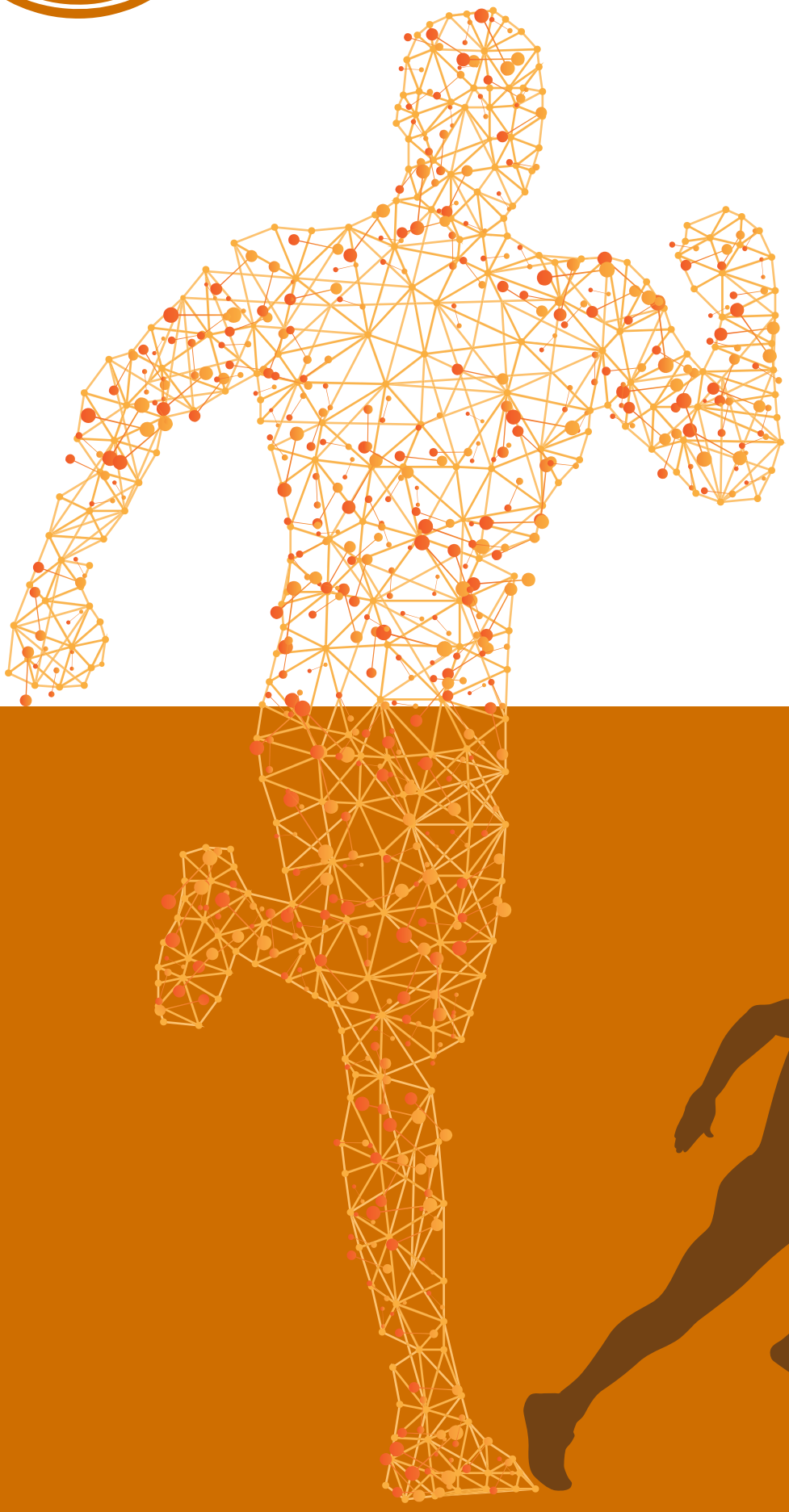
ISSN 2536-569X | eISSN 2536-5703

Journal of Anthropology of Sport and Physical Education

www.jaspe.ac.me



ISSN 2536-569X

April 2019

Vol.3
No.2

JASPE

Journal of Anthropology of Sport and Physical Education

Index Coverage

DOAJ; Index Copernicus; Google Scholar; Crossref; ROAD

Proofreading Service

Kristina Perovic Mijatovic

Prepress

Zeljko Pekic

Print

Art Grafika | Nikšić

Print run

500

MontenegroSport

CRNOGORSKA SPORTSKA AKADEMIJA
MONTENEGRIN SPORTS ACADEMY

UCG
Univerzitet Crne Gore

Fakultet za sport i fizičko vaspitanje
Univerzitet Crne Gore

ISSN 2536-569X.....eISSN 2536-5703

JOURNAL OF ANTHROPOLOGY OF SPORT AND PHYSICAL EDUCATION

International Scientific Journal

Vol. 3 (2019), No. 2 (1-71)

TABLE OF CONTENTS

Full-text available free of charge at http://www.jaspe.ac.me/

DOI 10.26773/jaspe.190401

Journal of Anthropology of Sport and Physical Education

ORIGINAL SCIENTIFIC PAPER

Differences in Vital Capacity and Length of a Dive in Dynamics with and without Glossopharyngeal Insufflation in Breath-hold Divers

Sime Zurak[1], Ivan Belcic[1], Alen Marosevic[2]

[1] University of Zagreb, Faculty of Kinesiology, Department of General and Applied Kinesiology, Croatia, [2] Croatian handball federation, national team (WU19), Zagreb, Croatia

Abstract

The purpose of this study was to determine differences between vital capacity and length of a dive in dynamics (DYN) with and without glossopharyngeal insufflation in breath-hold divers. The sample consisted of 15 elite breath-hold divers (12 male subjects and 3 female subjects) who were in regular training process and members of national team in Croatia. The sample of variables consisted two measures for estimating valuation of vital capacity (VC and VCP) and two measures for determining length of a dive in meters (URON and URONP). All variables have standard their basic statistic parameters and were tested to determine statistically significant differences between the vital capacity and length of a dive with and without glossopharyngeal insufflation as technique of air packaging. One-sided t- test for dependent samples was used and with results (significance level of p = 0.00) it can be concluded that there is a statistically significant difference between vital capacity and length of a dive with and without glossopharyngeal insufflation. Technique of packing air (glossopharyngeal insufflation) is producing better results for competitors, but with this advantage athletes must be aware of disadvantages of using this technique which can cause injuries to respiratory system and its organs.

