) not presented any medical condition that could influence the tests; (d) maintained their regular physical activity during the course of the study. Prior to participation, all subjects were briefed on the requirements and risks involved with the study. Parental consent was sought for subjects. The study started after the approval of the Research Ethics Committee of the institution (14-12.1/7).

Procedure

This study is available just one group in which was included 20 male judokas and there isn't any control group. Four different streching and warm up protocol which have been applied with content for 48 hours. Twenty judokas into four equal stretching and warm up protocols were randomly taken to exclude the learning effect and the cumulative effect. Each stretching and warm up protocol lasted between about 10-12 minutes. Judokas did the exercises, and two judo coaches supervised each stretching and warm up period. Throughout the familiarization session's judokas were familiarized with stretching and warm up protocols (WS, SS, DW, and DSW). The entire stretching and warm up protocols carried at the same time of day (10.00 am, to avoid the effect of diurnal variations). Each stretching and warm up protocols started with a low tempo (jogging) aerobics run for 5 minutes. Vertical jump, 30 m. sprint, sit and reach flexibility, vertical jump, strength, balance and anaerobic power were measured respectively after each stretching and warm up protocols. This study continued aproximately 10 days. All protocols continued consecutive days. Sit and reach flexibility test was administered using a specially constructed box that had a slide ruler attached to the top. After one practice trial, the best score of three trials was recorded [17]. The anaerobic power of the judokas (peak and mean) was calculated using the Johnson & Bahamonde Formula [18] which allows calculation of the jump distance, body weight and height length data. Assessment of leg and back strength made by foot-plate of the dynamometer [19]. Flamingo balance test that involved balancing one foot on a certain beam and the purpose is to keep the judokas on foot for a maximum of a period of time on the axis of the foot (single foot) preferred by the test. Support could be obtained from the researcher to get the correct position, after the subject re-gained their balance, the stop watch was activated. The seconds the subject was in balance in a minute was measured. The shortest performance was separated from the other two performances, and the best one was taken and recorded as the Test Point. If the judokas made more than 15 mistakes within 30 seconds after they regained the balance, they are given (0) point [20].



(WS – without stretching; SS - static stretching; DW – dynamic warm up; DSW – dynamic+static warm up)

Figure 1. Experimental design

No stretching (NS): No stretching protocol consists of 5-minute low-tempo aerobic run. After 5 minutes of low-tempo aerobic run, vertical jump, 30 m. speed, flexibility, strength, balance and anaerobic power performances were measured. The maximum heart rate of the judokas was determined [21]. Then, each subjects' warm up rate was calculated as 30-40% according to heart rate [22]. Subjects participating in the study were run under the control of the experts. In this way, both the intensity of warm up and the warm up differences between judokas who participate in the study were removed.

Static stretching (SS): After the 5 minutes low tempo run each judokas stretched the target muscle of the right upper and lower extremities slowly and carefully until reaching a position that felt mild discomfort for 15x2 seconds both sides (adductor stretch, hip rotator stretch, hamstring stretch, quadriceps stretch, calf stretch). The next target to lower extremities muscle was stretched after a rest period of 10 seconds [8, 23].

Dynamic warm up (DW): This warm up protocol consisted of 12 DW exercises that improved from moderate to high intensity (high knee pull, straight-leg march, power skip, light skip, high glute pull, light high knees, light butt kicks, a skip, b skip, rapid high knees, carioca, walking lung). Judokas performed each DW exercise for a distance 15-meter, rested nearly 10 seconds, and then repeated the similar exercise for 15-meter as they came back to beginning place. All judokas were continually instructed to maintain proper form (e.g. vertical torso, knees towards chest, up on toes etc.) throughout the performance of the DW [23, 24].

Statistical Analysis

Arithmetic mean and standard deviation were used in the numerical presentation of the data. Conformity of the data to the normal distribution assumption was made by the Shapiro-Wilks test. Repeated Measures of ANOVA were used for repeated different measurements of the normal distribution data, and Bonferroni was used for post-hoc tests to find out which difference occurred. The Friedman test was used for repeated 4 different measurements of normally undistorted data. The Wilcoxon test was performed with binary pairings to find out which measure was derived from the difference. The data were analyzed using the SPSS 18.0 statistical program (SPSS Inc, Chicago, IL) and the statistical significance was accepted as $p < 0.05$.

Results

Table 1 shows that different stretching and warm up protocols have statistically significant effect on 30 m sprint performance ($p<0.05$). According to the Bonferroni analysis results, a statistically significant difference was found between WS and DSW, SS and DW, SS and DSW ($p<0.05$).

Table 2 shows that different stretching and warm up protocols have no statistically significant effect on flexibility values ($p>0.005$). According to the Bonferroni analysis results, a statistically significant difference was found between WS and SS ($p <0.05$).

Table 3 shows that different stretching and warm up protocols have no statistically significant effect on leg strength ($p>0.005$). According to warm up protocols, in favour of DSW, there was significant differences between WS and DSW, SS and DSW ($P<0.005$).

Table 4 shows that different stretching and warm up protocols have no statistically significant effect on

Table 1. 30 m. sprint values and differences after different stretching and warm up protocols

Test	WS	SS	DW	DSW	p	Group	Δ%	p
30m. Sprint (seconds)	5.72±0.70	5.90±0.65	5.64±0.63	5.45 ±0.66	**0.00**	1-2	3.14	0.10
						1-3	1.39	0.27
						1-4	**4.72**	**0.04**
						2-3	**4.40**	**0.00**
						2-4	**7.63**	**0.00**
						3-4	3.36	0.05

(**Δ%:** The rate of change)

Table 2. Flexibility values and differences after different stretching and warm up protocols

Test	WS	SS	DW	DSW	p	Group	Δ%	p
Flexibility (cm)	9.03±3.23	9.93±3.47	9.45±4.67	9.93±3.99	0.14	**1-2**	**9.96**	**0.04**
						1-3	4.65	0.23
						1-4	9.96	0.08
						2-3	4.83	0.54
						2-4	-	1.00
						3-4	5.07	0.53

(**Δ%:** The rate of change)

Table 3. Leg strength values and differences after different stretching and warm up protocols

Test	WS	SS	DW	DSW	p	Group	Δ%	p
Leg strength (kg)	40.05±16.18	40.65±15.40	46.18±20.01	53.85±24.89	0.126	1-2	1.48	0.83
						1-3	15.3	0.09
						1-4	**34.4**	**0.00**
						2-3	13.6	0.15
						2-4	**32.4**	**0.02**
						3-4	16.6	0.07

(**Δ%:** The rate of change)

Table 4. Vertical jump, anaerobic power, mean power, balance and back strength

Test	Stretching and Warm up Protocols	Vertical Jump (cm)	p	Anaerobic Power (W)	p	Mean Power (W)	p	Stability (Number of Errors)	p	Back Strength (kg)	p
Vertical jump, anaerobic power, mean power, balance, back strength	NS (1)	27.65±6.64	0.66	2747±795	0.66	954±357	0.66	5.15±5.00	0.58	46.75±19.4	0.34
	SS (2)	28.00±7.16		2774±866		968±396		4.15±3.66		46.14±21.2	
	DW (3)	28.40±7.92		2805±873		985±400		4.45±3.70		48.75±18.3	
	DSW (4)	28.40±8.15		2805±871		985±400		5.00±3.67		51.62±18.1	

vertical jump, anaerobic power, mean power, stability, back strength ($p>0.005$).

Discussion

The purpose of this study was to determine the effect of different warm up protocol on 30 meter sprint, flexibility, vertical jump, strength, balance and anaerobic power performance on junior male judokas. The other aim is about study to find out which stretching and warm up protocol is more efficient for junior male judokas. The main findings were that no significant differences on vertical jump, anaerobic power, mean power, stability, flexibility, leg strength and back strength ($p>0.05$). Different stretching and warm up protocols have statistically significant effect on 30 m sprint performance ($p<0.05$). According to the Bonferroni analysis results, a statistically significant difference was found between WS and DSW, SS and DW, SS and DSW ($p<0.05$). When the flexibility values were evaluated, a statistically significant difference was found between WS and SS in favor of SS ($p <0.05$). There was also significant differences between WS and DSW, SS and DSW on leg strength in favour of DSW ($p<0.05$).

Studies in the literature have shown that static stretching exercises reduce sprint performance [13, 25]. Fletcher and Jones, [13] researched the effect of different stretching protocols on 20-m sprint performance in trained rugby union players. They found that the passive static stretch (PSS) and active static stretch (ASST) groups had a significant increase in sprint time ($p<0.05$), while the active dynamic stretch (ADS) group had a significant decrease in sprint time ($p<0.05$). The decrease in sprint time, observed in the static dynamic stretch (SDS) group, was found to be nonsignificant ($p<0.05$). The decrease in performance for the 2 static stretch groups was attributed to an increase in the musculotendinous unit (MTU) compliance, leading to a decrease in the MTU ability to store elastic energy in its eccentric phase. Paradisis et al., [25] aimed to compare the acute effects of static and dynamic stretching on explosive power, flexibility and sprinting ability on adolescent boys and girls and to compare any differences due to gender. They found that static stretching hindered 20 sprint run (SR) and counter movement jump height (CMJ) by 2.5% and 6.3% respectively, whereas improved SR by 12.1%. Dynamic stretching hindered 20 SR and CMJ by 0.8% and 2.2% respectively, whereas improved SR by 6.5%. Dynamic stretching produces less reduction in 20SR and CMJ than static stretching; however the effect on SR was reverse. Whereas on for the decline in speed performance after static exercises.

Kubo et al. [26] suggested that static stretching can activate viscosity of tendon structures and increase elasticity, there by providing a background for reducing passive resistance and improving joint range of motion after stretching and warm up. In this sense, the low speed performance caused by static stretching in this study may be attributed to neuromuscular causes. On the contrary, dynamic warm up increases the speed performance [27,15]. Alikhajeh et al., [27] researched the purpose of this study was to determine the effects of static stretching, dynamic stretching, and no stretching warm-up trials on

10-m acceleration, 20 m maximal speed, and agility of elite male soccer players. They found that there were no significant differences among the different warm-up protocols for 10-m acceleration tests. There were significant differences among the different stretching warm-up protocols for the 20-m maximal speed and agility test, with dynamic stretching resulting in significantly better performance than static and no stretching.

Kafkas et al., [14] researched the purpose of this study was to determine the acute effect of different static warm up durations on sub-elite female swimmers on 50 m freestyle and breaststroke swimming performance. They found that there were significant differences between no warm up (NWU) and static warm up-30 (SS-30), static warm up (SS-60) on freestyle and breaststroke swimming performance (freestyle p=.000, p=.014 and breaststroke p=.005, p=.000 respectively). When 30-seconds and 60-second warm-up protocols were compared with eachother, a statistically significant difference was found in favor of the 30 seconds warm-up protocol in freestyle and breaststroke 50 m swimming performance (p=.001 and p=.003 respectively).

According to Bishop [28], active dynamic warm up increases nevre conduction, improves speed-force relationship, increases glycogenolysis and glycolysis, increases the use of high energy phosphate, increases agility performance and strength. According to similar results in this study; It is reported that dynamic exercises may be useful for performance improvement before exercises that are required in advanced level such as sprint exercises. No significant difference was found in flexibility performance after 4 different stretching protocol (p> 0.05). Compared with WS, the best improvement in flexibility performance achieved by static stretching and a 9.96% increase at p <0.05 (p = 0.042). This development is statistically in significant despite improvement in flexibility performance in DWU 4.65% (p = 0.236) and DSWU 9.96% (p = 0.86). Whereas the increase in flexibility performance after SWU; static exercises increase muscle fitness during stretching and reduce muscle stiffness and viscosity [29]. Similar results have been found in the study, which may be attributed to the increase in muscular stiffness and increased muscle compatibility between muscles after static exercises.

Conclusion

As a result, it was observed that different stretching and warm up protocol had a positive effect on 30 meter speed, flexibility and leg strength performance. It has been observed that DSW can improve 30 m sprint and leg strength performances and SS can improve flexibility performances. As a result of this study, 11-14 year old male judokas may suggested to perform DSW for sprint and leg strength performance before training or competition. Beside SS may suggested to improve flexibility performance for 11-14 year old male judokas.

Acknowledgements

This study was written by abridging Özgür Eken's Ege University Institute of Health Sciences master's thesis. We would like to thank junior male judokas who participated in the study.

Conflicts of Interest

The authors declare no conflict of interest.

References

1. Degoutte F. Energy demands during a judo match and recovery. *British Journal of Sports Medicine*. 2003;37(3):245–249. https://doi.org/10.1136/bjsm.37.3.245
2. Franchini E, Del Vecchio FB, Matsushigue KA, Artioli GG. Physiological profiles of elite judo athletes. *Sports Medicine*. 2011;41(2):147–166. https://doi.org/10.2165/11538580-000000000-00000
3. Avloniti A, Chatzinikolaou A, Fatouros IG, Avloniti C, Protopapa M, Draganidis D, ... Kambas A. The acute effects of static stretching on speed and agility performance depend on stretch duration and conditioning level. *Journal of Strength and Conditioning Research*. 2016;30(10):2767-2773. https://doi.org/10.1519/JSC.0000000000000568
4. Young W, Behm D. Should static stretching be used during a warm-up for strength and power activities? *National Strength and Conditioning Association.* 2002;24:33–37. https://doi.org/10.1519/00126548-200212000-00006
5. Kay AD, Blazevich AJ. Effect of acute static stretch on maximal muscle performance: a systematic review. *Medicine Science in Sports and Exercise*. 2012;44(1):154-164. https://doi.org/10.1249/MSS.0b013e318225cb27
6. Fradkin AJ, Zazryn TR, Smoliga JM. Effects of warming-up on physical performance: a systematic review with meta-analysis. *Journal of Strength and Conditioning Research*. 2010;24(1):140–148. https://doi.org/10.1519/JSC.0b013e3181c643a0
7. Neiva HP, Marques MC, Barbosa TM, Izquierdo M, Marinho DA. Warm-up and performance in competitive swimming. *Sports Medicine*. 2014;44(3):319–330. https://doi.org/10.1007/s40279-013-0117-y
8. Alter MJ. *Sports stretch*. Human Kinetics; 2004.
9. Bishop D. Warm up I: potential mechanisms and the effects of passive warm up on exercise performance. *Sports Medicine*. 2003;33(6):439–454. https://doi.org/10.2165/00007256-200333060-00005
10. Kafkas A, Eken Ö, Kurt C, Kafkas ME. The effects of different stretching and warm-up exercise protocols on 50-meter swimming performance in sub-elite women swimmers. *Isokinetics and Exercise Science*. 2019;1-9. https://doi.org/10.3233/IES-193141
11. Febbraio MA, Carey MF, Snow RJ, Stathis CG, Hargreaves M. Influence of elevated muscle temperature on metabolism during intense exercise. *American Journal of Physiology-Regulatory, Integrative and Comparative Physiology*. 1996;271:1251-1255. https://doi.org/10.1152/ajpregu.1996.271.5.R1251
12. Ross A, Leveritt M. Long-term metabolic and skeletal muscle adaptations to short- sprint training: Implications for sprint training and tapering. *Sports Medicine*. 2001;31(15):1063–1082. https://doi.org/10.2165/00007256-200131150-00003

13.Fletcher IM, Jones B. The effect of different warm-up stretch protocols on 20 meter sprint performance in trained rugby union players. *Journal of Strength and Conditioning Research*. 2004;18(4):885–888. https://doi.org/10.1519/14493.1
14.Kafkas A, Eken Ö, Çınarlı S, Kafkas ME. Acute effect of static warm-up duration on 50 meter freestyle and breaststroke performance. *Journal of Athletic Performance and Nutrition*. 2016;*3*(2):1–10.
15.Ceylan Hİ, Saygın Ö, Yildiz M. Acute effects of different warm-up procedures on 30m . sprint , slalom dribbling , vertical jump and flexibility performance in women futsal players. *Beden Egitimi ve Spor Bilimleri Dergisi*. 2014;8(1):19–21.
16.Lum D. Effects of various warm-up protocol on special judo fitness test performance. The Journal of Strength and Conditioning Research. 2019;33(2):459-465. ://doi.org/10.1519/JSC.0000000000001862
17.Lemmink KAPM, Kemper HCG, De Greef MHG, Rispens P, Stevens M. The validity of the circumduction test in elderly men and women. *Journal of Aging and Physical Activity*. 2003;11(4):433–444. https://doi.org/10.1080/02701367.2003.10609099
18.Johnson DL, Bahamonde R. Power output estimate in university athletes. *Journal of Strength and Conditioning Research*. 1996;10(3):161–166. https://doi.org/10.1519/00124278-199608000-00006
19.Coldwells A, Atkinson G, Reilly T. Sources of variation in back and leg dynamometry. *Ergonomics*. 94;37(1):79-86. https://doi.org/10.1080/00140139408963625
20.Altınkök M. Examining the effects of "activity education with coordination" on the development of balance and arm power in 6-year-old primary school children. *International Online Journal of Educational Sciences*. 2015;7(4):140–147. https://doi.org/10.15345/iojes.2015.04.019
21.Tanaka H, Monahan KD, Seals DR. Age-predicted maximal heart rate revisited. *Journal of the American College of Cardiology*. 2001;37:153–156. https://doi.org/10.1016/S0735-1097(00)01054-8
22.Karvonen MJ, Kentala E, Mustala O. The effects of training on heart rate: a longitudinal study. *Annales Medicinae Experimentalis et Biologiae Fenniae*. 1957;35:307-315.
23.Faigenbaum AD, Bellucci M, Bernieri A, Bakker B, Hoorens K. Acute effects of different warm-up protocols on fitness performance in children. *Journal of Strength and Conditioning Research*. 2005;19(2):376–381. https://doi.org/10.1519/R-15344.1
24.Mann DP, Jones MT. Guidelines to the implementation of a dynamic stretching program. *Strength and Conditioning Journal*. 1999;21(6):53–55. https://doi.org/10.1519/1533-4295
25.Paradisis GP, Pappas PT, Theodorou AS, Zacharogiannis EG, Skordilis EK, Smirniotou AS. Effects of static and dynamic stretching on sprint and jump performance in boys and girls. *The Journal of Strength and Conditioning Research*. 2014;28(1):154–160. https://doi.org/10.1519/JSC.0b013e318295d2fb
26.Kubo K, Kanehisa H, Kawakami Y, Fukunaga T. Influence of static stretching on viscoelastic properties of human tendon structures in vivo, *Journal of Applied Physiology*. 2001;90(2):520–527. https://doi.org/10.1152/jappl.2001.90.2.520
27.Alikhajeh Y, Rahimi NM, Fazeli H, Rahimi RM. Differential stretching protocols during warm up on select performance measures for elite male soccer players. *Procedia - Social and Behavioral Sciences*. 2012;46:1639–1643. https://doi.org/10.1016/j.sbspro.2012.05.353
28.Bishop DJ. Warm up II - Performance changes following active warm up and how to structure the warm up. *Sports Medicine*. 2003;33(7):483–498. https://doi.org/10.2165/00007256-200333070-00002
29.Behm DG, Chaouachi A. A review of the acute effects of static and dynamic stretching on performance. *European Journal of Applied Physiology*. 2011;111(11):2633–2651. https://doi.org/10.1007/s00421-011-1879-2

Information about the authors:

Özgür Eken; (Corresponding Author); https://orcid.org/0000-0002-5488-3158; ozgur.eken@inonu.edu.tr; Department of Movement and Training Science, Inonu University, Malatya, Turkey.

Mehmet Z. Özkol; https://orcid.org/0000-0003-2418-7036; zeki.ozkol@gmail.com; Department of Movement and Training Science, Ege University, Izmir, Turkey.

Saadet R. Varol; https://orcid.org/0000-0002-9196-984X; ranavarol@gmail.com; Department of Movement and Training Science, Ege University, Izmir, Turkey.

Cite this article as:
Özgür Eken, Mehmet Z. Özkol, Saadet R. Varol. Acute effects of different stretching and warm up protocols on some anaerobic motoric tests, flexibility and balance in junior male judokas. *Pedagogy of physical culture and sports*, 2020;24(4):169-174.
https://doi.org/10.15561/26649837.2020.0403

This is an Open Access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited (http://creativecommons.org/licenses/by/4.0/deed.en).

Received: 17.12.2019
Accepted: 12.01.2020; Published: 30.08.2020

ORIGINAL ARTICLE

Differences in body composition between young soccer players (U19) members of the best soccer clubs in Serbia, Bosnia and Herzegovina, and North Macedonia

Jovan Gardasevic[AB], Dusko Bjelica[BC], Ivan Vasiljevic[DE], Bojan Masanovic[AE]

University of Montenegro, Montenegro

Authors' contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds collection.

Abstract

Purpose: The aim of this research was to determine the differences between the young soccer players (U19) in terms of anthropometric characteristics and body composition. We considered players of three the most successful clubs in three countries of the southern region of the Balkan Peninsula.

Material: The first sub-sample of the subjects was consisted of 19 players of FC Radnicki from Serbia of the average age 17.84±.37. The second sub-sample was consisted of 19 players of FC Sarajevo from Bosnia and Herzegovina of the average age of 17.53±.51. The last sub-sample of the examinees was consisted of 13 players of FC Shkupi from North Macedonia of the average age 18.00±.00. Anthropometric characteristics in the body composition were evaluated by a battery of 11 variables. The significance of the differences between the young soccer players in the anthropometric characteristics and variables for assessing body composition were determined by ANOVA and LSD Post Hoc test.

Results: The young soccer players of the three mentioned clubs have statistically significant differences by the two variables that estimate fat percentage and muscle mass. The young soccer players of FC Radnicki are significantly better in variable fat percentage than other players. The young soccer players of FC Skhupi have significantly less muscle mass than other players.

Conclusions: The results can be useful for coaches of other clubs for making a comparison of their soccer players with the young soccer players in this research.

Keywords: anthropometric characteristics, body composition, young soccer players, Balkan Peninsula.

Introduction

Soccer is the most popular sport in the world, with up to 270 million participants [1]. A soccer game is said to be the most important secondary thing in the world. It gathers huge masses at stadiums and in front of TVs [2]. It is a highly dynamic and fast team game which, with its richness of movement, falls under category of polystructural sports games. Soccer is a sport characterized by numerous and various complex and dynamic kinesiological activities which are then characterized by either cyclical or acyclical movement [3]. Ability to run more for players or at the other hand distance covered during each full time competition significantly influenced by aerobic capacity and endurance performance [4]. In soccer, top score can be achieved only under conditions of well-programmed training process. High quality management of the training process depends on the knowing of the structure of certain anthropological capabilities and player's characteristics, as well as their development. Various researches are to be done in order to establish certain principles and norms for the transformational processes of the anthropological characteristics important for soccer. However, in many places much more time is spent on increasing the physical fitness of athletes without taking into consideration the assessment of their body composition and their nutritional status [5]. Findings regarding anthropometric characteristics and body composition are of crucial importance for complex sports games such as soccer. The anthropometric space is defined by the longitudinal dimension of the skeleton, the transversal dimensionality of the skeleton and the mass and volume of the body. The purpose of knowing anthropometric characteristics is to improve skills in many sports [6]. The anthropometric status of top level athletes is relatively homogeneous, depending on the sport, and it can be defined as a model of athletic achievement. Research on anthropometric characteristics and body composition among athletes of different sports indicates that athletes of different sports have their own specific characteristics. This is mostly due to the reason that absolute size contributes a significant percentage of total variance associated with athletic success [7]. Muscle mass improves performance in activities that require muscular strength and endurance, but also in those that require enviable aerobic ability [8, 9, 10]. The athlete's belonging to a certain sports branch gives to an athlete certain anthropometric characteristics and body compositions. It gives him the advantage of dealing with this sport in relation to others.

Today, soccer is certainly the number one sport in the world for its rating and popularity, and the same applies to the countries of the southern region of the Balkan Peninsula. These are the countries of the former Yugoslavia where soccer was the number one sport, and untill today it has maintained its primacy in Serbia, in Bosnia and Herzegovina, and in North Macedonia. In all these countries a lot of work is being done to develop

© Jovan Gardasevic, Dusko Bjelica, Ivan Vasiljevic, Bojan Masanovic, 2020
doi:10.15561/26649837.2020.0404

young soccer players. They all want to develop soccer players and sell them to the rich clubs in Europe. Mostly in this way soccer clubs in these countries provide their annual budgets. The three clubs that are at the top of the youth soccer of their countries are Soccer Club Radnicki (hereinafter FC Radnicki) from Serbia, Soccer Club Sarajevo (hereinafter FC Sarajevo) from Bosnia and Herzegovina and Soccer Club Shkupi (hereinafter FC Shkupi) from North Macedonia. It became interesting for researchers to determine the models of anthropometric characteristics and body composition of these soccer players, as well as to determine the differences among them.

The aim of this research was to analyze the differences in some anthropometric characteristics and body composition among young soccer players (U19), players of FC Radnicki from Serbia, FC Sarajevo from Bosnia and Herzegovina and FC Shkupi from North Macedonia.

Material and Methods

Participants: A sample of the subjects consists of a total of 51 young soccer players from three different countries, divided into three sub-samples. The first sub-sample of the subjects was consisted of 19 players of FC Radnicki from Serbia of the average age 17.84±.37, the second sub-sample was consisted of 19 players of FC Sarajevo from Bosnia and Herzegovina of the average age of 17.53±.51, and the last sub-sample of the examinees was consisted of 13 players of FC Shkupi from North Macedonia of the average age 18.00±.00. The soccer players were tested immediately after the season 2018/19 ended.

Procedure: Anthropometric research has been carried out with respect to the basic rules and principles related to the selection of measuring instruments and measurement techniques standardized in accordance with the International Biological Program guidelines. For the purpose of this study, eight (8) anthropometric measures have been taken: body height, body weight, triceps skinfold, biceps skinfold, skinfold of the back, abdominal skinfold, upper leg skinfold and lower leg skinfold, and three (3) body composition assessment variables: body mass index, fat percentage and muscle mass. Anthropometer, caliper, and measuring tape were used for anthropometric measurements. To evaluate the body composition, Tanita body fat scale - model BC-418MA, was used. The principle of this scale is based on indirect measurement of the body composition; a safe electrical signal is transmitted through the body via electrodes located in the standalone unit. The Tanita Scale, thanks to its athletics mode, enables athletes to closely monitor their body weight, health condition and form with all relevant parameters.

Statistical analysis: The data obtained through the research were processed by descriptive and comparative statistical procedures. For each variable, central and dispersion parameters have been processed. The significance of the differences between the players of the three successful soccer clubs in the anthropometric characteristics and variables for assessing body composition was determined by ANOVA and LSD Post Hoc tests, with statistical significance of $p<0.05$.

Results

The variables for assessing anthropometric characteristics and body composition of young soccer players and ANOVA to identify significant differences between them are shown in Table 1.

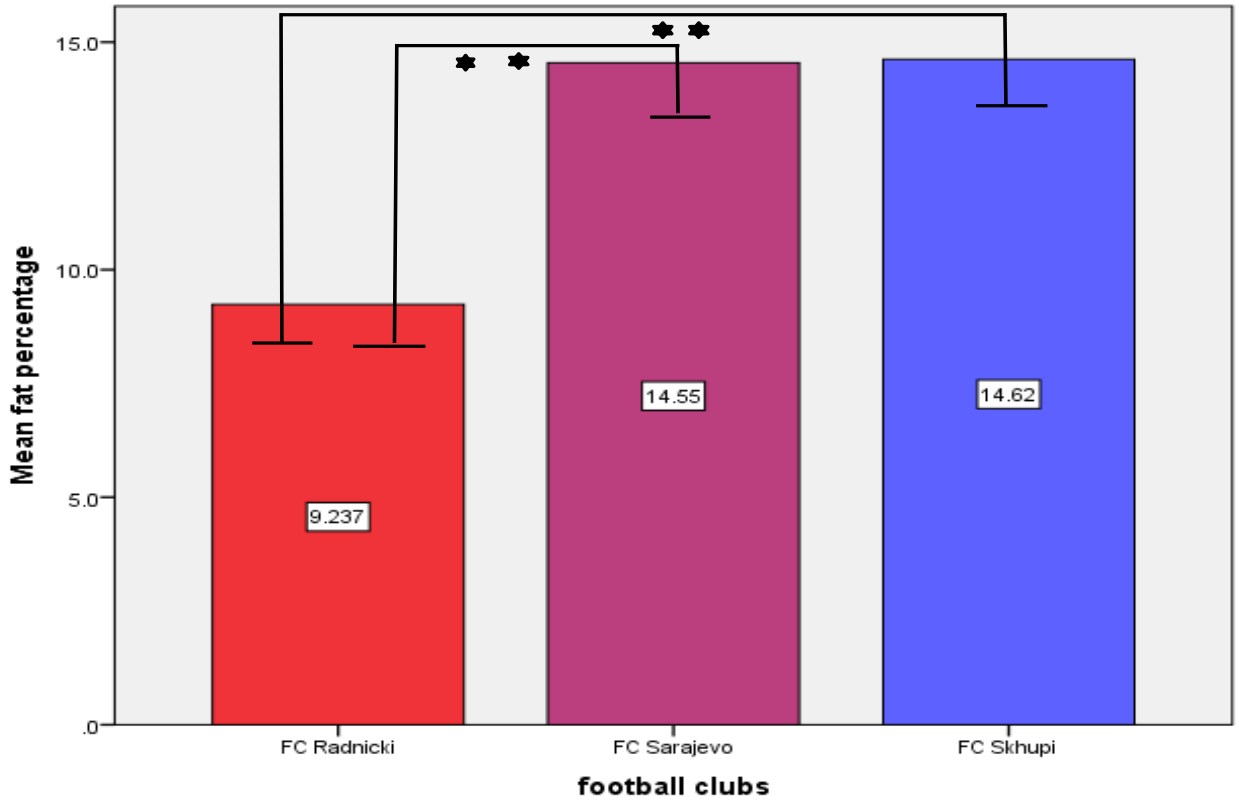
ANOVA test (Table1) found that the young soccer players of the three mentioned clubs have statistically significant differences by the two variables that estimate the fat percentage (F=17.62) and muscle mass (F=4.20). LSD post hoc test confirmed the significant differences of fat percentage and muscle mass among the soccer players of these three clubs (Table 2).

The LSD Post Hoc test showed significant differences in fat percentage the young soccer players of the three clubs (Table 2). The FC Radnicki players had significantly lowest fat percentage than the players of FC Sarajevo ($p<0.01$) and FC Skhupi ($p<0.01$). The LSD Post Hoc test also showed significant differences in muscle mass the young soccer players of the two clubs (Table 2). The

Table 1. Descriptive data and ANOVA of 51 young soccer players, members of the three clubs

Variables	FC Radnicki	FC Sarajevo	FC Shkupi	ANOVA	
	Mean ± Standard Deviation			F	Sig.
body height (cm)	179.09±6.56	180.77±6.65	175.78±6.59	2.23	.12
body weight (kg)	71.76±6.19	74.14±7.50	68.95±9.41	1.81	.17
triceps skinfold (mm)	7.39±2.07	7.86±2.58	8.01±3.55	.25	.78
biceps skinfold (mm)	5.40±1.44	5.38±2.21	5.01±1.77	.20	.82
skinfold of the back (mm)	9.01±2.37	9.63±2.81	9.93±3.25	.46	.63
abdominal skinfold (mm)	9.89±4.29	10.16±5.35	10.45±4.65	.05	.95
upper leg skinfold (mm)	10.37±3.42	10.27±3.27	11.56±6.40	.40	.67
lower leg skinfold (mm)	7.37±3.27	6.57±1.89	7.22±2.79	.45	.64
body mass index (kg/m^2)	22.38±1.48	22.63±1.28	22.23±1.95	.27	.76
fat percentage (%)	9.24±3.75	14.55±2.77	14.62±2.44	17.62	.00**
muscle mass (kg)	36.89±2.99	35.84±3.61	33.25±4.08	4.20	.02*

Legend: * - p<.05; ** - p<.01



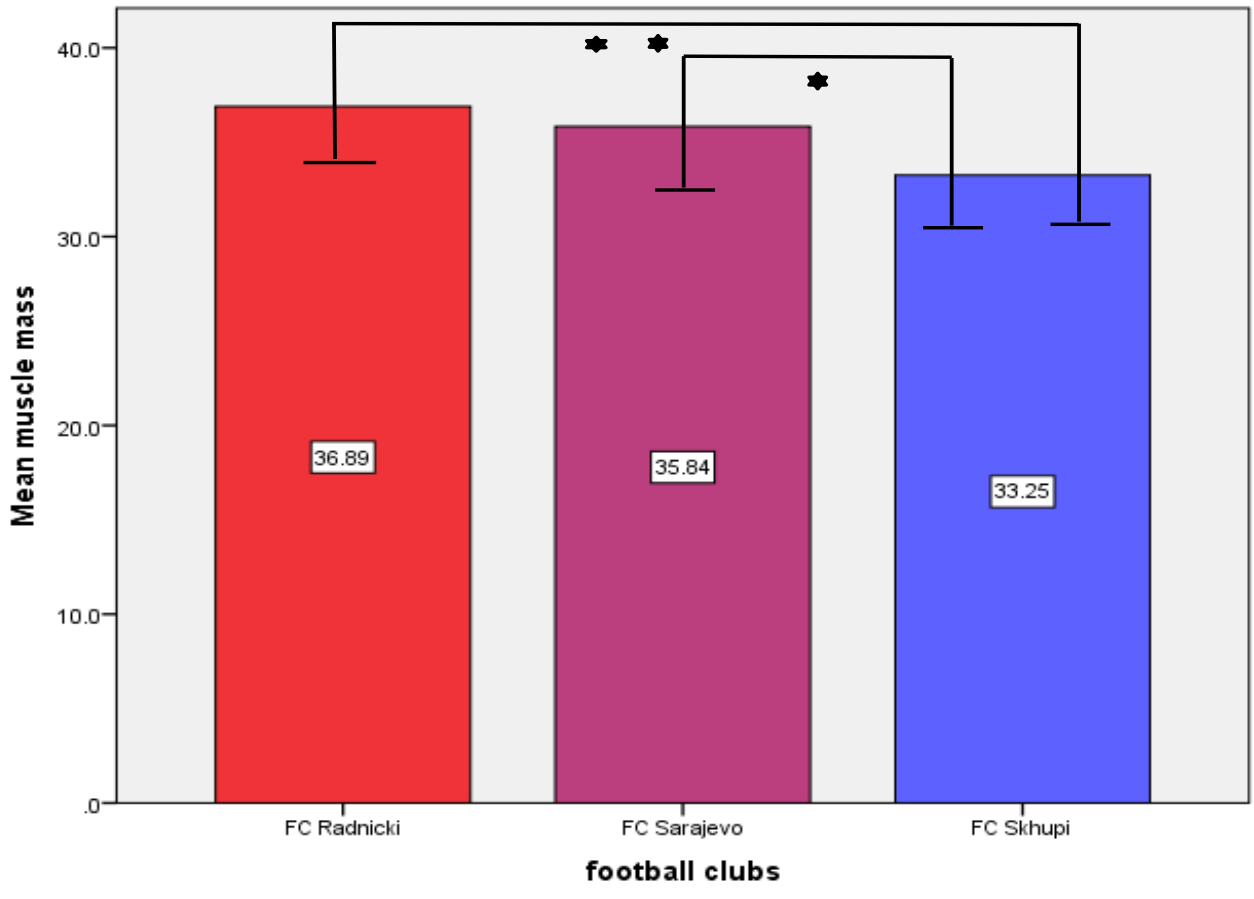


Figure 1. Statistically significant differences between young football players of football clubs in two variables - fat percentage and muscle mass (*p<.05; ** p<.01)

Table 2. LSD Post Hoc tests

Dependent Variable	clubs		Mean Differ.	Std. E	Sig.
fat percentage	FC Radnicki	FC Sarajevo	-5.31**	1.01	.000
		FC Skhupi	-5.39**	1.12	.000
	FC Sarajevo	FC Radnicki	5.31**	1.01	.000
		FC Skhupi	-.07	1.12	.946
muscle mass	FC Radnicki	FC Sarajevo	1.06	1.14	.360
		FC Skhupi	3.64**	1.27	.006
	FC Sarajevo	FC Radnicki	-1.06	1.14	.360
		FC Skhupi	2.58*	1.27	.047

Legend: * - p<0.05; ** - p<0.01

FC Skhupi players had significantly lowest muscle mass than the players of FC Radnicki (p<0.01) and FC Sarajevo (p<0.05)

The significant differences of fat percentage and muscle mass among the young soccer players of these clubs are shown in Figure 1.

Discussion

Considering the basic descriptive statistical parameters, it can be concluded that we have examined selected players. It can be noticed that the soccer players of these three clubs are of the approximately similar mean values of the variables analyzed. This is not surprising as these are the top three clubs in Serbia, Bosnia and Herzegovina, and North Macedonia, i.e. a concentration of the best players. The ANOVA showed that the young soccer players of the three mentioned clubs have statistically significant differences by the two variables. The first is fat percentage and the second is muscle mass. The LSD Post Hoc test showed that the players of FC Radnicki have significantly lower values of fat percentage than the players of FC Sarajevo and FC Skhupi. Soccer players of FC Radnicki have shown statistically better values because a smaller number means a better result when the disrupting factor of subcutaneous fat on playing soccer is considered. Moreover, it is wellknown that low fat percentage is desirable for high physical performance in all sports. Although, not every body composition characteristic is expected to play a role in optimal performance in professional soccer. Lower levels of body fat (that are specific to each player) are desirable for optimal performance as body mass must be moved against gravity [11]. In other words, by achieving optimal levels of body fat and fat-free mass, the player can minimize the negative effects of excess body fat without sacrificing skill.

However, only soccer players of FC Radnicki had a good fat percentage. This was no expected, because many of the previous research recognized soccer as a predominantly aerobic sport [12]. Furthermore, it is very important to soccer players to have a determined body fat percentage in order to perform well enough and achieve their full playing potential. The fat percentage soccer players of English Premier League vary from 9.9 percent to 12.9 percent, depending on the position [13], in Japan 8.5-13.7% [14], in Zimbabwe 9.2-11.2% [15]. However, these are just guidelines and the soccer players of FC Sarajevo and FC Skhupi would work together with their coaches to determine the individual body fat percentage to enhance their physical abilities and their health. The importance of body composition in sport performance is a primary concern in creating athlete profiles as well as conditioning programs throughout a season at all levels of competition [16]. Those describing anthropometric characteristics and body composition of athletes and detecting possible differences in relation to competition levels may give coaches a better working knowledge of the studied groups of athletes [17].

The second variable in which a statistically significant difference has been found is a variable that estimates body composition, muscle mass. The LSD Post Hoc test shows that the soccer players of FC Skhupi had the significantly lowest muscle mass compared to the soccer players of FC Radnicki and FC Sarajevo. Muscle mass very significant in today's soccer. FC Skhupi soccer players are, on average, older than other soccer players and they have to exercise to increase muscle mass.

For other variables, some values are better for players of FC Radnicki, some for players of FC Sarajevo or FC Skhupi, although, insignificantly for statistics. This indicates that these players have very similar anthropometric parameters and body composition, which is again, not surprising, considering that these three clubs are among the best in their countries. The concentration of the best soccer players in these three-member states of the southern region of the Balkan Peninsula is in these 3 clubs. The assumption is that the mean values of the analyzed variables in all of them should be the model values for the soccer players of other clubs.

Compered to all the participants in the 2018 World Soccer Championship, the average height of the players in Serbia and Bosnia and Herzegovina is enough for their

age. An official statistical data showed the average height in Rusia 181.70 centimeters, while in Croatia league (183.60 cm), Germany (183.5 cm), Denmark (183.5 cm), Poland (183 cm).