Key words: *Divers, Dynamics, Breathing Technique, Dive Length, Respiratory System*

Introduction

Breath-hold diving, skin diving, freediving, free-diving and free diving are all form of underwater diving which consists of breath-holding until resurfacing without using any of breathing apparatus like scuba gear. In this paper breath-holding diving will be used in further text. Breath-hold diving is a young sport with room for improvement where knowledge of natural laws and physiology is needed to achieve the best possible results. Nowadays science finds new solutions to explain the practice of all long dives and longer periods of apnea. There are no physiological limitations associated with hyperbaric conditions, and the limits are determined by the psycho-physical capacity of the individual (Drviš, 2010). Most breath-hold divers wonder how to extend the stay below the surface, how to adapt the organism to something foreign that opposes what our organism wants, or how to prolong the apnea.

One of a series of techniques and exercises to achieve this goal is the technique of glossopharyngeal breathing or glossopharyngeal insufflation (GI), which is called "air packing" in diving language. Other names are frog breathing, lips pumping, packing of lung and carp (Nygren-Bonnier, 2008). Different terminology for this kind of breathing is used in various papers, but the most common is the glossopharyngeal insufflation (Seccombe et al., 2006). The word breathing also refers to the inhalation phase and the exhalation phase, whereas the glossopharyngeal insufflation refers only to the phase of exhalation. Professional breath-holding di-

Correspondence:

I. Belcic

University of Zagreb, Faculty of Kinesiology, Horvaćanski zavoj 15, 10000 Zagreb, Croatia

E-mail: ivan.belcic@kif.hr

vers use this technique to increase the amount of air stored in the lungs resulting in longer apnea and hence with a longer dive. This manoeuvre originated in France in search of a solution to the problem of constraint imposed by the need to equalize the diving mask pressure. However, this is a difficult manoeuvre, which is recommended only to top level breath-hold divers, and requires expertise and experience (Pelizzari & Tovaglieri, 2004).