Conclusion

The values obtained in this research can be useful for coaches of other clubs for making a comparations and formulate their training in a way that enables reduction of those parameters that are not good, and raise those that are good to a higher level. That will surely make their soccer players even better and more successful. Also, soccer clubs in states of the southern region of the Balkan Peninsula should turn to other researches. They should check the functional-motoric status, psychological preparation as well as tactical training of their players and analyze whether there is a room for their improvement.

Conflicts of interest

The authors declare no conflict of interest.

References

1. Bjelica D, Gardasevic J, Vasiljevic I, Jeleskovic E, Covic N. Body Composition and Morphological Characteristics of Soccer Players in Bosnia and Herzegovina. *Kinesiologia Slovenica*. 2019; 25(1):5–13.
2. Gardasevic J, Bjelica D, Corluka M, Vasiljevic I. Elite football players from Bosnia and Herzegovina and Kosovo and their body composition. *Sport Mont.* 2019; 17(2):75–79. https://doi.org/10.26773/smj.190613
3. Sermaxhaj S, Popovic S, Bjelica D, Gardasevic J, Arifi F. Effect of recuperation with static stretching in isokinetic force of young football players. *J. Phys. Educ. Sport*, 2017; 17(3):1948–1953.
4. Amani AR, Sadeghi H, Afsharnezhad T. Interval training with blood flow restriction on aerobic performance among young soccer players at transition phase. *Montenegrin Journal of Sports Science and Medicine.* 2018; 7(2):5–10. https://doi.org/10.26773/mjssm.180901
5. Triki M, Rebai H, Abroug T, Masmoudi K, Fellmann N, Zouari M, Tabka Z. Comparative study of body composition and anaerobic performance between soccer and judo groups. *Science and Sports.* 2012; 27(5):293–9. https://doi.org/10.1016/j.scispo.2011.07.004
6. Carter JEL, Heath BH. *Somatotyping–Development and application*. Cambridge, United Kingdom: Cambridge University Press, 1990.
7. Carvajal W, Betancourt H, León S, Deturnel Y, Martínez M, Echevarría I, Eugenia Castillo M, Serviat N. Kinanthropometric Profile of Cuban Women Olympic Volleyball Champions. *MEDICC Review.* 2012; 14(2):16–22. https://doi.org/10.1590/S1555-79602012000200006
8. Ramadan J, Byrd R. Physical characteristics of elite soccer players. *Journal of Sports Medicine and Physical Fitness.* 1987; 27:424–428.
9. Gardasevic J, Bjelica D, Vasiljevic I. Morphological characteristics and body composition of elite soccer players in Montenegro. *International Journal of Morphology*. 2019; 37(1):284–288.
10. Rico-Sanz J. Body composition and nutritional assessments in soccer. *International Journal of Sport Nutrition.* 1998; 8:113–123. https://doi.org/10.1123/ijsn.8.2.113
11. Rienzi E, Drust B, Reilly T, Carter JEL, Martin A. Investigation of anthropometric and work-rate profiles of elite South American international soccer players. *J Sports Med Phys Fitness.* 2000; 40(2):162–169.
12. Kemi OJ, Hoff J, Engen LC, Wisloff U. Soccer specific testing of maximal oxygen uptake. *The Journal of Sports Medicine and Physical Fitness.* 2003; 43(2):139–44.
13. Sutton l, Scott M, Wallace J, Reilly T. Body composition of English Premier League soccer players: Influence of playing position, international status, and ethnicity. *Journal of Sports Sciences.* 2009; 27(10):1019-1026. https://doi.org/10.1080/02640410903030305
14. Tahara Y, Moji K, Tsunawake N, Fukuda R, Nakayama M, Nakagaichi M, Komine T, Kusano Y, Aoyagi K. Physique, body composition and maximum oxygen consumption of selected soccer players of Kunimi High School, Nagasaki, Japan. *J Physiol Anthropol.* 2006; 25:291–297.
15. Masocha V, Katanha A. Anthropometry and somatotype characteristics of male provincial youth league soccer players in Zimbabwe according to playing positions. *Int J Sci Res.* 2014; 3:554–557.
16. Silvestre R, Kraemer WJ, West C, Judelson DA, Spiering BA, Vingren JL, Hatfield DL, Anderson JM, Maresh CM. Body Composition and Physical Performance during a National CollegiateAthleticAssociationDivisionIMen'sSoccerSeason. *J. Strength and Conditioning Research.* 2006; 20(4):962–70. https://doi.org/10.1519/00124278-200611000-00038
17. Masanovic B. Comparative study of morphological characteristics and body composition between different team players from Serbian junior national league: soccer, handball, basketball and volleyball. *International Journal of Morphology*. 2019; 37(2):612–9.

Information about the authors:

Jovan Gardasevic; (Corresponding author); https://orcid.org/0000-0002-1387-1521; jovan@ucg.ac.me; Faculty for Sport and Physical Education, University of Montenegro; Cetinjski put 2, 81000, Podgorica, Montenegro.

Dusko Bjelica; https://orcid.org/0000-0001-5272-528X; dbjelica@ucg.ac.me; Faculty for Sport and Physical Education, University of Montenegro; Cetinjski put 2, 81000, Niksic, Montenegro.

Ivan Vasiljevic; https://orcid.org/0000-0001-9463-2532; vasiljevic.ivan301@gmail.com; Faculty for Sport and Physical Education, University of Montenegro; Cetinjski put 2, 81000, Niksic, Montenegro.

Bojan Masanovic; https://orcid.org/0000-0002-4939-4982; bojanma@ac.me; Faculty for Sport and Physical Education, University of Montenegro; Cetinjski put 2, 81000, Niksic, Montenegro.

Cite this article as:
JJovan Gardasevic, Dusko Bjelica, Ivan Vasiljevic, Bojan Masanovic. Differences in body composition between young soccer players (U19) members of the best soccer clubs in Serbia, Bosnia and Herzegovina, and North Macedonia. *Pedagogy of physical culture and sports*, 2020;24(4):175-180.
https://doi.org/10.15561/26649837.2020.0404

This is an Open Access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited (http://creativecommons.org/licenses/by/4.0/deed.en).

Received: 17.12.2019
Accepted: 12.01.2020; Published: 30.08.2020

ORIGINAL ARTICLE

Does an acute bout of high intensity interval exercise suppress appetite in obese women?

Sepideh Khalaj[ABCDE], Bahman Mirzaei[ABCDE]

University of Guilan, Rasht, Iran

Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection.

Abstract

Purpose: The aim of this study was to investigate the 24 hour response of appetite and energy intake and the amount of Agouti-Related Protein to the high intensity interval exercise in obese untrained women.

Material: Ten obese untrained women were voluntarily selected according to the criteria of the research and evaluated in two experimental and control sessions. Blood samples were collected in two sessions of control and experimental group in five stages. Also, the appetite questionnaire was completed in 9 steps. Also, energy intake was recorded by them during the day.

Results: Agouti-Related Protein increased significantly in experimental session immediately after exercise compared to the control session ($p<0.05$). In the Visual analog scale, the feeling of hunger and desire to eat decreased significantly immediately after exercise and before lunch in the experimental session ($p<0.05$). While feeling of satiety and fullness were significantly higher immediately after exercise and before lunch ($p<0.05$), in other words, the desire to eat was reduced. Also, exercise significantly reduced energy intake in the experimental session compared to control session ($p<0.05$). The amount of protein consumption, carbohydrate, and fat decreased in the experimental session compared to the control session, but this decrease was not statistically significant ($p>0.05$).

Conclusions: Although a session of high intensity interval exercise resulted in reduced energy intake, but this reduction was not related to just one macronutrient. Hunger and desire to eat decreased after exercise and before lunch but the Agouti-Related Protein increased after exercise.

Keywords: obesity, appetite, energy intake, AgRP, intensity interval exercise.

Introduction

Over the years, obesity is considered as a worldwide problem, and is defined as abnormal or excessive fat accumulation that impairs health [1]. However, recent reports indicate that obesity rates have doubled worldwide in recent years and women are more likely to be obese or overweight than men [2]. Obesity is a major risk factor for mortality mainly from cardiovascular disease [3], type 2 diabetes [4], types of cancer [5], and other diseases. In addition, the pathogenesis of human obesity results from a bad regulation of energy intake and energy expenditure that affects the balance of daily energy and ultimately leads to body weight gain [6].

Research has shown that physical activity is one of the ways to regulate energy balance in the body and evidence suggests that both acute exercise and regular exercise training directly generate negative energy balance and also reduce appetite and the total energy consumption and affect the levels of a number appetite related peptides [7]. However, the hypothalamus plays a key role in regulating appetite, food intake, and energy homeostasis in humans [8]. The hypothalamus contains a group of neurons that secretes specific neuropeptides affecting eating behaviors [9]. Hypothalamic neuropeptides are factors that affect appetite, eating behavior, and energy balance, which are divided into two groups of appetite stimulus and appetite suppressant; one of these hormones is the Agouti-Related Protein (AgRP) which is known as one of the most important orexigenic hormones [10]. Thus appetite is controlled by a series of complex processing in the brain and several peripheral secretion hormones [11]. AgRP is a 132 amino acid peptide that is secreted from the midline of the arterial nucleus of the hypothalamus and the inner region of the adrenal gland [12]. This hormone is a candidate gene for human obesity and a strong appetite stimulant, and evidence suggests that it plays a large role in receiving and choosing food, regulating weight, and energy hemostasis [13]. It has also been reported that it has both acute and long-term effects on food intake [12].

As mentioned above, some conditions such as physical activity and exercise can create changes in appetite, energy intake, and peptides that affect energy balance and adjustment. In this case Carnier et al. examined the long-term effect of aerobic training and the combination of aerobic and resistance training on anorexigenic and orexigenic hormones in obese adolescent and concluded that in both groups, daily energy intake decreased although in combination group the concentration of AgRP increased [14]. In another study that investigated the effect of treadmill running on plasma concentration of AgRP in rats, the results showed that plasma AgRP levels increased with running [15]. Also researches evaluated the response of AgRP to a single session of circuit resistance exercise in college men and finally the results indicated that AgRP plasma levels increased immediately after exercise and returned to pre-exercise levels during recovery [16].

As there are only few studies on the response of this hormone to exercise and women are more likely to

© Khalaj Sepideh, Mirzaei Bahman, 2020
doi:10.15561/26649837.2020.0405

be obese or overweight than men; therefore, the main challenge for researchers is to control obesity in obese women; whereas, the caloric intake within 24 hours can be very important in controlling this process. Considering that high intensity interval exercise (HIIE) has been recently recognized as a high performance exercise method in obese individuals and this type of exercise affects individual's appetite greatly, also most individuals tend to choose HIIE instead of continuous exercise [17, 18]; therefore the present study attempts to investigate the 24 hour response of appetite and energy intake and the amount of Agouti-Related Protein to the high intensity interval exercise in obese untrained women.

Materials and Methods

Subject design

15 obese untrained women (age: 33±8.47 years, height: 161.92±4.12 cm, weight: 85.75±3.40 kg, body fat: 39.80±1.93 %, body mass index: 32.48±1.59 kg/m^2) voluntarily participated in this study. Eventually five of them were excluded due to incomplete cooperation. The criteria for participation in the research were as follows: 1) obese (BMI: 30-39.9 kg/m^2) and untrained. 2) Weight stability within the last 6 months. 3) Not using a specific drug that effects on appetite. 4) Not dieting. 5) Sufficient ability to participate in research. First, after coordination with the subjects, initial measurements including height, weight, body mass index, body fat percentage, blood pressure, and heart rate were performed one day before the subjects were invited to study. Then, written consent was taken from subjects and the medical and sports records questionnaire were completed by them. It should be noted that all stages of research were confirmed by the Ethics Committee of Guilan University of Medical Sciences (IR.GUMS.REC.1398.081). Table 1 describes the characteristics of the study participants.

Table 1. Characteristics of the study participants

Characteristics	Mean ± SD
Age (y)	33±8.47
Height (cm)	161.92±4.12
Weight (kg)	85.75±3.40
Body fat (%)	39.80±1.93
BMI (kg.m^2)	32.48±1.59

Design and exercise protocol

At first, the subjects were evaluated in the form of the control group and then examined with an interval of 10 days in the experimental group form. In the experimental session, the subjects performed 10 exercises, 1 minute running on treadmill at 90% HRmax and with 1 minute rest interval between exercises at 30% HRmax [1]. It should be noted that subjects did not perform any exercises in the control session and only blood samples were taken from them and the visual analog scale (VAS) was completed by them; energy intake was also reported.

Anthropometric measurements

A digital scale with a precision of 0.01 kg was used to evaluate the subject's weight. A wall-mounted stadiometer with a precision of 0.01 cm was used to measure height. For measurements of height and weight, the subjects were bare foot and wearing slight clothing. Body mass index was calculated as body weight (kg) divided by height squared (m^2). Percentage of body fat was measured using caliper Lafayette at three anatomical landmarks (tight, triceps, suprailiac). All measurements were taken from the right side of the body and measured three times to reduce the measurement error.

Blood sampling and biochemical analysis

Blood samples were collected from the antecubital vein at five stages; first stage: morning before breakfast (before exercise), second stage: after exercise, third stage: before lunch, fourth stage: before dinner, and fifth stage: one hour after dinner. Plasma was separated by centrifugation; the samples were then stored at -80 ° C until testing time. Plasma AgRP was measured using a Human Agouti Related Protein (AgRP) ELISA Kit (HANGZHOU EASTBIOPHARM, china, sensitivity 1.01 ng/ml).

Subjective appetite sensations

The VAS is also completed before and after breakfast (8:00), before and after the exercise (11:00), before and after lunch (12:15), before and after dinner (19:00), and one hour after dinner [19]. Participants were asked to rate the amount of satiety, fullness, hunger, and desire to eat using the VAS (0 to 100 mm). Participants rated their appetite perceptions by placing a mark on a 100 mm continuum with descriptors positioned at either end. The validity and reliability of this questionnaire have been proven by Flint et al [20].

Energy intake

Energy intake was measured using the registration of foods in the consumables recording sheet. The amounts of each food consumed was reported to gram .Then each food was coded according to the instructions of the N4software: by entering the code for each foodstuff in the software and specifying the amount of foods consumed to gram, the Calories related to that foodstuff to the kilocalories, and the amount of macronutrients (protein, carbohydrate, fat) as well as the total caloric intake of the whole day were provided by the software

Statistical analysis

The Shapiro-Wilk test was used to verify the normality of the data. Parametric descriptive data were presented in mean and standard deviation (SD). Two-way repeated measures analysis of variance (ANOVA) followed by Bonferroni's method was used to analyse the data from the VAS (hunger, satiety, fullness, desire to eat) and AgRP. T-test method was used to analyse the energy intake and macronutrients data. All statistical procedures were performed using SPSS version .20.0.

Results

Agouti-related protein

Based on Fig 1 plasma levels of AgRP increased significantly in experimental session immediately after exercise compared to control session ($p<0.05$), but no

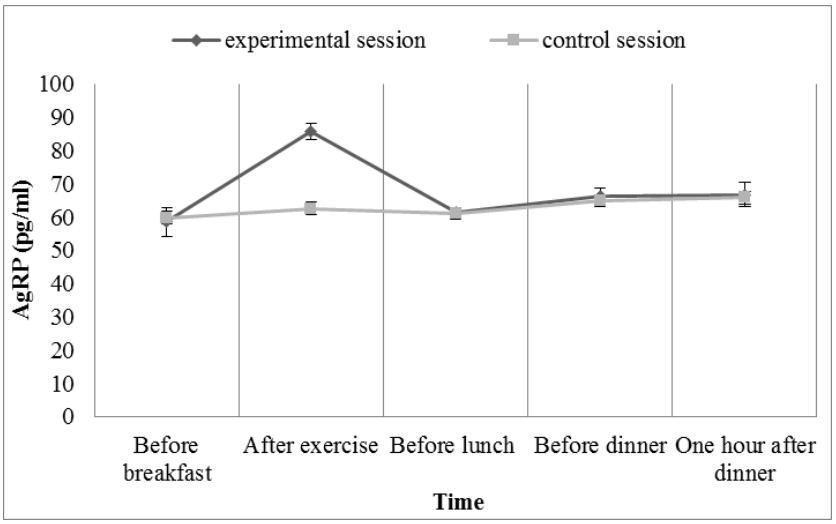


Figure 1. Plasma concentration of AgRP in the control and experimental session. Values are mean±SD (n=10).

significant difference was observed in other stages of measurement compared to control sessions ($p>0.05$).

Appetite questionnaire

According to the information presented in Fig 2-5, in the exercise session, the rating of hunger and desire to eat immediately after exercise and before lunch significantly decreased compared to the control session ($p<0.05$), while rating of satiety and fullness were significantly higher immediately after exercise and before lunch ($p<0.05$). In other words, desire to eat was reduced. while no significant difference was observed before breakfast, after breakfast, before exercise, after lunch, after dinner, and one hour after dinner for four components (hunger, satiety, fullness, desire to eat) compared to control session ($p>0.05$).

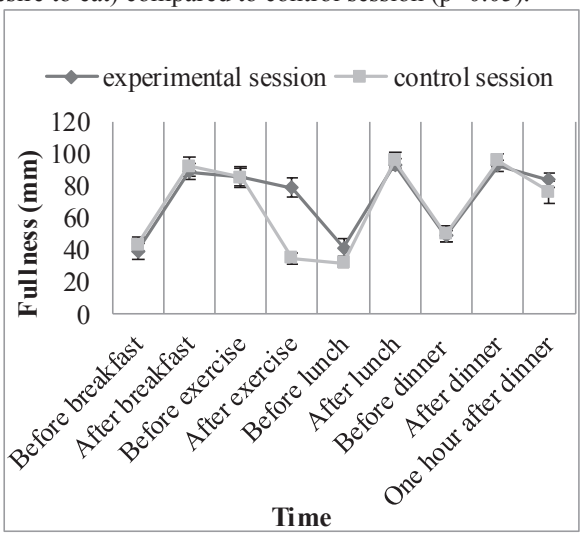


Figure 2. Rating of fullness in the control and experimental session. Values are mean±SD (n=10).

Energy intake and macronutrients

As shown in Fig 6 and Table 2 in the experimental session, total energy intake during the day was significantly lower than the control session ($p<0.05$), while according to Table 3 the protein, carbohydrate and fat intake decreased in experimental group, but this decrease was not statistically significant ($p>0.05$).

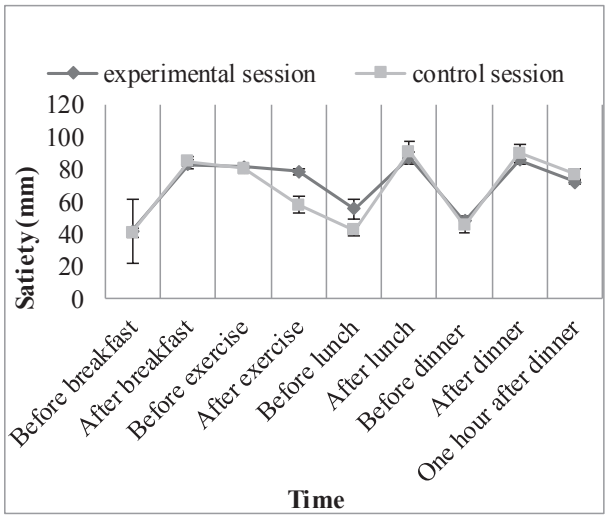


Figure 3. Rating of satiety in the control and experimental session. Values are mean±SD (n=10).

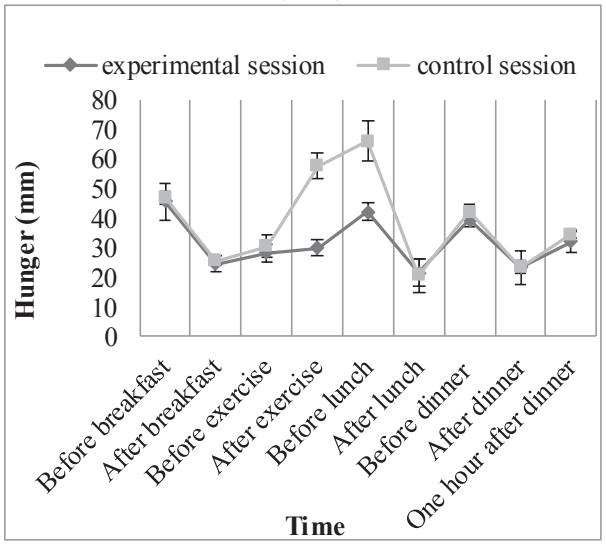


Figure 4. Rating of hunger in the control and experimental session. Values are mean±SD (n=10).

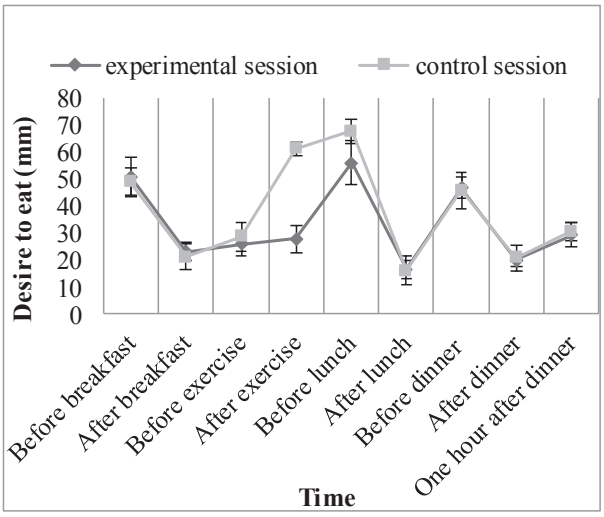


Figure 5. Rating of desire to eat in the control and experimental session. Values are mean±SD (n=10).

Discussion

Obesity is rising now in developing countries and in developed countries [21]. Obesity develops when energy intake is more than energy expenditure, given that exercise is an important component of daily energy balance [22]. Since exercise affects eating behavior, and appetite regulation is one of the important issues for weight control in exercise physiology, the purpose of this study was to determine the 24 hour response of appetite and energy intake and the amount of Agouti-Related Protein to the high intensity interval exercise in obese untrained women.

Exercise and Agouti-related protein

In the current study, plasma levels of AgRP in the experimental session, immediately after HIIE significantly increased compared to the control session and baseline levels and the lunch meal, dinner meal, and one hour after dinner. It was also close to its baseline level which was even higher than the baseline level, but this amount was not statistically significant. The reason for the increase in AgRP seems to be that exercise and physical activity greatly disturb the energy balance of the cell. During exercise, muscle energy requirements increase dramatically. This need must be met in a way that allows the muscle to continue its activity. The disturbance of energy balance increases the expression of AgRP in the hypothalamus which was previously shown by other research [16, 23-25]. It should be noted that little research has been done on the effects of exercise on AgRP on humans. Among the studies that examined the effect of exercise on human plasma AgRP concentration was Ghanbari-Niaki et al. [16] These researchers investigated the effect of one session of a circuit resistance exercise on the concentration of AgRP in male students. The results of their research showed that plasma AgRP level significantly increased immediately after exercise and returned to baseline level during recovery period [16]. This study is in line with the current research. Also, in contradiction with the current research, Ghanbari-Niaki et al. assessed the effect of a session circuit resistance exercise training on serum levels of AgRP in male students and proved that this type of exercise significantly reduced serum levels of AgRP immediately after exercise in subjects [26]. The difference between this research and the present study was the type and intensity of the exercise and the characteristics of subjects. The current study subjects were obese untrained women. In this regard Katsuki et al. compared 30 obese men and women with 30 non-obese men and women and same age of plasma levels

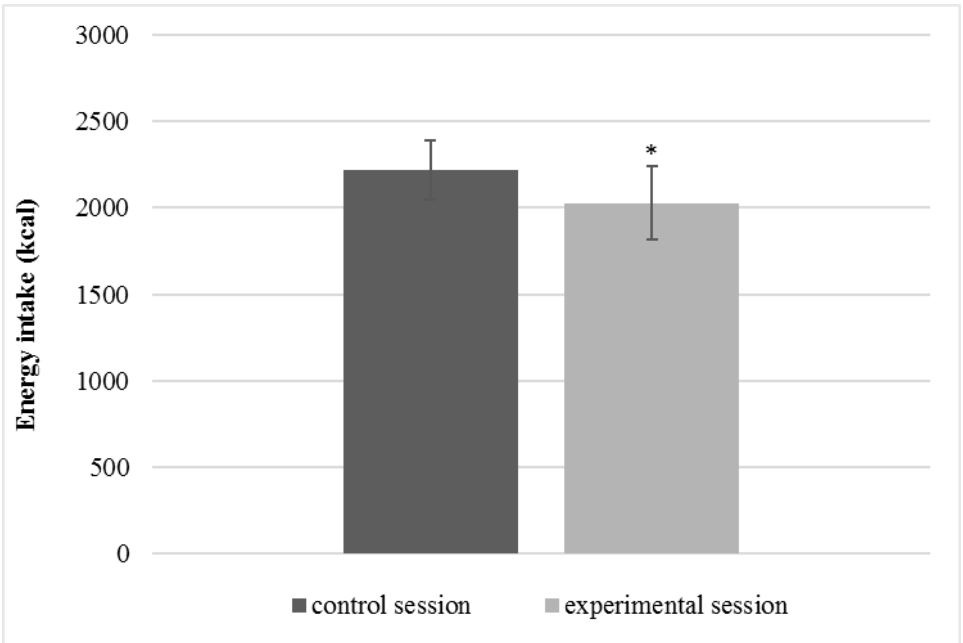


Figure 6. Rating of energy intake in the control and experimental session. Values are mean±SD (n=10). * = Significant difference between two sessions using the T-test method.

Table 2. Energy intake in the control and experimental session (Mean±SD)

Meals (kcal)	Control Session (n=10)	Experimental Session (n=10)
Breakfast meal	672.432 ± 115.463	572.480 ± 177.255
Breakfast snack	122.279 ± 74.742	85.126 ± 35.928
Lunch meal	591.409 ± 164.280	515.015 ± 211.051
Afternoon snack	156.880 ± 112.093	190.108 ± 160.826
Dinner meal	538.475 ± 245.820	549.920 ± 317.685
One hour after dinner	135.728 ± 155.079	119.563 ± 116.115

Table 3. Macronutrients intake in the control and experimental session throughout the day (Mean±SD).

Macronutrients (gram)	Control Session (n=10)	Experimental Session (n=10)
Carbohydrate	284.666 ± 39.432	266.155 ± 75.717
Protein	92.819 ± 24.644	77.388 ± 5.331
Fat	74.384 ± 25.189	67.605 ± 25.367

of AgRP. The results of this study showed that plasma concentration of AgRP was higher in both obese men and women than non-obese men and women. The researchers also found that there was a positive correlation between plasma levels of AgRP and BMI [24].

In addition, it has been suggested that increasing AgRP can be considered as an effective factor in the mechanism of glycogen repair and super compensation following exercises [27]. Therefore, considering that the exercise protocol of the present study is considered as a high intensity exercise, it seems that one of the reasons for increasing plasma AgRP immediately after exercise in the present study is the intensity of the exercise to compensate for the lost energy.

As noted above, in the present study at dinner meal and one hour after dinner, plasma levels of AgRP were higher than baseline levels. Compared to that of before dinner and one hour after dinner, the levels of this hormone were higher than before lunch, it might be said, given that it was reported that AgRP has a unique circadian rhythm. On the one hand, this rhythm is consistent with changes in some of the other hormones and eating behavior. On the other hand, it has been reported that AgRP levels increase with the onset of darkness relative to its base levels [28]. Perhaps it can be justified that one of the reasons for increasing plasma levels of AgRP before dinner and one hour after dinner than before lunch and its base level is the beginning of darkness and not the effect of the exercise. Because the plasma levels of this hormone in the control session were also increased before dinner and one hour after dinner than before stages. And given that in both sessions, AgRP plasma levels increased before dinner and one hour after dinner compared to baseline levels and before lunch, and this amount was statistically significant, so it seems that the factor affecting the increase of this hormone is the circadian cycle.

Exercise and appetite (Visual Analog Scale)

In the current study, the rating of hunger and desire to eat decreased immediately after exercise and before lunch in the experimental session, while rating of satiety and fullness were significantly higher immediately after exercise and before lunch; in other words, the desire to eat was reduced. Also, there was no difference in appetite after lunch, before and after dinner, and one hour after dinner in two sessions.

Many studies have reported suppression of hunger after exercise. In agreement with the present study, King et al. showed that, hunger significantly decreased immediately after high intensity exercise [29]. Also, Stephanie et al. found significant decrease in rating of hunger and desire to eat immediately after high intensity exercise in high-trained women, while the rating of satiety and fullness were significantly lower at 60 minutes post-exercise, in other words, rating of desire to eat were significantly higher 60 minutes post-exercise. In their research, the results of the VAS were consistent with the appetite hormone [30]. But, in the present study, the results of the AgRP and VAS were not consistent; in our study, AgRP levels were significantly higher as an orexigenic hormone immediately after exercise. The reason for the lack of consistence between these two factors in the present study can be confirmed by the hypothesis that AgRP is an agent for stimulating the continued eating behavior, not an agent to increase appetite to start eating [31].

Exercise, energy intake and macronutrients

Based on the results obtained in the present study, the energy intake in the exercise session decreased significantly compared to the control session.

In line with the current research, Sime et al. reviewed the energy intake in overweight individuals following HIIE for the 24 hour and concluded that the energy intake in these individuals was significantly reduced [32]. While Martins et al. did not report any significant difference in the energy intake throughout the day following HIIE and MICE with obese subjects [11]. Also Westerterp et al. found a significant decrease in energy intake 10 minute after two hours of moderate intensity cycling [33]. Most of the previous studies examined energy intake in the laboratory and after food consumptions at single meals and shortly after exercise [34-37]. But in the present study, energy intake was evaluated throughout the day. Also, one session of HIIE, although reducing the consumption of protein, carbohydrates, and fat, this decline was not significant. In this regard, short-term interventions examined the acute effects of an exercise session on macronutrients intake and reported different results, but most of the samples showed a lack of change [38, 39]. Martins et al. reported no significant change in macronutrients consumption after 60 minutes of moderate-intensity cycling [37].

A limitation of research was that the energy intake was reported by the participants and its correctness depended on the honesty of respondents. But to reduce this limitation, participants were well-trained before starting the study. However, it is suggested that other hormones such as leptin and ghrelin be measured along with AgRP due to the interaction of appetite hormones together.

Conclusion

In conclusion, this investigation has shown that one session of HIIE, immediately after exercise and lunchtime suppressed appetite. It also declined energy intake throughout the day. AgRP showed an increase immediately after exercise as an appetite stimulating hormone. This increase was not consistent with the VAS. Perhaps a significant increase in the AgRP immediately after exercise may affect factors other than appetite or some of its associated factors. Finally, we concluded that this type of exercise is useful in obese women to control appetite and energy intake throughout the day. But, due to the short-term effects of this type of exercise, it is suggested that the exercise be done two times in the morning and in the evening and close to the main meals.

Acknowledgements

The authors would like to thank the study participants for their dedication and effort throughout the study.

Conflicts of interest

The authors declare that they have no competing interest.

References

1. Matos V, Souza D, Santos V, Medeiros Í, Browne R. Nascimento, P., et al. Acute effects of high-intensity interval and moderate-intensity continuous exercise on glp-1, appetite and energy intake in obese men: A crossover trial. *Nutrients*, 2018; 10.7: 889. https://doi.org/10.3390/nu10070889
2. Lohmann AE, Goodwin PJ, Chlebowski RT, Pan K, Stambolic V, Dowling RJ. Association of obesity-related metabolic disruptions with cancer risk and outcome. *Journal of Clinical Oncology*, 2016; 34.35: 4249- 4255. https://doi.org/10.1200/JCO.2016.69.6187
3. Atkins JL. Effects of Sarcopenic Obesity on Cardiovascular Disease and All-Cause Mortality. In: *Nutrition and Skeletal Muscle*. Academic Press, 2019; p. 93-103. https://doi.org/10.1016/B978-0-12-810422-4.00007-5.
4. Ohnishi H, Saitoh S. Obesity and Diabetes Mellitus as Risk Factors for Cardiovascular Disease in the Elderly. In: *Health Issues and Care System for the Elderly*. Springer, Singapore, 2019; p. 97-106. https://doi.org/10.1007/978-981-13-1762-0_7
5. Avgerinos KI, Spyrou N, Mantzoros CS, Dalamaga M. Obesity and cancer risk: Emerging biological mechanisms and perspectives. *Metabolism*, 2019; 92: 121-135. https://doi.org/10.1016/j.metabol.2018.11.001.
6. Piaggi P, Vinales KL, Basolo A, Santini F, Krakoff J. Energy expenditure in the etiology of human obesity: spendthrift and thrifty metabolic phenotypes and energy-sensing mechanisms. *Journal of endocrinological investigation*, 2018; 41.1: 83-89. https://doi.org/10.1007/s40618-017-0732-9
7. Larsen PS, Donges CE, Guelfi KJ, Smith GC, Adams DR, Duffield R. Effects of aerobic, strength or combined exercise on perceived appetite and appetite-related hormones in inactive middle-aged men. *International journal of sport nutrition and exercise metabolism*, 2017; 27.5: 389-398. .https://doi.org/10.1123/ijsnem.2017-0144
8. Timper K, Brüning JC. Hypothalamic circuits regulating appetite and energy homeostasis: pathways to obesity. *Disease models & mechanisms*, 2017; 10.6: 679-689. https://doi.org/10.1242/dmm.026609
9. Williams G, Cai XJ, Elliott JC, Harrold JA. Anabolic neuropeptides. *Physiology & behavior*, 2004, 81.2: 211-222. https://doi.org/10.1016/j.physbeh.2004.02.005
10. Bai F, Sözen MA, Lukiw WJ, Argyropoulos G. Expression of AgRP, NPY, POMC and CART in human fetal and adult hippocampus. *Neuropeptides*, 2005; 39.4: 439-443. https://doi.org/10.1016/j.npep.2005.02.007.
11. Martins C, Stensvold D, Finlayson G, Holst J, Wisloff U, Kulseng B, et al. Effect of moderate-and high-intensity acute exercise on appetite in obese individuals. *Medicine & Science in Sports & Exercise*, 2015; 47.1: 40-48. https://doi.org/10.1249/MSS.0000000000000372
12. Hillebrand JJG, De Wied D, Adan RAH. Neuropeptides, food intake and body weight regulation: a hypothalamic focus. *Peptides*, 2002; 23.12: 2283-2306. https://doi.org/10.1016/S0196-9781(02)00269-3
13. Inui A. Transgenic approach to the study of body weight regulation. *Pharmacological reviews*, 2000; 52(1): 35-62.
14. Carnier J, de Mello MT, Ackel-ĎElia C, Corgosinho FC, da Silveira Campos RM, de Lima Sanches P, et al. Aerobic training (AT) is more effective than aerobic plus resistance training (AT+ RT) to improve anorexigenic/orexigenic factors in obese adolescents. *Appetite*, 2013; 69: 168-173. https://doi.org/10.1016/j.appet.2013.05.018
15. Ghanbari-Niaki A, Abednazari H, Tayebi SM, Hossaini-KakhakA, Kraemer RR. Treadmill training enhances rat agouti-

related protein in plasma and reduces ghrelin levels in plasma and soleus muscle. *Metabolism*, 2009, 58(12): 1747-1752. https://doi.org/10.1016/j.metabol.2009.06.002

16. Ghanbari-Niaki A, Nabatchian S, Hedayati M. Plasma agouti-related protein (AGRP), growth hormone, insulin responses to a single circuit-resistance exercise in male college students. *Peptides*, 2007; 28(5): 1035-1039. https://doi.org/10.1016/j.peptides
17. Bailey DP, Smith LR, Chrismas BC, Taylor L, Stensel DJ, Deighton K, et al. Appetite and gut hormone responses to moderate-intensity continuous exercise versus high-intensity interval exercise, in normoxic and hypoxic conditions. *Appetite*, 2015; 89: 237-245. https://doi.org/10.1016/j.appet.2015.02.019
18. Miguet M, Fillon A, Khammassi M, Masurier J, Julian V, Pereira B, et al. Appetite, energy intake and food reward responses to an acute High Intensity Interval Exercise in adolescents with obesity. *Physiology & behavior*, 2018; 195: 90-97. https://doi.org/10.1016/j.physbeh.2018.07.018
19. Thivel D, Isacco L, Montaurier C, Boirie Y, Duché P, Morio B. The 24-h energy intake of obese adolescents is spontaneously reduced after intensive exercise: a randomized controlled trial in calorimetric chambers. *PLoS One*, 2012; 7(1): e29840. https://doi.org/10.1371/journal.pone.0029840
20. Flint A, Raben A, Blundell JE, Astrup A. Reproducibility, power and validity of visual analogue scales in assessment of appetite sensations in single test meal studies. *International journal of obesity*, 2000; 24(1): 38.
21. Kelly T, Yang W, Chen CS, Reynolds K, He J. Global burden of obesity in 2005 and projections to 2030. *Int J Obes*. 2008; 32(9): 1431- 1437. https://doi.org/10.1038/ijo.2008.102
22. King JA. *Effects of exercise on appetite, food intake and the gastrointestinal hormones Ghrelin and Peptide YY*. [PhD Thesis]. 2010.
23. De Rijke CE, Hillebrand JJG, Verhagen LAW, Roeling TAP, Adan RAH. Hypothalamic neuropeptide expression following chronic food restriction in sedentary and wheel-running rats. *Journal of molecular endocrinology*, 2005; 35(2): 381-390. https://doi.org/10.1677/jme.1.01808.
24. Katsuki A, Sumida Y, Gabazza EC, Murashima S, Tanaka T, Furuta M, et al. Plasma levels of agouti-related protein are increased in obese men. *The Journal of Clinical Endocrinology & Metabolism*, 2001; 86(5): 1921-1924. https://doi.org/10.1210/jcem.86.5.7458
25. Shen CP, Wu KK, Shearman LP, Camacho R, Tota MR, Fong TM, Van der Ploeg LHT. Plasma agouti-related protein level: a possible correlation with fasted and fed states in humans and rats. *Journal of neuroendocrinology*, 2002; 14(8): 607-610. https://doi.org/10.1046/j.1365-2826.2002.00825.x
26. Ghanbari-Niaki A, Sharifi-Rigi AAH. Serum agouti--related protein (AGRP) response to a single session of circuit-resistance exercise at different intensities in male college students. *Journal of applied exercise physiology*, 2009; 55-63.
27. Qian, S, Chen H, Weingarth, D, Trumbauer ME, Novi DE, Guan, et al. Neither agouti-related protein nor neuropeptide Y is critically required for the regulation of energy homeostasis in mice. *Molecular and cellular biology*, 2002; 22(14): 5027-5035. https://doi.org/10.1128/MCB.22.14.5027-5035.2002.
28. Lu XY, Shieh KR, Kabbaj M, Barsh GS, Akil H, Watson SJ. Diurnal rhythm of agouti-related protein and its relation to corticosterone and food intake. *Endocrinology*, 2002; 143.10: 3905-3915. https://doi.org/10.1210/en.2002-220150.
29. King NA, Burley VJ, Blundell JE. Exercise-induced suppression of appetite: effects on food intake and implications for energy balance. *European journal of clinical nutrition*, 1994; 48(10): 715-724.
30. Howe S, Hand T, Larson-Meyer D, Austin K, Alexander B, Manore M. No effect of exercise intensity on appetite in highly-trained endurance women. *Nutrients*, 2016; 8(4): 223. https://doi.org/10.3390/nu8040223
31. Wirth MM, Giraudo SQ. Agouti-related protein in the hypothalamic paraventricular nucleus: effect on feeding. *Peptides*, 2000; 21(9): 1369-1375. https://doi.org/10.1016/S0196-9781(00)00280-1
32. Sim AY, Wallman KE, Fairchild TJ, Guelfi KJ. High-intensity intermittent exercise attenuates ad-libitum energy intake. *International journal of obesity*, 2014; 38(3): 417. https://doi.org/10.1038/ijo.2013.102
33. Westerterp-Plantenga MS, Verwegen CR, IJedema MJ, Wijckmans NE, Saris WH. Acute effects of exercise or sauna on appetite in obese and nonobese men. *Physiology & behavior*, 1997; 62(6): 1345-1354. https://doi.org/10.1016/S0031-9384(97)00353-3
34. George VA, Morganstein A. Effect of moderate intensity exercise on acute energy intake in normal and overweight females. *Appetite*, 2003; 40(1): 43-46. https://doi.org/10.1016/S0195-6663(02)00146-0.
35. Erdmann J, Tahbaz R, Lippl F, Wagenpfeil S, Schusdziarra V. Plasma ghrelin levels during exercise—effects of intensity and duration. *Regulatory peptides*, 2007; 143(1-3): 127-135. https://doi.org/10.1016/j.regpep.2007.05.002
36. Shorten AL, Wallman KE, Guelfi KJ. Acute effect of environmental temperature during exercise on subsequent energy intake in active men. *The American journal of clinical nutrition*, 2009; 90(5): 1215-1221. https://doi.org/10.3945/ajcn.2009.28162
37. Martins C, Morgan LM, Bloom SR, Robertson MD. Effects of exercise on gut peptides, energy intake and appetite. *Journal of Endocrinology*, 2007; 193(2): 251-258. https://doi.org/10.1677/JOE-06-0030.
38. Tremblay A, Drapeau V. Physical activity and preference for selected macronutrients. *Medicine and science in sports and exercise*, 1999; 31(11 Suppl): S584-9. https://doi.org/10.1097/00005768-199911001-00016
39. Elder SJ, Roberts SB. The effects of exercise on food intake and body fatness: a summary of published studies. *Nutrition reviews*, 2007; 65(1): 1-19. https://doi.org/10.1111/j.1753-4887.2007.tb00263.x

Information about the authors:

Khalaj Sepideh; https://orcid.org/0000-0001-8621-4357; Sepideh_khalaj@yahoo.com; Faculty of Physical Education and Sport Sciences, University of Guilan; P.O Box: 1438, Rasht, Iran.