The goal of air packing is to fill the lungs with air as much as possible at the end of the last breath. This is achieved using the mouth as a pump, opening them and sealing rhythmically to bring the residual air from the mouth to the lungs. In this way, the air in the lungs is maximally compressed, thus allowing the breath-hold diver to dive with a higher amount of air than would be achieved by a normal maximum inhalation. The advantage is that the breath-hold diver has a larger amount of air at its disposal required for apnea and equalizing pressure in the ears of deep diving.

Glossopharyngeal insufflation is a technique that works by using the muscles of the face, mouth, face, lips, tongue, soft palate, larynx and glands to push the air to the lungs. Tongue is the main organ of this breathing technique. The tongue moves forward and backward to push the air into the gutter. The neck is opened and the air passes into the trap, where it is captured by the closing of the larynx. The suppression mechanism appears in every swallow. Swallow is defined as the projection of the air into the mouth by pushing the tongue. Some people carry glossopharyngeal breathing with their open mouth (with a numbed nose), while others carry glossopharyngeal breathing with their mouth shut, releasing air through the nose. This is an alternative breathing technique that maintains adequate ventilation when the respiratory muscles are weak (Nygren-Bonnier, 2008). Glossopharyngeal insufflation techniques are used by professional breath-hold divers to increase their lung capacity beyond their normal vital capacity, and therefore the performance of diving. Large lung capacity was recorded in the breath-hold divers who are competing at highest level, but it is unknown whether this result is genetically conditioned in divers who had selection process or is the result of the training process of glossopharyngeal insufflation. In several researches of glossopharyngeal insufflation by group of authors (Seccombe et al., 2006; Lemaitre, Clua, Andreani, Castras, & Chollet 2010; Brodin, Lindholm, Lennartsson, & Nygren-Bonnier, 2014; Boussuges et al., 2014), they have concluded that breath-hold divers or air retention competitors would achieve significant increase in lung volume by means of glossopharyngeal insufflation due to increased vital capacity and additional air in the lungs due to air compression.

Some of those studies conducted researches using glossopharyngeal insufflation technique like it was used in this research, with main purpose of the study to find whether the vital capacity and the length of the dive with glossopharyngeal insufflation differs statistically from the vital capacity without glossopharyngeal insufflation by breath-hold divers. Research will show differences with and without this technique or air packing. Glossopharyngeal insufflation technique has its side effects and potential health related risks which will be explained trough discussion and in conclusion.

Methods

Subjects

Testing was conducted on the sample of 15 top breath-hold divers from Croatia with an average age of 27.53±2.02 (range from 24 to 30 years). Eight subjects were members of Croatian national breath-hold diving team and 3 of the subjects were also international CMAS recorders. From all subjects 3 subjects were female and 12 were male.

Ethics

All testing procedures were carried out in accordance with ethical principles. Each subject who participated in testing procedures was provided with an explanation of the study, a possible health risk and the envisaged testing procedure. All subjects needed to sign an agreement confirming that they are familiar with the purpose and objectives of the study, the testing protocol and possible risks during procedure, and that he or she approached testing voluntary.

Procedure

Testing of 15 top male and female divers will show their: 1. vital capacity without glossopharyngeal insufflation; 2. vital capacity after glossopharyngeal insufflation; 3. length of dive without glossopharyngeal insufflation and 4. length of dive with glossopharyngeal insufflation. After processing the test results and calculating certain parameters, differences in vital capacity and length of dive before and after the packing of the air will be investigated. Based on the results it will be possible to prove the role and importance of air packing technique in top breath-hold diving. Testing was performed at the Laboratory for Functional Diagnostics of the Diagnostic Center of the Faculty of Kinesiology in Zagreb and Utrine pool in Zagreb.