Mirzaei Bahman; (corresponding author); https://orcid.org/0000-0003-3723-7434; mirzaei@united-world-wrestling.org; Faculty of Physical Education and Sport Sciences, University of Guilan; P.O Box: 1438, Rasht, Iran.

Cite this article as:
Sepideh Khalaj, Bahman Mirzaei. Does an acute bout of high intensity interval exercise suppress appetite in obese women? *Pedagogy of physical culture and sports*, 2020;24(4):181-188.
https://doi.org/10.15561/26649837.2020.0405

This is an Open Access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited (http://creativecommons.org/licenses/by/4.0/deed.en).

Received: 20.12.2019
Accepted: 26.01.2020; Published: 30.08.2020

2020
04

ORIGINAL ARTICLE

Challenges in perspective of life skills acquisition; implication for placement of life skills in university curriculum

Wasim Khan [ABCD], Salahuddin Khan [AD], Tasleem Arif [D], Sohail Roman Khan [CD]

Gomal University, D.I.Khan, Pakistan

Authors' contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds collection.

Abstract

Purpose: The main purpose behind the study was to establish the challenges in relation to the acquisition of life skills among university student-athletes of Khyber Pakhtunkhwa. The study assessed the extent to which the concern existing resources, facilitators, and trainer attitude influences life skills acquisition among student-athletes.

Material: Descriptive survey research design was followed to obtain desirable results. The target population of this study consisted of all those who participated in different sport at the university level of Khyber Pakhtunkhwa (KP), Pakistan. Amongst them, we selected a representative sample (n=389 fifty 50% of the total population) with the help of a simple random sampling technique. The Statistical Package for Social Sciences (SPSS) version, 24 was used to code and analyse the data. The hypotheses were tested by applying statistical tests like Step-wise regression and independents sample t-test. The significance level of 0.05 was fixed to accept or reject the set hypotheses.

Results: Findings of the study indicated that existing resources, facilitators, and trainer/coach attitude significantly influences life skills acquisition among student-athletes (.001, .001 & .000 < .05). The analysed data revealed no significantly difference regarding extent to which specific challenges such as existing resources, facilitators, and trainer attitude influences the acquisition of life skills (.500, .133 & .149 > .05).

Conclusions: The findings of the study revealed that all participants have agreed upon the importance of life skills. Therefore, the life skills course might be considered as an integral part of every educational curriculum of Pakistan. It is suggested that a minimum of 2 hours per week may be included in the educational curriculum of each discipline.

Keywords: challenges, perspective, acquisition, life skills, implication, placement, university curriculum.

Introduction

The youth of the homeland country comprise two-third of its total population. The development of any nation largely depends upon the manpower of its citizens. In this regard, one cannot overstate the role of youth. As a result, there have been many efforts that play an important role in empowering the youth. one of these efforts is through the activities provided in the educational institutions of the country.

Sports and games are an integral part of the academic curriculum [1]. It is necessary for all the educational institutions to make sure the smooth conduct of sports activities and participation. Especially, the participation of university students' who spend most of the time in classrooms, laboratories for research and cut off from social life [2]. The main goal for university sports is the training of the brain and body of young people to keep them physically fit and become a good citizen. Physical activities and sports participation always help the students in higher academic achievements [3].

Sports is believed by many to play an important role in making individuals productive and useful members of society [4, 5]. There is some support in the literature for this view with better positive academic outcomes being reported as directly related are to the time spent in sports activities [6, 7]. Danish colleagues [8] suggest that participation in high-school sports not only develop life skills among students, but it also contributes to educational achievements. Barber and colleagues [3] reported that sports participation led to higher academic performance, greater autonomy and greater satisfaction in one's first job. While many studies report positive outcome other studies associated with negative outcomes including addiction to tobacco and the use of alcohol [9, 10].

Life skills are those skills that help individuals to successfully work in the environment in which they live [11]. According to Gould and Carson [12] life skills are that personal asset that can be developed in the sports arena and transferred in a non-sports setting. Life skills are those important skills that need in various domains of life, such as family, school, and community [13]. Life skills are important and applicable to everyone who wants successes in various aspects of his/her life and look for a quality life. Life skills at school stage assist students are decision making to select courses for their future career, as well as for selecting a suitable profession [14]. The engagement of young students in dissipated, unsocial and illegitimate activities like smoking, drug abuse, and alcoholism is the result of lack of proper guidance, motivation antisocial behaviour of parents and the use of the internet [15].

© Wasim Khan, Salahuddin Khan, Tasleem Arif , Sohail Roman Khan, 2020
doi:10.15561/26649837.2020.0406

The lack of availability of life skills, most of the students is unable to utilize their hidden potentialities in an appropriate manner. Unsocial engagements not only deteriorate the physical but also depreciate the intellectual capacities of the students, the real asset of the nation [16]. In this regard, a well-organized and properly planned program of life skills development can help students to deal with the growing pace and alteration of modern life [17]. Development of basic life skills strengthens the individuals' capabilities to meet the present day demands and helps in dealing with many emerging issues like poverty, famines, suicide, drug abuse, sexual harassment, juvenile delinquency and anti-social activities.

A resource is an aid or support that is needed to assist, to sketch and to achieve something. Life skills do require numerous resources in the shape of required facilities, facilitators, space, positive attitude of trainer, and equipment for its development and improvement. Clearly, one of the most important skill for a trainer is to determine the needs and to identify resources that can resolve these needs and then to require the needed resources. For life skills acquisition, it is highly desirable to have proper qualified and non-qualified trainer/coach, proper space, and proper equipment and gears in relevance with the nature of activity. without these facilities the program cannot be conducted in a befitting manner. So, for any program identification and facilitation of resources are very much important.

Although life skills acquisition seems most neglected in the curriculum of the educational institutions of Pakistan. The focus is mainly on the curriculum contents already designed especially for university students. However, those students who participate in sport can learn basic life skills to some extent.

Objectives: To examine the influence of specific challenges such as existing resources, facilitators, and trainer attitude upon life skills acquisition among university student-athletes of Khyber Pakhtunkhwa, and to examine the extent to which the influence of specific challenges such as existing resources, facilitators, and trainer attitude is the same between male and female university student-athletes of Khyber Pakhtunkhwa.

Hypotheses: Ha1 – The specific challenges such as existing resources, facilitators, and trainer attitude would significantly influence the acquisition of life skills among university student-athletes. Ho2 – The extent to which specific challenges such as existing resources, facilitators, and trainer attitude influences the acquisition of male athletes would not significantly differ from that of female athletes.

Materials and Methods

Participants: Population refers to the full set of individuals or of objects having uniformity in their characteristics. The population for the study comprised of all those students who participated in a competitive sport and were enrolled in Public or Private Sector Universities of Khyber Pakhtunkhwa.

Research Design: For obtaining desirable information, the researcher used the survey technique, in which the data were collected at a specified time of the year from different students of both private and public sector universities of Khyber Pakhtunkhwa.

Sampling Strategy: The province of KP comprises 26 districts in which thirty-six (36) public and private sector universities are established. Amongst, these universities, the researcher selected 18 those universities, whose teams are regularly taking part in Inter-Collegiate, Inter-Varsity, and all Pakistan Inter-Varsity sports events. The researcher then obtained a total number of those students who participated in sports events of Inter-Collegiate, Inter-Varsity, and all Pakistan Inter-Varsity from the respective Directorate of Sports of every university. According to the Entry Form of students 778 students from the sampled universities participated in the Inter-Collegiate, Inter-Varsity, and all Pakistan Inter-Varsity sports competitions. Amongst them, the researcher selected a representative sample (n=389 fifty 50% of the total population) with the help of a simple random sampling technique.

Research Instrument: Questionnaire was the main instrument used for data collection in the study. Questionnaire is considered as useful tool as it eliminates bias since respondents are given the same questions [18]. The questionnaire was properly developed by the researchers encompassing all the aspects of the study and validated by the academic staff in the Department of Sports Sciences and Physical Education of Gomal University. Prior to the main study, pre-testing of the developed instrument was conducted between thirty students (males=17 and females=13) from a target population having different sport and socio-cultural background. The students those who participated in the pilot study but were not included in the main study. Mugenda, O. and Mugenda, A. [19] suggests the pretest sample is between 1% and 10% depending on the sample size. This pre-testing of the questionnaire was conducted to identify questions that don't make sense or problems with the questionnaire that might lead to biased answers.

Data Collection Procedure: Prior to data collection, the researchers accorded formal approval from Students Supervisory Committee (SSC), Department of Sports Sciences and Physical Education, Gomal University to conduct survey in the universities. Upon receiving formal approval, the survey began in the first week of January 2019. The researchers collected the required data in four weeks. The coaches and sports organizers of the Sports Directorate of the sampled universities helped the researchers in soliciting the responses from students' athletes. It is important to mention that a total of 389 questionnaires were distributed among the respondents, however; 335 corrected filled questionnaires were received back and used in data analysis.

Statistical Analysis: The responses collected through questionnaires were carefully arranged, tabulated and analysed with the help of Statistical Package for Social Sciences (SPSS) version, 24. To assess the influence of existing resources, facilitators, and trainee attitude upon the life skills acquisition of university student-athletes,

step-wise regression was applied; where the acquisition of university student-athletes was considered the dependent variable and existing resources, facilitators, and trainee attitude were taken as the independent variable. Similarly, to examine whether there exist significant differences based on gender (Males and Females) regarding specific challenges such as existing resources, facilitators, and trainer attitude. To address this hypothesis, the independent sample t-Test was used. The aforementioned statistical tests were used considering the requirements of the set hypotheses of the study. The basic aim behind the use of these statistical tests was to test the hypothetical statement for obtaining precise and accurate findings and conclusion.

Results

Demographic Profiles: The gender, ethnicity, and mother tongue were taken into consideration as shown in table 4.1. The distribution of the athletes based on their gender shown in table 1 was 265 (79.1%) male and 70 (20.9%) females. Ethnicity of the respondents was classified into four categories i.e., Pakhtoon, Saraiki, Hindko, and any others; out of 335 student-athletes 261 (77.9 %) were Pakhtoon, 60 (17.9%) Saraiki, 10 (3.0%) were having Hindko ethnicity, and 04 (1.2%) were those having any other ethnicity. Similarly, the mother tongue was analyzed from four categories as shown in table 1 i.e., Pashto, Saraiki, Hindko, and any others; out of 335 athletes 245 (75.8%) were spoken Pashto, 61 (18.2%) Sariki language, 12 (3.6%) were speaking Hindko, and only 08 (2.4%) were spoken other languages.

Table 1 presented the characteristics of n = 335 participants included in the study. The gender, ethnicity, and mother tongue were taken into consideration as shown in table 1.

Testing of Hypothesis

Hypothesis 1

H 1 – The specific challenges such as existing resources, facilitators, and trainer attitude would significantly influence the acquisition of life skills among university student-athletes.

The above table showing the results of step-wise regression regarding the effect of Existing Resources, Facilitator, and Trainer Attitude upon Life Skills acquisition of the participants. In first model, Existing Resources identified 47.8% effect upon learning Life Skills. The second model Existing Resources and Facilitator produced 48% effect on learning Life Skills. As well as the third model Existing Resources Facilitator, and Trainer Attitude put 48% upon learning Life Skills.

Coefficient Table shows that if one-unit increase in Existing Resources will cause of .676-unit increase in the influence of learning Life Skills, on the other hand if one-unit increase in model two Existing Resources Facilitator will cause of .677 unit increases in the influence of learning Life Skills. If one-unit increase in model three Existing Resources, Facilitator, and Trainer Attitude will cause of .693 units increases in influence of learning Life Skills.

Table 1. Demographics characteristics of participants (n=335)

Characteristics		Frequency	Percent
	Male	265	79.1
Gender	Female	70	20.9
	Total	335	100.0
	Pakhtoon	261	77.9
	Saraiki	60	17.9
Ethnicity	Hindko	10	3.0
	Any other	4	1.2
	Total	335	100.0
	Pashto	254	75.8
	Saraiki	61	18.2
Mother Tongue	Hindko	12	3.6
	Any other	8	2.4
	Total	335	100.0

Table 2. Step-wise regression showing the influence of existing resources, facilitators, and trainee attitude upon the acquisition of university student-athletes

Model Summary					
Model	**R**	**R^2**	**Adjusted R^2**	**F**	**Sig.**
1	.692[a]	.478	.474	118.303	.000[b]
2	.693[b]	.480	.472	59.021	.000[c]
3	.693[c]	.480	.468	39.080	.000[d]

a. Predictors: (Constant), Existing Resources; b. Predictors: (Constant), Existing Resources and Facilitators; c. Predictors: (Constant), Existing Resources, Facilitators, and Trainer Attitude

Table 3. Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.165	.210		5.549	.000
	Existing Resources	.676	.062	.692	10.877	.000
2	(Constant)	1.035	.307		3.375	.001
	Existing Resources	.677	.062	.692	10.855	.000
	Facilitators	.037	.064	.037	.585	.000
3	(Constant)	1.063	.328		3.244	.002
	Existing Resources	.693	.091	.709	7.600	.000
	Facilitators	.055	.095	.055	.577	.000
	Trainer Attitude	.041	.166	.029	.248	.000

a. Dependent Variable: learning Life Skills

Table 4. independents sample t-test describing the results of male and female students regarding specific challenges such as existing resources, facilitators, and trainer attitude

Variables	Gender	n	Mean	Std.	T	Sig.
Existing Resources	Males	265	3.2931	.69082	-6.674	**.500**
	Females	70	3.3736	.84985		
Facilitator	Males	265	3.6365	.72334	1.505	**.133**
	Females	70	3.4940	.65831		
Attitude of Trainer	Males	265	3.8006	.72974	-1.443	**.149**
	Females	70	3.9486	.71850		

Hence the hypothesis that the specific challenges such as existing resources, facilitators, and trainee attitude would influence the acquisition of university student-athletes is hereby accepted.

Hypothesis 2

H 1 – The extent to which specific challenges such as existing resources, facilitators, and trainer attitude influences the acquisition of life skills among male athletes would not significantly differ from that of female athletes.

The independents sample t-test indicated that there are no significant differences in existing resources as challenges in the acquisition of life skills between male and female students (t (335) = -6.674, p = .500 > .05). Similarly, there are no significant differences in facilitator as a challenge between male and female students (t (335) = 1.505, p = .133 > .05). The table describes, there is no significant differences in attitude of their trainers between male students' athlete and female students' athletes (t (335) = -1.443, p = .149 > .05), Therefore, the hypothesis that extent to which specific challenges such as existing resources, facilitators, and trainer attitude influences the acquisition of male athletes' would not significantly differ from that of female athletes is accepted.

Discussion

The researchers focused on to establish the challenges in relation to the acquisition of life skills among university student-athletes of Khyber Pakhtunkhwa. The main hypothesis that the specific challenges such as existing resources, facilitators, and trainee attitude would influence the acquisition of university student-athletes is confirmed by the analysed data shown in (table 2 & 3). When we analyse the responses of students pertaining to the three questions a) availability of existing resources, b) existing facilitators, c) attitude of trainer/coach, and, all show that student-athletes admitted the influence of existing resources, facilitators, and trainer attitude influences the acquisition in relation to the acquisition of life skills.

One of the interesting findings of this study tends to indicate the participants had not acknowledged the role of coaches in the development of life skills through sports. Participants in this study reported that university sports program where coaches are not specifically trained to teach life skills, student-athletes still replied they can learn life skills. It may be due to the fact that athletes are not taught in perspective of life skills development through sports in a systematic manner. Similar results have been found by Holt et al [20] that athletes reported a number of skills such as ability of collaborative work,

time management skills, proper planning, ability to compromise, self-efficacy, and leadership abilities, even though their coach did not directly teach them to develop these skills. A study conducted by Shah [21] found that coaches have limited knowledge, especially in the two important areas of sports nutrition and sports psychology. Therefore, efforts must be taken to arrange and participate in sports coaches and trainers in sport psychology interventions. In terms of gender differences regarding extent to which specific challenges such as existing resources, facilitators, and trainer attitude influences the acquisition of male athletes', the analysed data revealed no significantly difference.

Conclusion

Based on the findings, the study concludes that acquisition of life skills is important in educational institution. Although life skill is not included in the program of activities of universities. The acquisition of life skills might be considered as life long process that seeks to help students effectively function in various domains of life, such as family, school, and community. The study concludes that participants both male and female reported that the proper and effective acquisition of life skills is influenced by several factors like existing resources, facilitators, and trainer attitude. The findings of the study revealed that all participants have agreed upon the importance life skills. Therefore, the life skills course might be considered as an integral part of every educational curriculum of Pakistan. It is suggested that a minimum of 2 hours per week may be included in the educational curriculum of each discipline.

Implication

The results of the present study were supporting the participation in sport for promoting remarkable development in the perspective life skills among university students. However, if the obstructive limitations faced by the researcher during the course of study are overcome; the results may be more desirable both the perspectives, i.e; development of life skills and its smooth onward transfer through sport. The findings of the study may help in the expansion of awareness and education on benefits of life skills acquisition among student, as well as addressing the challenges facing in the acquisition of life skills among students through the curriculum.

Limitation

The present study was carried out among the university level students, the researcher is ambitious to inclusion of larger and diverse population would help in adding to the credibility of future research in this area. Likewise, this practice would produce better results that would substantiate the relation of the sport with the development and transfer of life skills among students.

Acknowledgement

First of all, we are immensely grateful to show our gratitude to our colleagues, Department of Sports Sciences and Physical Education, Gomal University, Dera Ismail Khan for sharing their pearls of wisdom with us during the course of this research paper. We are also immensely grateful to all the study participants who participated in the survey.

Conflict of Interest

The authors have declared no conflict of interest.

References

1. Kirk D. Beyond the "academic" curriculum: The production and operation of biopower in the less-studied sites of schooling. *Dangerous coagulations*, 2004;1:117-34.
2. Beyer JM, Hannah DR. The cultural significance of athletics in US higher education. *Journal of Sport Management,* 2000;14(2):105- 32. https://doi.org/10.1123/jsm.14.2.105
3. Lee SM, Burgeson CR, Fulton JE, Spain CG. Physical education and physical activity: results from the School Health Policies and Programs Study 2006. *Journal of school health*, 2007;77(8):435- 63. https://doi.org/10.1111/j.1746-1561.2007.00229.x
4. Camiré M, Trudel P, Forneris T. Coaching and transferring life skills: Philosophies and strategies used by model high school coaches. *The sport psychologist,* 2012;26(2):243- 60. https://doi.org/10.1123/tsp.26.2.243
5. Khan MY, Jamil A, Khan UA, Kareem U. Association between participation in sports and academic achievement of college students. *International Journal of Academic Research in Business and Social Sciences,* 2012;2(8):419.
6. Miller KE, Melnick MJ, Barnes GM, Farrell MP, Sabo D. Untangling the links among athletic involvement, gender, race, and adolescent academic outcomes. *Sociology of sport journal,* 2005;22(2):178- 93. https://doi.org/10.1123/ssj.22.2.178
7. Khan MY, Jamil A, Khan UA, Karim U. Perception of community about the role of sports in social training of youth. *International Journal of Academic Research in Business and Social Sciences*, 2012;2(8):2222-6990.
8. Danish SJ, Forneris T, Wallace I. Sport-based life skills programming in the schools. *Journal of Applied School Psychology*. 2005;21(2):41- 62. https://doi.org/10.1300/J370v21n02_04
9. Melnick MJ, Miller KE, Sabo DF, Farrell MP, Barnes GM. Tobacco use among high school athletes and nonathletes: Results of the 1997 Youth Risk Behavior Survey. *Adolescence,* 2001;36(144):727.
10. Feldman AF, Matjasko JL. The role of school-based extracurricular activities in adolescent development: A comprehensive review and future directions. *Review of educational research,* 2005;75(2):159- 210. https://doi.org/10.3102/00346543075002159
11. Lavallee D. The effect of a life development intervention on sports career transition adjustment. *The sport psychologist,* 2005;19(2):193- 202. https://doi.org/10.1123/tsp.19.2.193
12. Gould D, Carson S. Life skills development through sport: Current status and future directions. *International review of sport and exercise psychology,* 2008;1(1):58- 78. https://doi.org/10.1080/17509840701834573
13. Danish SJ, Forneris T, Wallace I. Sport-based life

skills programming in the schools. *Journal of Applied School Psychology,* 2005;21(2):41- 62. https://doi.org/10.1300/J370v21n02_04
14. Sharma S. Measuring life skills of adolescents in a secondary school of Kathmandu: an experience. *Kathmandu University medical journal (KUMJ),* 2003;1(3):170-6.
15. Burdek A, Ławska W. Reasons for alienation leading to anti-social and delinquent behaviour among uveniles, according to the juveniles themselves. *Państwo i Społeczeństwo,* 2016(4):55- 68. https://doi.org/10.31749/pismzp2016/20236
16. Wood J. The University as a Public Good: Active citizenship and university community engagement. *International Journal of Progressive Education*, 2012;8(3):15-31.
17. Caffarella RS, Baumgartner L. *Learning in adulthood: A comprehensive guide*. Jossey-Bass; 2007.
18. Burton D, Bartlett S. *Key issues for education researchers*. Sage; 2009.
19. Mugenda OM. Mugenda AG. *Research methods: Qualitative and quantitative approaches*. Nairobi: African Centre for Iechnology Studies, Renya; 2003.
20. Holt NL, Tamminen KA, Tink LN, Black DE. An interpretive analysis of life skills associated with sport participation. *Qualitative research in sport and exercise,* 2009;1(2):160- 75. https://doi.org/10.1080/19398440902909017
21. Shah AJ. *Knowledge, opinion, and practices; a survey of national coaches regarding diet plan for elite athletes in Pakistan.* M.Phil Research report; 2019.

Information about the authors:

Wasim Khan; (Corresponding Author); https://orcid.org/0000-0002-1888-2975; wasimkhan2057@gmail.com; Department of Sports Sciences and Physical Education, Gomal University, D.I.Khan; Khyber Pakhtoonkhwa, Pakistan.

Salahuddin Khan; https://orcid.org/0000-0002-1491-9363; drslahuddinkhan@yahoo.com; Department of Sports Sciences and Physical Education, Gomal University, D.I.Khan; Khyber Pakhtoonkhwa, Pakistan.

Tasleem Arif; https://orcid.org/0000-0002-0718-5330; Tasleemarif12345@gmail.com; Department of Sports Sciences and Physical Education, Sarhad Univesity of Science and Technology, Peshawar; Khyber Pakhtoonkhwa, Pakistan.

Sohail Roman Khan; https://orcid.org/0000-0002-0505-7538; Roman614015@gmail.com; Department of Sports Sciences and Physical Education, Gomal University, D.I.Khan; Khyber Pakhtoonkhwa, Pakistan.

Cite this article as:
Wasim Khan, Salahuddin Khan, Tasleem Arif , Sohail Roman Khan. Challenges in perspective of life skills acquisition; implication for placement of life skills in university curriculum. *Pedagogy of physical culture and sports*, 2020;24(4):189-194. https://doi.org/10.15561/26649837.2020.0406

This is an Open Access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited (http://creativecommons.org/licenses/by/4.0/deed.en).

Received: 17.12.2019
Accepted: 12.01.2020; Published: 30.08.2020

ORIGINAL ARTICLE

Cardiovascular, lactate and appetite response to light and spicy music tempo after an endurance swimming protocol in young girls

Javad Mehrabani[1ABCDE], Soodabeh Bagherzadeh[2BCDE], Aboozar Jorbonian[1CD], Eisa Khaleghi-Mamaghani[1DE], Maryam Taghdiri[3D], Mona Mehdizadeh-Haghighi[2B]

[1] *University of Guilan, Rasht, Guilan, Iran*
[2] *Islamic Azad University, Rasht, Guilan, Iran*
[3] *University of Mazandaran, Babolsar, Mazandaran, Iran*

Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Resource Collection.

Abstract

Purpose: During exercise, the effects of music on the performance have been previously evaluated. However, the superiority of the type of music and during recovery is not yet clear. Therefore the aim of this study was to determine the impact of music with a spicy and light beat on changes in lactate levels, blood pressure, heart rate, and appetite during the recovery period after the endurance swimming.

Material: Thirteen healthy young girls participate in three control and experimental trials. The participants performed a swimming. Immediately after swimming, they listened to music. Also, evaluations before and after (several times) swimming were performed.

Results: Five minutes after swimming there was a significant difference between the non-sound group with the music groups ($p<0.05$). In blood lactate, there was a significant difference between the spicy and light music groups compared to the non-sound group, 2 and 5 minutes after swimming. In heart rate, systolic blood pressure and appetite components, there were significant difference between spicy and light music groups at time 10, 15 and 25 minutes. In the 25 minutes after the swim, reducing the heart rate in light music was more than spicy. Also, 10 minutes after swimming, the spicy music group could not cope with the increase in heart rate ($p<0.05$). There was a significant difference between the two music groups in minutes 5, 10 and 15 after swimming ($p<0.05$).

Conclusions: Listening to light music during recovery from endurance swimming was associated with decreased lactate levels and heart rate, but listening to spicy music increased heart rate and prospective.

Keywords: swimming, lactate, heart rate, appetite, music tempo.

Introduction

Athletes use music to improve performance and increase motivation. The effects of listening to music on physiological, psychological and physical indices of sports enthusiasts have also been studied [1-4]. Some studies have shown a positive effect of music on improving the physiological status, such as changes in heart rate (HR), respiration, blood pressure (BP), endorphin levels, skin reactions, brain waves, and also the reduction of sensation and threshold of physical pain [3-5].

The effect of music before and during the sport and physical activities has been discussed before, and It has been shown that music before the exercise can act as a stimulant to the level of arousal and physiological state [6]. Also, the music during exercise has been considered as a motivation to continue long-term, repetitive activities [7].

Endurance exercise and fatigue are associated with changes in the cardio-respiratory system and increase psychological stress [8]. In recent research, submaximal and medium level exercise was improved by music. Also in these exercises music reduced the rating of perceived exertion (RPE) [9, 10].

In intense exercises, music increases the potential to improving motivation, while this improvement in motivation is likely not to improve performance [11].

Although athletes report music favorable effects during training or competition, conflicting studies have also been observed. The contradictory results of the music effects are probably due to the type of music, the nature of exercise and the specification of participants (age, gender, etc.).

Swimming is a competitive recreational sport that causes significant physiological fatigue from intense activity in competitive swimmer [12]. However, the characteristic of swimming exercise is that the joints are not under bodyweight pressure and its beneficial role in achieving cardiovascular fitness is important. So this sport has been popular with people and athletes and the potential of music is likely effective in swimmer performance. In addition, swimming is a pleasure sport. So it is important to create a feeling of enjoying music in swimming. Yet due to the lack of effective devices for transmitting sound in this environment, the effect of music on swimmer performance is unclear [12].

Appetite is a mental feeling of hunger, fullness, satisfaction and prospective that can affect to calorie intake [13]. Physical activity reduces appetite by increasing energy consumption, and temporarily inhibiting hunger

© Javad Mehrabani, Soodabeh Bagherzadeh, Aboozar Jorbonian, Eisa Khaleghi-Mamaghani, Maryam Taghdiri, Mona Mehdizadeh-Haghighi, 2020
doi:10.15561/26649837.2020.0401

and delaying the onset of food eating [14].

Many studies have examined the effects of exercise on appetite, but there is a contradiction in this. Several studies have reported an increase, decrease, and loss of appetite after exercise [13-15]. However, metabolic substances produced by metabolism after an exercise can affect appetite. Studies have shown that increasing lactate due to exercise may be acting a role in reducing appetite and is one of the possible mechanisms for inhibiting hunger [14].

Lactate is a metabolic product of physical activity and it was suggested at the beginning of the twentieth century that increased levels of lactate in muscle and so blood is the major cause of fatigue exertion when exercise is very intense [16].

However, fatigue results in impaired physiological functions. For example, it reduces appetite and accumulates metabolic products. In such a situation, a desirable recovery can lead to the reconstruction of energy resources and delay the fatigue process [7].

Nowadays, the effects of post-exercise music are considered as a contributing factor to recovery. The use of music to improve post-exercise recovery has different physiological dimensions. Using music in the recovery period is considered a new strategy and elite athletes use music before or after the competition to increase their recovery and physiological and psychological fitness [7].

In this regard Jeffreys argued that music was not just a motivator during hard work and could help to better recover. He showed those who listened to music during the recovery period had a faster drop in lactic acid than those who did not listen to music [17].

From a long time ago recovery is performed both active and passive. Active recovery is preferred because it reduces lactate levels in the blood [18, 19].

A possible mechanism for this is the increase in blood flow to tired muscles and the metabolites washout by this process. However, most athletes after exercise and the resulting fatigue tend not to perform active recovery with maintaining a certain speed [20]. In this case, using music to facilitate the recovery process seems more appropriate, because it causes a series of changes in emotional, hormonal, nervous and cardiac and cardiorespiratory systems and etc. [7, 20].

Most research in music has focused on the impact of its function on the science, and rarely has been investigated from the biological and psychological point of view [16]. Some limited studies have examined the effect of music on time spent on post-exercise recovery [7]. Also, some researchers have studied the effect of music on the performance of athletes. So, recent studies have mostly focused on the effectiveness of music in reducing stress and enhancing exercise performance [21, 22].

Choosing the right type of music is very important, as the specific type of music stimulates people, and it makes people calm [23, 24]. So, the main question for researchers is, which music (with what beat) is better.

Therefore, the present study was designed to investigate the effect of the type of music. In this study, we hypothesized that the type of music can have different effects. According to this assumption, we evaluated the effect of music with a spicy and light beat on changes in lactate, BP, HR and appetite during the recovery after an endurance swimming.

Materials and methods

Participants. Twenty-seven girl swimmers (with 5 years of championship history) voluntarily notification their readiness to participate in the present study. Of these twenty-seven, only twelve (age: 31.25±3.15 yr, height: 165.1±4.7 cm, weight: 63.1±3.42 kg, body fat: 26.41±2.24%, BMI: 22.12±3.24 kg.m^2) were randomly selected to participate in the study. The characteristics of the participants are presented in Table 1.

Prior to the implementation of the research protocol, all stages of the study and possible risks were explained to the participants, and written consent was obtained from them.

The criteria for entering and exiting the participants were as follows:

- Participants were swimmers (with 5 years of championship history).
- Participants were healthy (self-report of their health and health visit by a physician).
- The participants were not smokers and did not drink alcohol. Caffeine or any stimulant was prohibited.
- Participants had no exercise or heavy physical activity 72 hours before taking part in the study.

Initial evaluation

One week before the start of the protocol, baseline evaluation was performed, which included weight, height, body fat, and waist to hip ratio (WHR). Also, the baseline study was performed to determine a pressure range equal to 75-85% of the maximum heart rate (MHR) in all participants. In addition the speed of movement along the pool was calculated.

Measurement of appetite

The appetite visual analog scale (VAS) was presented before, immediately after, 15, 30 minutes and 1, 2 and 3 hours after swimming. Participants were asked to fill out a questionnaire at a specified time and on VAS evaluate their amount of fullness and hunger.

Participants on the chart (0-100 mm in size) indicated their amount of satisfaction, fullness, hunger, and desire to eat with a marking.

Measurement of heart rate and blood pressure

Baseline HR and systolic blood pressure (SBP) and diastolic blood pressure (DBP) was measured 75 min after breakfast and before the protocol began. Furthermore, HR and BP was measured immediately after the start of music play and in the 2, 5, 10, 15 and 25 minutes.

Measurement of blood lactate

Lactate was measured immediately, 5 and 15 minutes after exercise in recovery period using an Xpress lactometer (Germany, Morfelden-Walldorf).

Nutrition control

Participants ate breakfast similar to 185 calories (fruit juice, bread, and cheese).

Swimming protocol

Each participant was present in the pool for 3 sessions. The protocol was repeated with a one-week recovery based on a crossover design for spicy or light music and control (non-sound) trials.

- Each swim session was as follows: 10-min warm-up, which included 5 min of stretching and 5 min of soft swimming.
- Participants began swimming. Then they continued to until exhaustion with 75–80% of their MHR.
- Swimming protocol included a high-intensity interval freestyle swimming in a pool with a length of 25 meters. Every 25 meters (pool length) lasted for 55 seconds, and participants every 25 meters had rest for 10 seconds. In the end, participants swam averaged 1240 meters in 24 minutes.

The intensity of exercise was monitored by a HR telemetry device and measured with a Pro chest strap polar HR monitor (H10 polar, 2017, Polar Electro, Inc. Finland).

A 6-20 RPE that introduce by Borg was used to determine the exhaustion of subjects together with HR measures. Borg scale was shown to subjects every 10 seconds (Rest interval time).

Music selection

Music intervention was started immediately after leaving the water. Each music trial included 25 min light (80 bpm) or spicy (120 bpm) or non-sound (just using headphones without any sound). Each music trial included six unblemished music that played with Adobe Music 1.5 audition software to proportional to the number of rhythms. The music loudness was considered as 70 dB [7].

It is worth mentioning that the subjects were present in the pool from 8 am (start the research) to 12 pm (end the research) and the pool water temperature was 25-27 °C.

Statistical analysis

The Shapiro-Wilk test was used to determine the normality of data. The results of the study are reported as mean and standard deviation. To determine the variation of each of the variables in different stages was used one-way repeated-measures ANOVA. In addition, the Bonferroni test was used for the difference between test stages and between the groups. The significance level of $P<0.05$ was considered.

Results

Blood lactate

Lactate increased immediately after swimming and five minutes after swimming than before swimming in all three groups. Five minutes after swimming there was a significant difference between the no sound group with the spicy and light music group. Also, 5 minutes after swimming there was a significant difference between all three groups with immediately after swimming. In addition, 15 minutes after swimming there was a significant decrease compared to immediately after swimming ($p<0.05$) (Table 2).

Heart rate

In three modes of spicy, light and non-sound music, the HR increased significantly immediately after swimming, 2, 5, 10, 15 minutes after swimming compared to pre-swimming. Also, 25 minutes after swimming, the HR significantly decreased in the spicy and light music group than immediately after swimming ($p<0.05$) (Table 3).

There were no significant differences between the 5, 10, and 15 minutes (Table 3).

Two minutes after swimming, there was a significant difference between the spicy and light music groups compared to the non-sound group. This indicates a

Table 1. Characteristics of participants (n=12)

Variable	Mean ± SD
Age (yr)	31.25±3.15
Height (cm)	165.1±4.7
Weight (kg)	63.1±3.42
BMI (kg.m^2)	22.12±3.24
Body fat (%)	26.41±2.24
WHR	0.79±0.09
Swimming distance (m)	1231.48±80.12
Swimming time (min)	24.02±3.71

Note: BMI= Body mass index; WHR= Waist to hip ratio; SD= Standard deviation

Table 2. The changes of lactate

	Condition	Before	Immediately after	Min 5	Min 15
Lactate (mmol/L)	Spicy music	2.19±0.08	*3.89±0.51	$^{*©\dagger}$4.12±0.9	3.87±0.57
	Light music	2.17±0.04	*3.45±0.27	$^{*©\dagger}$4.01±1	3.65±0.15
	Non-sound	2.21±0.06	*3.66±0.43	*†4.89±0.89	†4.03±0.67

*Significant change with ANOVA Rep. measurements and Bonferroni compared to baseline ($p<0.05$).

†Significant change compared with immediately after swimming ($p<0.05$).

$^{©}$Significant difference with non-sound control group 5 min after swimming ($p<0.05$).

decrease in HR with both kinds of music in a time of 2 minutes after a swim. Also, there was a significant difference between spicy and light music groups at ten, fifteen and twenty-five minutes. This showed that in all three times, light music was effective in reducing HR ($p<0.05$) (Table 3).

However, in the twenty-five minutes after the swim, due to a significant reduction in the HR in the light music group compared to the non-sound group, the light music was more effective than spicy. Also, ten minutes after swimming, it was found that because of the significant difference between the spicy music group and the non-sound group, the spicy music group could not cope with the increase in HR ($p<0.05$) (Table 3).

Blood pressure

SBP and DBP increased in both spicy and light music groups immediately after swimming and 2 minutes after swimming, in addition, SBP changes significantly in both spicy and non-sound groups 10 min after swimming and non-sound group 15 min after swimming with before swimming ($p<0.05$) (Table 3).

In values heart rate, significant differences were observed between the spicy and light music groups at 5, 10 and 15 minutes after swimming ($p<0.05$) (Table 3).

The values of DBP in all three groups and on times 5th, 10th, 15th and 25th minutes after swimming did not show any significant changes with times before swimming (Table 3).

Appetite

Fullness

Significant differences were observed between the spicy and light music groups with the pre-swim stage at one and 3 hours after swimming ($p<0.05$). Indeed, a significant differences were observed between the spicy and light music groups with an immediately after-swimming stage at fifteen minutes after swimming. In addition, there was a significant difference between the spicy and non-sound music groups at the 15th minute after swimming ($p<0.05$). However, at other stages there was no significant difference (Figure 1 A).

Hunger

Significant differences were observed between the spicy and light music groups with the pre-swim stage at 3 hours and 15 min after swimming ($p<0.05$). Significant differences were observed between the spicy and light music groups with an immediately after-swimming stage at thirty minutes and one, 2 and 3 hours after swimming ($p<0.05$). However, at other stages there was no significant difference (Figure 1 B).

Prospective

Significant differences were observed between the spicy and light music groups with an immediately after-swimming stage at fifteen and thirty minutes and one, 2 and 3 hours after swimming. In addition, there was a significant difference between the spicy and light music groups at the 15th minute ($p<0.05$). However, at other stages there was no significant difference (Figure 1 C).