Variables sample

Respecting the aim of this research, a two predicate and criteria variables were determined. Tests are specific for breath-hold diving and are taken from previous researches. In the test to determine vital capacity of breath-hold divers spirometry system Quark b2 (Cosmed, Italy) which provides continuous ('breath by breath') breathing data, graphic view, storage and analysis of measured ventilation, metabolic and ergometric parameters in a way that is connected via the interface and peripheral inputs and managed by a personal computer and the corresponding software. Measurement is performed indoors (Diagnostic Center of the Faculty of Kinesiology in Zagreb). Testing was carried out in stable microclimate conditions of closed space with air temperature between 18 and 20°C and air humidity of 60%, which requires calibration of the spirometer.

In test vital capacity (VC), the subject makes several (3-5) normal breaths and exhales into the spirometer. On agreed sign subject performs maximal inhale for maximal lung capacity after which with short air retention (no longer than 1 second), subject blows all the air from lungs in the mouth

holder (air should not protrude through the nose "tick" or near the mouth). In the second test vital capacity with packing of air (VCP), the subject should sit upright and comfortably because of the possibility of loss of consciousness that can result in a fall injury. Unconsciousness which is also known as "packing blackout" because the packing decreases blood pressure, due to reduced venous blood flow to the heart (increased pressure by packing), arterial pressure and reduced blood flow to the brain arises, hence hypoxia and the possible fall in unconsciousness when sitting or lying due to gravity, the possibility of unconsciousness is decreased. Subject performs the same technique as in first test. The task is performed twice, and a better result is taken. Values of vital capacity are read out (amount of air that can be exhaled from the lungs in litres) after a maximum inhale.

As the criterion variable, the length of the dynamics with monofin was taken. Variables are without packing of air and with packing of air. The results were obtained based on the length of the dive in a 50-meter basin. The temperature of the water was 26±1°C, and the air temperature was 27 °C. The variation in the dive length is scaled in such a way that the longer dive length signifies a better result. Subject must dive as much horizontal distance as possible using the monofin. The task is performed according to the AIDA rules (International Association for the Development of Apnea, version 1.2.). Subject has to be in his track precisely at the scheduled time and after the sign of the starting referee subject has 10 seconds to start the procession. Dive is performed with discipline of dynamic apnea with fins (DYN). The goal is to cover as much of the length as possible which is expressed in meters and the task is completed when the subject drains out of the water, removes the mask and shows a sign that everything is fine. Task is performed only once. The difference between the two criterion variables is in packaging and without packing the air before the dive.

Data Analysis

The statistical package Statistica (data analysis software system, version 9.0) was used for the statistical analysis. Central and dispersion parameters, arithmetic mean (AM) and standard deviation (SD) were calculated. Differences between the vital capacity with and without glossopharyngeal insufflation and the length of the dive with and without glossopharyngeal insufflation from a breath-hold divers were tested with a T-test for the dependent samples. Test was used to determine statistically significant difference between two variables and level of significance was set at $p<0.05$.

Results

In Table 1 descriptive parameters are presented for the results of the study using variables vital capacity, vital capacity after GI, dynamic with monofin and dynamic with monofin after GI.

Tabela 1. Descriptive statistical parameters

VAR	MEAN	MIN	MAX	SD
VC	6.74	4.37	8.07	1.20
VCP	8.69	5.11	11.12	1.80
URON	156.33	130	205	24.24
URONP	177.55	140	250	30.81

Note: VC – vital capacity, VCP – vital capacity after GI, URON – dynamic with monofin, URONP – dynamic with monofin after GI, Mean – arithmetic mean, MIN – minimal result, MAX – maximal result, SD – standard deviation

In Table 1 it can be seen that the variable total vital capacity (VC) average value is 6.74 litres, while the minimum result is 4.37 litres and a maximum of 8.07 litres. While in variable vital capacity after glossopharyngeal insufflation (VCP) average value is 8.69 litres, minimum result is 5.11 litres and the maximum result is 11.12 litres. In the variable length of dive (URON) average length of dive is 156.33 meters, the minimum length is 130 meters and the maximum length is 205 meters. In length of dive with glossopharyngeal insufflation average length of dive is 177.55 meters, the minimum result is 140 meters and the maximum result is 250 meters.