Satisfaction

Significant differences were observed between the spicy music group with the pre-swim stage at 3 hours after swimming ($p<0.05$).

Significant differences were observed between the spicy music group with an immediately after-swimming stage at thirty minutes and 3 hours after swimming. In addition, there was a significant difference between the spicy and light music group with a non-sound group at the 15th minute after swimming. Also, there was a significant difference between the light and spicy music groups with the non-sound group at 30 minutes and one hour after swimming respectively ($p<0.05$). However, at other stages there was no significant difference (Figure 1 D).

Discussion

Previous research has examined the effect of music during and after exercise [6, 25]. Listening to music during exercise is not possible for some sports including swimming, and swimmers listen to music just before the exercise or during recovery. However, choosing the type of music can also have different effects [23, 24]. According to our knowledge, the effect of music on the recovery period has not been studied.

Two recovery methods have been introduced: this is active and inactive recovery. Many coaches tend to have active recovery because of the superiority of active recovery in reducing lactate [18, 19]. However, during the recovery period, athletes do not tend to be active recovery and use new methods and techniques to aid in the recovery process [20]. One of these is listening to music.

Table 3. Changes in HR and BP before and after swimming protocol

Variable	Music tempo	Before swimming	Immediately after	Recovery				
				min 2	min 5	min 10	min 15	min 25
HR (min)	Spicy	96.3±6.1	†177.6±6.8	†*128.6±15.3	†129.8±9.2	#†*121.5±10.8	†#112.3±8.6	#96.2±10.1
	Light	95.4±7.3	†180.5±8.2	†*123.9±18.1	†124.7±11.9	†116.7±8.8	†106.5±10.4	*87.6±9.5
	Non-sound	93.9±8.7	†181.5±8.2	†140.3±14.9	†121.5±8.2	†117.7±10.4	†110.8±12.4	95.6±8.5
SBP (mmHg)	Spicy	102.5±0.7	†141.4±1.09	†130.7±0.93	#†119.3±0.96	#†120.2±1.01	#109.1±0.79	106.43±1.05
	Light	100.3±0.88	†139.9±1.19	†127.9±0.94	†114.01±1.01	111.6±0.79	102.2±0.83	104.31±0.7
	Non-sound	101.3±0.5	†142.2±0.2	†131.5±1.0	†118.10.86	†122.1±0.88	†111.4±0.91	109.71±0.9
DBP (mmHg)	Spicy	7.75±0.46	†9.25±1	†8.81±1.28	7.93±0.62	7.87±0.58	7.81±0.75	7.75±0.65
	Light	7.5±0.75	†9.12±1.06	†8.68±0.7	7.54±0.92	7.01±0.79	7.11±0.45	7.44±0.39
	Non-sound	7.61±0.66	†9.56±1	†8.99±1.28	7.81±0.12	7.32±0.58	7.54±0.48	7.18±0.09

Note: HR: Heart rate; SBP: Systolic blood pressure; DBP: Diastolic blood pressure; *significant difference with non-sound group; #significant difference with light music group. †Significant change compared with before swimming ($p<0.05$).

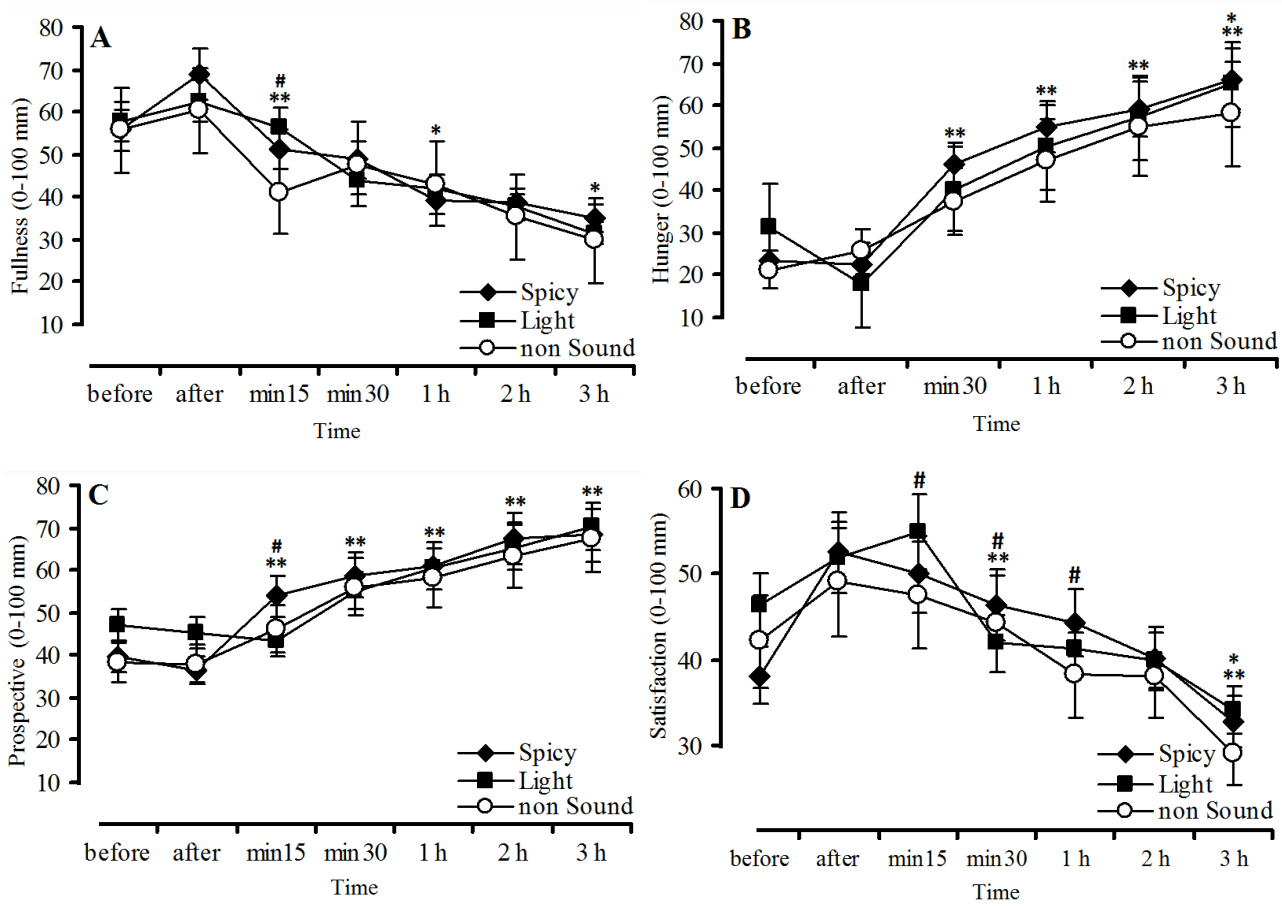


Figure. (A) Fullness; *Significant change in spicy and light groups compared to before and **immediately after swimming; #Significant changes in spicy compared to non-sound group 15 min after swimming (P<0.05); **(B) Hunger**; *Significant change in spicy and light groups compared to before and **immediately after swimming (P<0.05); **(C) Prospective**; **Significant change in spicy and light groups compared to immediately after swimming; #Significant changes in spicy compared to light music 15 min after swimming (P<0.05); **(D) Satisfaction**; *Significant change in spicy group compared to before swimming and **immediately after swimming; #Significant difference in spicy compared to non-sound group 15 min and 1 h after swimming, and with light music group 15 and 30 min after swimming (P<0.05).

Therefore, the purpose of this study was to evaluate the effect of two types of spicy and light music in the recovery period.

As observed in previous studies the effect of music on lactate [20, 25], we hypothesized that a particular type of music (spicy and light) would have different effects on lactate clearance. Interestingly, in the minute 5 of the recovery, the music affected. That is, under fatigue and at the beginning of recovery, music did not have a beneficial effect, and it did not, at the 15th minute.

This finding was not similar to Eliakim et al [20] research, as they observed the effect of the music at twelve and fifteen minutes, and stated that the positive effect of music was only evident in the recovery period as time elapsed. Because as time went by, fatigue and HR was reduced.

Probably the reason for the 15th minute inconsistency was due to the type of exercise. The exercise protocol of the present study was endurance, while their research exercise was intense, and endurance exercise than intense exercise does not affect too much lactate levels [26].

Because the exercise protocol of the present study is enduring in nature, it does not affect lactate levels more [26], and for the same reason, at the 15th minute lactate was significantly reduced in all groups, even in the control group.

Physical exertion is caused by the duration and intensity of the exercise. In endurance exercise, fatigue occurs because of the long duration of the exercise. This fatigue has strong effects on mental states. Therefore, in the interplay of the psychological effects of music on the mind and fatigue on the mind, fatigue will overcome. So it was probably because of this factor that music didn't affect lactate after exercise [20].

Immediately after swimming, HR increased due to physical activity, and this increase is also noticeable in the minutes of 2, 5, 10 and 15 after swimming. However, in the second minute, there was a significant difference between the non-sound and the music groups. This indicated that the influence of music on the HR variations after a moderate time swimming. Probably in contrast between the mental effect of fatigue and the mental effect of music, the positive effects of music are temporarily dominant, the effect disappears in the fifth minute.

As time elapsed and fatigue decreased in the minutes of 10, 15 and 25 after swimming, the fatigue decreased

and the effects of music reappeared.

At minutes of 10, 15 and 25, there was a significant increase in spicy music compared to light music, which was probably due to the motivational state of spicy music that increased the HR [7].

Interestingly, over time, the effect of understanding music increased. And at twenty-five minutes after swimming the music significantly decreased the HR compared to the control group. Consistent with this finding, Savitha et al. concluded that light music after swimming is suitable for rest and helps to recover physical parameters and HR decrease [25].

In addition, there is a hypothesis that light music can also affect the HR by affecting the respiratory system [25]. So it is also likely that more effect of light music in the twenty-fifth minute (due to distance from exercise time) was likely to be due to breathing.

The results of this study showed that listening to music during the recovery period after swimming did not have a significant effect on BP. The SBP and DBP immediately after swimming, 2 and 5 (only DBP) minutes after swimming in three types of music was significantly higher than before swimming.

Savitha et al reported that listening to both spicy and light music during the recovery period after exercise, will significantly reduce the BP [23].

In our research, the lack of a significant effect of music on BP can be due to lactate and metabolites accumulation. On the other hand, there is also the possibility that music does not impressive affect BP due to the body's need to lower its temperature and increase the blood flow of the skin and active muscles.

So, in order to balance the hemostasis, it is necessary to maintain BP at a higher level than before swimming.

However, there was a significant difference in SBP between the two groups of spicy and light music. In the spicy music, BP was high because of the stress state of spicy music.

In the present study, appetite decreased after swimming in all three groups. But there was an increase from minutes 15. That means independent of the music effect, exercise has an effect of appetite suppress. However, this suppression of appetite was temporary, and at other times of recovery and with increasing time interval from swimming, appetite increased. This finding is consistent with the findings of most previous studies [27-29]. In this respect, it is hypothesized that exercise is a negative energy balance. Exercise with this mechanism stimulates food intake behavior to rebuild depleted resources and restore energy balance [30, 31]. In addition, the difference of fullness and satisfaction were meaningful in spicy music and an increase was observed in prospective statement compared with quiet music.

According to our results, the rhythm of music is important in appetite. Along with the results of the present study, we can point to Mc Elrea and Standing [32] research that increased the consumption of drinks with spicy music. This finding was also confirmed by other researchers [33-36].

Conclusion

In summary, listening to light music during recovery from endurance swimming was associated with decreased lactate levels and HR, but listening to spicy music increased HR and prospective. Also, music no impact on BP.

Whether these changes can useful the next training session or competition is still unclear and needs further investigation. And we suggest that, given the limitations of the present study, this study should be conducted over a longer period of time and following other exercises and by evaluating other relevant variables.

Disclosure of interest

The authors declare that they have no competing interest.

References

1. Hayakawa Y, Takada K, Miki H, Tanaka K. Effects of music on mood during bench stepping exercise. *Perceptual and motor skills*. 2000;90(1):307-14. https://doi.org/10.2466/pms.2000.90.1.307
2. Pates J, Karageorghis CI, Fryer R, Maynard I. Effects of asynchronous music on flow states and shooting performance among netball players. *Psychology of Sport and Exercise.* 2003;4(4):415-27. https://doi.org/10.1016/S1469-0292(02)00039-0
3. Corigliano B. What are the ergogenic effects of music during exercise?, *Kinesiology, Sport Studies and Physical Education, Education Synthesis Projects.* 2017; 26.
4. Tan F, Tengah A, Nee LY, Fredericks S. A study of the effect of relaxing music on heart rate recovery after exercise among healthy students. *Complementary therapies in clinical practice*. 2014;20(2):114-7. https://doi.org/10.1016/j.ctcp.2014.01.001
5. Edworthy J, Waring H. The effects of music tempo and loudness level on treadmill exercise. *Ergonomics*. 2006;49(15):1597-610. https://doi.org/10.1080/00140130600899104
6. Terry Peter C, Costas I Karageorghis. *Music in sport and exercise*. 2011.
7. Savitha D, Mallikarjuna RN, Rao C. Effect of different musical tempo on post-exercise recovery in young adults. *Indian journal of physiology and pharmacology*. 2010;54(1):32-6.
8. Masters KS, Ogles BM. Associative and dissociative cognitive strategies in exercise and running: 20 years later, what do we know? *The sport psychologist.* 1998;12(3):253-70. https://doi.org/10.1123/tsp.12.3.253
9. Crust L. Carry-over effects of music in an isometric muscular endurance task. *Perceptual and motor skills*. 2004;98(3):985-91. https://doi.org/10.2466/pms.98.3.985-991
10. Tenenbaum G. A social-cognitive perspective of perceived exertion and exertion tolerance. *Handbook of sport psychology*. 2001;2:810-822.
11. Urakawa K, Yokoyama K. Music can enhance exercise-induced sympathetic dominancy assessed by heart rate variability. *The Tohoku journal of experimental medicine*. 2005;206(3):213-8.

https://doi.org/10.1620/tjem.206.213
12. Tate AR, Gennings C, Hoffman RA, Strittmatter AP, Retchin SM. Effects of bone-conducted music on swimming performance. *Journal of strength and conditioning research.* 2012;26(4):982-988. https://doi.org/10.1519/JSC.0b013e31822dcdaf
13. Yarahmadi H, Haghighi A, Shojaei M, Beheshti Nasr S. Effect of nine weeks of moderate aerobic training on insulin resistance and appetite level in obese women. *Quarterly of the Horizon of Medical Sciences*. 2014;20(1):9-16.
14. Maraki M, Tsofliou F, Pitsiladis Y, Malkova D, Mutrie N, Higgins S. Acute effects of a single exercise class on appetite, energy intake and mood. Is there a time of day effect? *Appetite*. 2005;45(3):272-8. https://doi.org/10.1016/j.appet.2005.07.005
15. King JA, Miyashita M, Wasse LK, Stensel DJ. Influence of prolonged treadmill running on appetite, energy intake and circulating concentrations of acylated ghrelin. *Appetite*. 2010;54(3):492-8. https://doi.org/10.1016/j.appet.2010.02.002
16. Ghavam-Bakhtiar R, Nikbakht H, Ziaee N, Mohammadi M. The effect of relaxing music on changes in blood lactate level during recovery following a maximal exercise session in young female athletes. *International Journal of Sports Medicine.* 2012;2(9):432-5.
17. Jeffreys I. A multidimensional approach to enhancing recovery. *Strength and Conditioning Journal*. 2005;27(5):78- 85. https://doi.org/10.1519/00126548-200510000-00014
18. Dodd S, Powers SK, Callender T, Brooks E. Blood lactate disappearance at various intensities of recovery exercise. *Journal of Applied Physiology*. 1984;57(5):1462-5. https://doi.org/10.1152/jappl.1984.57.5.1462
19. Hermansen L, Stensvold I. Production and removal of lactate during exercise in man. *Acta Physiologica Scandinavica.* 1972;86(2):191-201. https://doi.org/10.1111/j.1748-1716.1972.tb05325.x
20. Eliakim M, Bodner E, Eliakim A, Nemet D, Meckel Y. Effect of motivational music on lactate levels during recovery from intense exercise. *The Journal of Strength & Conditioning Research*. 2012;26(1):80-6. https://doi.org/10.1519/JSC.0b013e31821d5f31
21. Lee D, Henderson A, Shum D. The effect of music on preprocedure anxiety in Hong Kong Chinese day patients. *Journal of clinical Nursing*. 2004;13(3):297-303. https://doi.org/10.1046/j.1365-2702.2003.00888.x
22. Szmedra L, Bacharach D. Effect of music on perceived exertion, plasma lactate, norepinephrine and cardiovascular hemodynamics during treadmill running. *International journal of sports medicine.* 1998;19(01):32-7. https://doi.org/10.1055/s-2007-971876
23. Boone T, Linderman JK, Astorino T, Baker J, Dalleck L, Drury D, et al. Cardiovascular responses to music tempo during steady-state exercise. *Journal of Exercise Physiology Online*. 2009; 12(1):50-56.
24. Pujol TJ, Langenfeld ME. Influence of music on Wingate Anaerobic Test performance. *Perceptual and motor skills.* 1999;88(1):292-6. https://doi.org/10.2466/pms.1999.88.1.292
25. Bhavsar SD, Abhange RS, Afroz S. Effect of different musical tempo on post-exercise recovery in young adults. *Journal of Dental and Medical Sciences*. 2014;13(5):60- 4. https://doi.org/10.9790/0853-13516064
26. Ohkuwa T, Tsukamoto K, Yamai K, Itoh H, Yamazaki Y, Tsuda T. The relationship between exercise intensity and lactate concentration on the skin surface. *International journal of biomedical science*. 2009;5(1):23.-27.
27. Sim AY, Wallman K, Fairchild T, Guelfi K. High-intensity intermittent exercise attenuates ad-libitum energy intake. *International journal of obesity*. 2014;38(3):417-422. https://doi.org/10.1038/ijo.2013.102
28. Matos V, Souza D, Santos V, Medeiros Í, Browne R, Nascimento P, et al.. Acute effects of high-intensity interval and moderate-intensity continuous exercise on glp-1, appetite and energy intake in obese men: A crossover trial. *Nutrients*. 2018;10(7):889. https://doi.org/10.3390/nu10070889
29. King N, Burley V, Blundell J. Exercise-induced suppression of appetite: effects on food intake and implications for energy balance. *European journal of clinical nutrition*. 1994;48(10):715-24.
30. Katsuki A, Sumida Y, Gabazza EC, Murashima S, Tanaka T, Furuta M, et al. Plasma levels of agouti-related protein are increased in obese men. *The Journal of Clinical Endocrinology & Metabolism*. 2001;86(5):1921-4. https://doi.org/10.1210/jcem.86.5.7458
31. Shen CP, Wu K, Shearman L, Camacho R, Tota M, Fong T, et al. Plasma agouti-related protein level: a possible correlation with fasted and fed states in humans and rats. *Journal of neuroendocrinology*. 2002;14(8):607-10. https://doi.org/10.1046/j.1365-2826.2002.00825.x
32. McElrea H, Standing L. Fast music causes fast drinking. *Perceptual and Motor skills*. 1992;75(2):362. https://doi.org/10.2466/PMS.75.5.362-362
33. Milliman RE. The influence of background music on the behavior of restaurant patrons. *Journal of consumer research.* 1986;13(2):286-9. https://doi.org/10.1086/209068
34. Caldwell C, Hibbert SA. The influence of music tempo and musical preference on restaurant patrons' behavior. *Psychology & Marketing*. 2002;19(11):895-917. https://doi.org/10.1002/mar.10043
35. Wansink B, Van Ittersum K. Fast food restaurant lighting and music can reduce calorie intake and increase satisfaction. *Psychological Reports.* 2012;111(1):228-32. https://doi.org/10.2466/01.PR0.111.4.228-232
36. Novak CC, La Lopa J, Novak RE. Effects of sound pressure levels and sensitivity to noise on mood and behavioral intent in a controlled fine dining restaurant environment. *Journal of Culinary Science & Technology*. 2010;8(4):191-218. https://doi.org/10.1080/15428052.2010.535756

Information about the authors:

Javad Mehrabani; (Corresponding Author); https://orcid.org/0000-0001-7504-8066; mehrabanij@guilan.ac.ir; Department of Exercise Physiology, Faculty of Sport Sciences, University of Guilan ; Rasht, Guilan, Iran.