Tabela 2. Statistical significance and results of T-test for variables VC and VCP

VAR	MEAN	SD	SD	t	df	p
VC / VCP	6.74 / 8.69	1.20 / 1.80	.82	- 9.19	14	.000

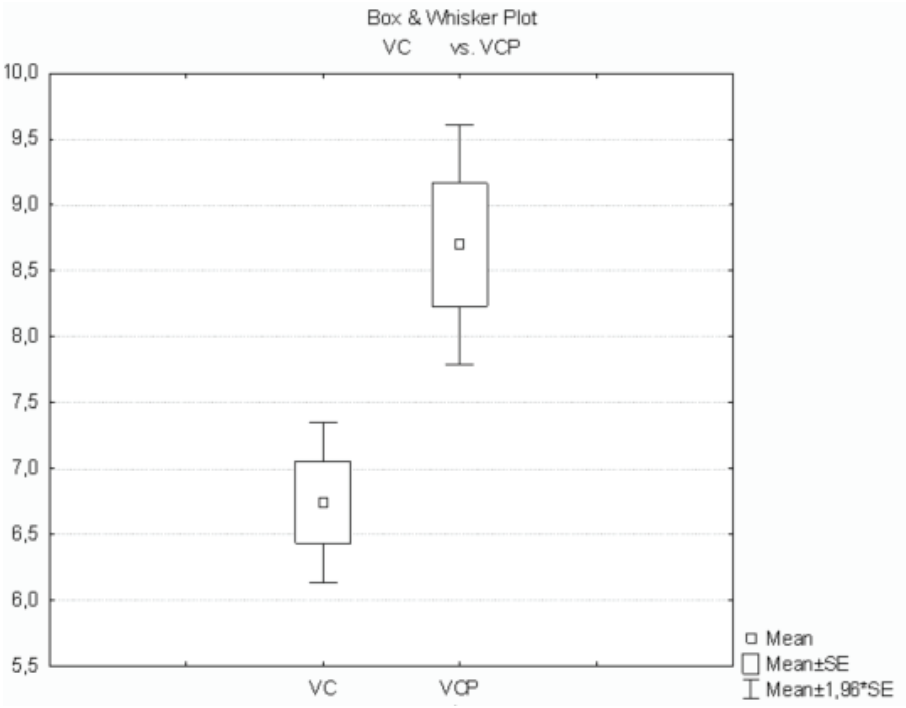
Note: VC –vital capacity, VCP – vital capacity after GI, Mean – arithmetic mean, SD – standard deviation, t -value of t-test, df – degrees of freedom, p – statistical significance value ($p<0.05$)

A statistically significant difference between the vital capacity and the vital capacity after glossopharyngeal insufflation at the significance level of $p = 0.00$ was found. A statistically significant difference was also found in the length of dive without glossopharyngeal insufflation and dive with glossopharyngeal insufflation.

Tabela 3. Statistical significance and results of T-test for variables URON and URONP

VAR	MEAN	SD	SD	t	df	p
URON / URONP	1.56.33 / 177.55	22.24 / 30.81	10.15	- 8.09	14	.000

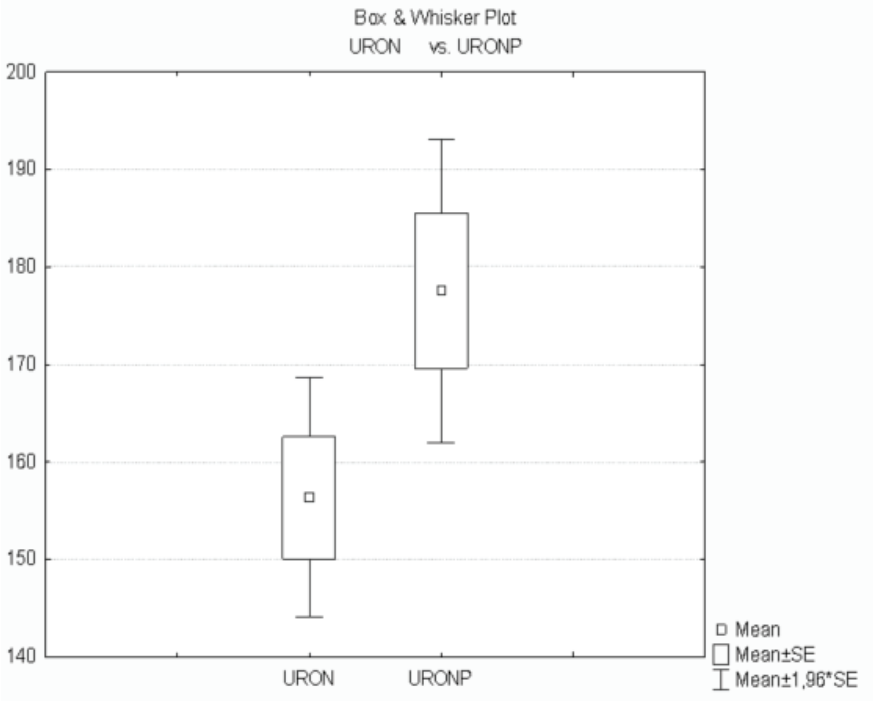
Note: URON – dynamic with monofin, URONP – dynamic with monofin after GI, Mean – arithmetic mean, SD – standard deviation, t -value of t-test, df – degrees of freedom, p – statistical significance value ($p<0.05$)



Picture 1. Dispersion of results and centroids of variables VC and VCP

In picture 1 there is dispersion of results in vital capacity and vital capacity with glossopharyngeal insufflation.

In picture 2 dispersion of results in length of dive and length of dive with glossopharyngeal insufflation is showed.



Picture 2. Dispersion of results and centroids of varibales URON and URONP

Discussion

As it can be seen from results of T-test in Table 2 there is a statistically significant difference between the arithmetic mean at the significance level of error $p<0.05$ in the amount of packed air in the lungs that is manifested between total vital capacity of 6.74 litres (VC) and vital capacity after glossopharyngeal insufflation of 8.69 litres (VCP). Difference between arithmetic means of 1.95 litres is amount which differs according to breathing technique in 15 top level breath-hold divers. The reasons why breath-hold divers achieve a significant increase in lung volume by glossopharyngeal insufflation is due to increased vital capacity, which also has a great part in the flexibility of the chest and compression of air for which one third of the air is located in the lungs (Loring et al., 2007). According to Seccombe et al. (2006) in the analysis of 7 top breath-hold divers, the difference in vital capacity before and after the glossopharyngeal insufflation technique is increased in the average volume of vital capaci-

ty after glossopharyngeal insufflation for 1.92 litres. Similar results are obtained in this research also. While Chung et al. (2010) assert that for maximum amount of air which can be stored in the lungs by glossopharyngeal insufflation technique can be increased for up to 3 litres above normal lung volume which is also similar to findings in this research.

Statistically significant difference was found between arithmetic mean at the significance level of $p<0.05$ in dive length between the URON variable (dive length without glossopharyngeal insufflation) and variable URONP (length of dive with glossopharyngeal insufflation). According to numbers in table we can conclude that difference between two techniques of breathing before taking a dive result by 10-11% longer length in dive per litre of additional packed air. For example, breath-hold divers without glossopharyngeal insufflation dive 100 meters and with glossopharyngeal insufflation they will dive approximately (assuming that they packed 2 litres more of air) 120 meters. Glossopharyngeal insufflation increases the amount of air in the lungs, i.e. the lung volume is increased by 3.2 litre, but the actual amount of air is increased by 4 litre due to pressure increase due to "packaging" and 0.8 litre is gained in the pressure inside the lungs. The amount of air increases on the basis of two parameters: chest flexibility and pressure increase due to glossopharyngeal insufflation. For example, by the glossopharyngeal insufflation, the volume of lungs is increased by 50%. Of this, 40% percent goes to the flexibility of the chest and 10% on the increase in pressure. A higher percentage cannot be obtained based on increased pressure due to the physiological characteristics of the epiglottis that cannot withstand higher pressure within the lungs. A larger amount of air means a higher amount of oxygen available (no higher oxygen percentage) that the body can use during the dive.