Soodabeh Bagherzadeh; https://orcid.org/0000-0001-9791-9782; soodabehbagherizadeh1@yahoo.com; Department of Physical Education and Sport Sciences, Faculty of Humanities, Islamic Azad University. ; Rasht, Guilan, Iran.

Abuzar Jorbonian; https://orcid.org/0000-0002-0447-1016; jorbonian_a@yahoo.com; Department of Exercise Physiology, Faculty of sport Sciences, University of Guilan ; Rasht, Guilan, Iran.

Eisa Khaleghi Mamaghani; https://orcid.org/0000-0002-0780-9211; khaleghimamaghani.eisa@yahoo.com; Department of Exercise Physiology, Faculty of sport Sciences, University of Guilan ; Rasht, Guilan, Iran.

Maryam Taghdiri; https://orcid.org/0000-0001-7161-2010; taghdiri.maryam.i@yahoo.com; Department of Exercise Physiology, Faculty of Sport Sciences, University of Mazandaran ; Babolsar, Mazandaran, Iran.

Mona Mehdizadeh Haghighi; https://orcid.org/0000-0003-1465-4497; mehdizadeh-haghighi@yahoo.com; Department of Physical Education and Sport Sciences, Faculty of Humanities, Islamic Azad University ; Rasht, Guilan, Iran.

Cite this article as:
Javad Mehrabani, Soodabeh Bagherzadeh, Aboozar Jorbonian, Eisa Khaleghi-Mamaghani, Maryam Taghdiri, Mona Mehdizadeh-Haghighi. Cardiovascular, lactate and appetite response to light and spicy music tempo after an endurance swimming protocol in young girls. *Pedagogy of physical culture and sports*, 2020;24(4):195-202.
https://doi.org/10.15561/26649837.2020.0407

This is an Open Access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited (http://creativecommons.org/licenses/by/4.0/deed.en).

Received: 04.01.2020
Accepted: 25.02.2020; Published: 30.08.2020

ORIGINAL ARTICLE

The relationship between the social responsibility and the job performance among physical education professors

Kenioua Mouloud[ABCDE], Krine Nawal[DE]

University of Ouargla, Algeria

Authors' contributions: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection.

Abstract

Purpose: The study aimed to know the level of social responsibility and job performance among the physical education professors and examine the relationship between the social responsibility and the job performance.

Material: The participants were 29 physical educations professors (male) from Institute of Physical Education and Sport University of Ouargla. The social responsibility and the job performance scales were used as search tools. Data analyses were carried out by means of statistical packet for social sciences (SPSS) 26.00 software program. The Mean, Std. Deviation and Pearson Correlation were used in the main study. In addition, alpha-Cronbach was used in the exploratory study.

Results: The level of social responsibility and job performance is high among physical education professors, and there is a positive correlation between social responsibility and job performance.

Conclusions: Given the importance of the role of social responsibility and job performance and the lack of enough studies in this specialization, it is necessary to conduct more additional studies that would serve knowledge in this specialization.

Keywords: social responsibility, job performance, physical education, professors.

Introduction

Social responsibility is considered an important topic in any society, as it relates to the task of defining and controlling the behaviour of individuals within the community [1]. Social responsibility is the commitment of individuals to their actions and behaviours towards society through participation in a range of social activities related to community service [2]. It's associated with many concepts, including those rights, duties, identity, ethics, mission, job and individual and collective conscience [3].

Job performance can be defined on a micro level as actions and behaviour of an employee that contribute to the goals of the organization [4, 5]. The behaviour aspect refers to what individuals do while at work [4]. Other aspect is the outcome that refers to the results of the individual's behaviour [6].

The teaching staff at the University is considered one of the pillars of the University. It plays a major role in influencing the student's personality and scientific formation. But it does not limited to that role only. It contributes scientifically through scientific discoveries. Intellectual creativity and enrichment of human knowledge and its development are also address to the problem solving of society [1, 7, 8].

At the University teaching staff has both vital role and high volume of responsibility for the work they do.

It became necessary to study social responsibility, performance and its importance in the character of the professor.

There was the lack of studies on social responsibility and job performance for teaching staff at the University (based on some academic platforms). An exception is the study of Bakar [1]. These make the problem more important.

The aim of this study is to know the level social responsibility and job performance among physical education professors, to investigate relationship between social responsibility and job performance. For the purpose of this study, the research study hypotheses were as follows:

HYP.1 There is high level of social responsibility among physical education professors.

HYP.2 There is high level of job performance among physical education professors.

HYP.3 There is (positive) correlation relationship between social responsibility and job performance among physical education professors.

Material and methods

Participants. The participants were 29 physical educations professors (male) from Institute of Physical Education and Sport University of Ouargla. The social responsibility and the job performance scales were used as search tools.

Instruments. In this study, two scales were used to collect data. The first scale is social responsibility was prepared by Bakar [1], the scale was distributed according to the Likert type scale. Cronbach alpha reliability value of the scale was found (0.85). The second scale is job performance was prepared by Bakar [1], the scale was distributed according to the Likert type scale. Cronbach alpha reliability value of the scale was done (0.80).

Statistical Analysis. Data analyses were carried out by means of statistical packet for social sciences (SPSS)

© Kenioua Mouloud, Krine Nawal, 2020
doi:10.15561/26649837.2020.0408

26.00 software program. The Mean, Std. Deviation and Pearson Correlation were used in the main study. In addition, alpha-Cronbach was used in the exploratory study.

Results

Level of social responsibility among physical education professors

In Table 1, it was found:

- the highest arithmetic mean of social responsibility scale was estimated at (M=3.00) at standard deviation (SD=.000);
- the lowest arithmetic mean of social responsibility scale was (M=1.82) at standard deviation (SD=.722);
- the value of the total arithmetic mean of the social responsibility scale was estimated at (M=2.58) with a standard deviation of (SD.192).

It shows that the level of social responsibility is high among physical education professors.

Level of job performance among physical education professors

In Table 2, it was found:

- the highest arithmetic mean of job performance scale was estimated at (M=2.96) at standard deviation (SD=.188);
- the lowest arithmetic mean of job performance scale was (M=1.96) at standard deviation (SD=.506);
- the value of the total arithmetic mean of the job performance scale was estimated at (M=269) with a standard deviation of (SD.240);

It shows that the level of job performance is high among physical education professors.

The relationship between social responsibility and job performance among physical education professors.

Table 3 shows:

- there is a positive correlation between social responsibility and job performance among physical education professors;
- the value of the correlation coefficient Pearson was (0.65) at the level of significance (0.01);

It means that the greater the awareness of the concept of social responsibility, the more sense of job performance.

Discussion

The level of social responsibility is high for physical education professors. The reason perhaps is that they represent a class of a high degree of awareness.

As well as knowing the importance of the large role assigned to them. The professor has a great social responsibility towards students, the University and society [7]. The true social responsibility of the professor is in two dimensions, the internal dimension that depends

Table 1. Shows the results of the means and standard deviations of the social responsibility scale

Items	N	Mean	SD	Rank	Level
1- I am trying to be in solidarity with members of my residential area	29	2.42	741.	9	High
2- I maintain my workplace reputation (Sports Institute)	29	2.89	416.	4	High
3- I try to be honest with myself	29	2.89	314.	4	High
4- I am ready to offer suggestions to solve my country's problems	29	2.60	566.	7	High
5- I am working to educate my family (Awareness)	29	2.96	.188	2	High
6- I feel my moral responsibility to my professors' colleagues	29	2.89	.314	4	High
7- I am ready to assume any duty to serve the country	29	2.57	572.	8	High
8- I treat my neighbours well	29	3.00	.000	1	High
9- I believe that community development is everyone's responsibility	29	2.92	.262	3	High
10- I assign some of my rights for the happiness of my family	29	2.75	440.	5	High
11- I am trying to keep the relationships between my family members together	29	3.00	.000	1	High
12- The omission of the constant monitoring of students makes them neglect their duties	29	2.07	.604	11	Average
13- I control my emotions in tense situations	29	2.39	566.	10	High
14- I prefer to discuss the problems of my community collectively	29	2.07	.766	11	Average
15- I respect the ideas of others even if they contradict my point of view	29	2.60	.497	7	High
16- I am ready to be a paramedic to save accident victims	29	2.60	.566	7	High
17- I accept the advice of my friends, with open arms	29	2.64	.558	6	High
18- It is difficult for me to adhere to my community's customs and traditions	29	1.82	.722	13	High
19- I have fallen into silence if there is a dispute between my professors' colleagues, even though I can resolve the dispute	29	1.85	.705	12	High
20- I am interested in constantly developing my self	29	2.75	.585	5	High
Total	**29**	**2.58**	192.		**High**

Table 2. Shows the results of the means and standard deviations of the job performance scale

Items	N	Mean	SD	Rank	Level
1- I make sure to carry out my scientific duties	29	2.82	.390	5	High
2- I employ modern technology in conference hall	29	2.53	.637	10	High
3- I make sure to diversify teaching methods to attract student attention	29	2.71	.460	7	High
4- I make sure to keep up with university activities and laws	29	2.71	.534	7	High
5- I am working to make the student the hub in the classroom	29	2.75	.518	6	High
6- I use the blackboard to clarify the concepts of the lesson	29	2.60	.628	9	High
7- I rely on my teaching on the elements of excitement and suspense	29	2.75	.440	6	High
8- I can develop my scientific area	29	2.92	.262	2	High
9- Lessons added on the quorum do not affect my scientific attribution	29	2.00	544.	12	Average
10-I use technical means that contribute to clarifying the lesson	29	2.71	.460	7	High
11- I always have the desire to teach in all times	29	1.96	.507	13	Average
12- Working with my students gives me happiness	29	2.85	.356	4	High
13- I set organized times to meet my students and solve their problems	29	2.42	.643	11	High
14-When I am late for my lesson, I feel a sense of embarrassment toward my students	29	2.71	.599	7	High
15- I encourage my students to interact with each other	29	2.89	314.	3	High
16- I feel comfortable when I help my students	29	2.85	.356	4	High
17- I stay away from situations that lead to waste of time	29	2.67	.475	8	High
18- I deal with my students in a good way	29	2.89	.314	3	High
19- I distribute my interest to all students	29	2.92	.262	2	High
20- My relationship with students is based on affection and love	29	2.96	.188	1	High
21- I develop positive trends for students	29	2.85	.356	4	High
Total	**29**	**2.69**	.240		**High**

Table 3. Shows the Pearson correlation coefficient between the scales of social responsibility and job performance

Social responsibility job performance	N	Correlation coefficient	Significance level
	29	0.65	0.01

on the moral values of society, and the external dimension that depends on contemporary international variables [9]. Solving students' educational and social problems is part of the professor's social responsibility [10-12]. The professor is the pillar in the University education system in research, education, service to society and participation in the comprehensive development [13].

The level of the job of performance is high for physical education professors. The reason is due to the availability of an appropriate organizational climate for work, good relationship with everyone.These motivate them to fulfil their roles in the best way and harness all their energies for the success of academic and social tasks.

This result agreed with the results of Souam [14], Arabiyat [15] and Al-yahya [16]. Nassar's [17] study indicates that the level of teaching performance is great among professors and the highest level is preparation and planning for the lesson, then dialogue and discussion with students, then evaluation and measurement, and finally scientific research. Nagy [18] refers that faculty members in academic departments and faculties are doing their best to advance their university and maintaining their distinguished scientific level despite the difficult conditions that hinder them.

There is a positive correlation with a positive statistical significance between social responsibility and job performance for physical education professors. Hence the professor revitalizes the sporting activities of associations and clubs. Such organizations take care of specific groups such as orphans, people with special needs, necessarily. In this case the professor is a persistent professor who performs his job proficiently at the university. Also, a professor who respects his working hours and attends on time and provides lessons and lectures professionally. He offers community work. He becomes role models. Thus students imitate him not only in the Institute/Faculty but even in their private lives. This result agreed with the results of Bakar [1]. The study of Al-Hilali and Al-

Sherbini [19] indicates that competent faculty members have a spirit of social responsibility. An individual's commitment to his work and duties is a kind of social responsibility [20]. A strong sense of social responsibility will increase the level of job performance [21].

Conclusion

Through theoretical and applied study of the topic became clear that social responsibility and job performance were high. There was also a positive correlation between the two variables. Given the importance of the role of social responsibility and job performance and the lack of enough studies in this specialization, it is necessary to conduct more additional studies that would serve knowledge in this specialization.

Conflict of interest

The authors declare that there is no conflict of interest.

References

1. Bakar N. Social responsibility and its relationship to job performance with the faculty. *Journal of the College of Basi Education*. 2012; 73: 587–567.
2. Holmes S. Corporate Social performance and present Areas of Management, *Journal of Business,* 1985;20:14–20.
3. El-hariti ZBA. *The reality of personal social responsibility among Saudi youth and their development*. Riyadh: Naïf Arab Academy for Security Sciences; 2001.
4. Campbell JP. Modeling the performance prediction problem in industrial and organizational psychology. In: Dunnette MD, Hough LM. (Eds.). *Handbook of industrial and organizational psychology*. Palo Alto, CA: Consulting Psychologists Press; 1990. P. 100-115.
5. Murphy KR. Dimensions of job performance. In: Dillon R, Pellingrino J (Eds.). *Testing: Applied and theoretical perspectives*. New York: Praeger; 1998.
6. Sonnentag S, Judith V, Spychala A. *Job performance*. In: Barling Julian (Eds.). *Micro approaches*. Los Angeles, Calif. [u.a.]: SAGE; 2008. P. 427-447.
7. El-mohkter S. The reality of the practice of social responsibility among faculty members at the Faculty of Education, Al-Zawia University. *Journal of the Jail of humanities and social sciences*, 2019; 53:135-156.
8. Al-Matrafi AM. *The teacher's role in developing social responsibility among high school students*. [Unpublished PhD], Umm Al-Qura University, Saudi Arabia; 2003.
9. Al-Fatlawi S. *Quality in Education.* Amman: Dar Al Sharq for Publishing and Distribution; 2008.
10. Shaldan K, Saima S. Social responsibility of the faculty members of the Islamic University and ways to activate it. *The Arab Journal for Quality Assurance in Higher Education*. 2014;7 (18): 149-179.
11. Jaber M, Mahdi N. *The role of universities in promoting concepts of social responsibility among students of Al-Azhar University and Helwan University*. Al-Quds University; 2011.
12. Kamal S. *Internal conditions for the university's success in carrying out its social responsibilities.* Al-Quds University; 2011.
13. Bouab R. The social and functional performance of the university professor in the LMD system. *Social and Human Sciences Journal,* 2015;21:71-86.
14. Souam R. The empowerment as a strategic approach to achieving excellence in performance among faculty members from the viewpoint of department heads. *Studies Journal*. 2012; 50: 11-33. https://doi.org/10.1002/pfi.20248
15. Arabiyat B. The patterns of educational leadership prevailing among the heads of academic departments at Al-Balqa Applied University and their impact on the job performance of faculty members. *Islamic University Journal for Educational and Psychological Studies*. 2012; 20: 705-736.
16. Al-yahya S. Standards of personal quality performance among department heads and methods of enhancing them in Saudi universities. *Jordanian Journal of Educational Sciences*. 2011; 7: 35-58.
17. Nassar ACH. The reality of the teaching performance of faculty members in colleges of education from the viewpoint of students in the universities of Gaza. *Journal of the Islamic University of Studies*. 2017; 25: 160-174. https://doi.org/10.12816/0035834
18. Nagy RS. The degree of practice of heads of academic departments at Al-Aqsa University for Excellence Management is related to the level of improvement in the performance of faculty members. *Arab Journal for Quality Assurance of University Education*. 2018; 35:123-135. https://doi.org/10.20428/AJQAHE.11.35.6
19. Al-Hilali GH, Al-Sherbini A. Entrance to Excellence Management and its application requirements at Mansoura University. *The Future of Arab Education*. 2013; 83: 11-142.
20. Abdul Hassan R. Citizenship and its relationship to social responsibility. *Educational and Psychological Research Journal*. 2017; 52: 619-647.
21. Talal BAE. Relationship building moral ethical responsibility among University students. *London's second international conference in social science and humanities in the Islamic world research*. 2013. P. 100-115.

Information about the authors:

Kenioua Mouloud; (Corresponding Author); http://orcid.org/0000-0002-5405-5723; moukenioua@gmail.com; Institute of Physical Education and Sport University of Ouargla Algeria.

Krine Nawal; http://orcid.org/0000-0002-4593-7767; nawal_krine18@yahoo.com; Faculty of Literature and Language University of Ouargla, Algeria.

Cite this article as:
Kenioua Mouloud, Krine Nawal. The relationship between the social responsibility and the job performance among physical education professors. *Pedagogy of physical culture and sports*, 2020;24(4):203-207.
https://doi.org/10.15561/26649837.2020.0408

This is an Open Access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited (http://creativecommons.org/licenses/by/4.0/deed.en).

Received: 10.01.2020
Accepted: 11.02.2020; Published: 30.08.2020

SUBMISSION OF MANUSCRIPTS

(For more detailed information see http://www.sportpedagogy.org.ua/index.php/PPS/pages/view/trebovaniya-e)
Structure of article:
- title of an article;
- surname, full first name and patronymic;
- full name of organization (place of work or study);
- annotation in three language (Russian, Ukrainian, English). The scope of the annotation is to be 800-1000 symbols.

Annotation must contain translate of surname, full first name and patronymic of authors, in Ukrainian (Russian) and English. Structure of annotation: *Purpose, Material, Results, Conclusions*. For authors from Russia, the translation in the Ukrainian language makes editorial board.
Key words for the three languages: (4-6 words).
Introduction
Hypothesis, Purpose
Material and methods
Participants.
Research Design.
Statistical Analysis
Results
Discussion
Conclusions
Conflict of interests
References (more than 20) should be making up according to standard form.

REVIEW PROCEDURE FOR MANUSCRIPTS (For more detailed information see https://sportpedagogy.org.ua/index.php/PPS/pages/view/recenzirovaniye-e)
All manuscripts submitted for publication must go through the review process.
TREATMENT OF MANUSCRIPTS (For more detailed information see https://sportpedagogy.org.ua/index.php/PPS/pages/view/rassmotreniye-e)
Manuscripts are assessed by the Editorial Board within 1 month.
The Journal will acknowledge receipt of a manuscript within 2 days.
EDITORIAL ETHICS (For more detailed information see https://sportpedagogy.org.ua/index.php/PPS/pages/view/ethics-e)
The journal is committed to a high standard of editorial ethics.
Editorial board is used the principles of ethics of scientific publications upon recommendations of International Committee of Medical Journal Editors.
Conflicts of interests of persons who have direct or indirect relation to the publication of an article or any information that the article consist are settled according to the law of Ukraine in the field of intellectual property.

CONTACT INFORMATION
box 11135, Kharkov-68, 61068, Ukraine
phone. 38-099-430-69-22
http://www.sportpedagogy.org.ua
e-mail: sportart@gmail.com

Information Sponsors, Partners, Sponsorship:

- Olympic Academy of Ukraine
- Ukrainian Academy of Sciences.

SCIENTIFIC EDITION (journal)
Pedagogy of Physical Culture and Sports, 2020;24(4)
---
designer: Iermakov S.S.
editing: Yermakova T.
designer cover: Bogoslavets A.
administrator of sites: Iermakov S.S.
_____
passed for printing 30.08.2020
Format A4.
Red Banner str., 8, Kharkov, 61002, Ukraine.
PRINTHOUSE (B02 № 248 750, 13.09.2007).
61002, Kharkov, Girshman, 16a.