The glossopharyngeal insufflation technique from all the advantages has also its disadvantages that may arise as a side effect of its performance. Therefore, there are potential risks in glossopharyngeal insufflation such as: injury possibility of trachea, bronchi, bronchioles and alveolus. Those can be mild from appearance of blood droplets in saliva because of the stretching of wall to severe discontinuities leading to barotraumatic injuries such as mediastinal emphysema (characterized by air bubbles in the area around the heart), pneumothorax (occurs when the air penetrates the pleural space between the two layers and forces them to break apart). Because of these lungs or more often, one pulmonary wing collapses, subcutaneous pulmonary emphysema (characterized by skin bubbles in the area of the neck and key bones). Linerl & Andersson (2008), Eichinger et al. (2010) along with Lindholm & Lundgren (2008) indicate that acute effects most commonly occurring breath-hold divers during glossopharyngeal insufflation and diving in depths are barotraumas due to packaging (medial emphysema, gas embolism, subcutaneous emphysema).

Using breathing technique of glossopharyngeal insufflation will improve breath-hold divers' total vital capacity as well as length of dive which is increased using this technique. It is proved that glossopharyngeal insufflation has significant impact on results which are better than without using glossopharyngeal insufflation. It is concluded that the length of dive with glossopharyngeal insufflation technique is 10-11% longer per liter of charged air above the maximum vital capacity, then technique without glossopharyngeal insufflation. This compression of the air and the increase in pressure causes an increase in the amount of oxygen in the lungs. With well-trained breath-hold divers, and in particular professionals in this sport, glossopharyngeal insufflation can provide them additional 1 to 2 minute of apnea. Although glossopharyngeal insufflation technique has its advantages in view of statistically proved better results, breath-hold divers must be careful with it due to health-related issues to trachea, bronchi, bronchioles and alveolus. Breath-hold divers increase intrathoracic pressure voluntarily by taking a deep breath followed by glossopharyngeal insufflation, and with this technique they sometimes experience hypotension and syncope during the manoeuvre and breath-hold divers should be under constant control when performing glossopharyngeal insufflation technique. Those results are showing better values in performing dives for breath-hold divers which is significant cognition for coaches. On other side there would be guidance for medically qualified scientists to make more deeper researches, especially on higher number of subjects, about exact risks in undertaking glossopharyngeal insufflation technique especially as a longitudinal study of health of respiratory system for breath-hold divers who compete at a professional level.

Acknowledgements
There are no acknowledgements.

Conflict of Interest
The authors declare that there are no conflicts of interest.

Received: 18 January 2019 | **Accepted:** 28 February 2019 | **Published:** 19 April 2019

References

Brodin, N., Lindholm, P., Lennartsson, C., & Nygren-Bonnier, M. (2014). Effects of Glossopharyngeal Insufflation in Ankylosing Spondylitis: A Pilot Study. *International Journal of Rheumatology, 2014*, 1-6.

Boussuges, A., Gavarry, O., Bessereau, J., Coulange, M., Bourc'his, M., & Rossi, P. (2014). Glossopharyngeal Insufflation and Breath-Hold Diving: The More, the Worse? *Wilderness & Environmental Medicine, 25*(4), 466-471.

Chung, S., Seccombe, L., Jenkins, C., Frater, C., Ridley, L., & Peters, M. (2010). Glossopharyngeal insufflation causes lung injury in trained breath-hold divers. *Respirology, 15*(5), 813-817.

Drviš, I. (2010). The mysterious world of top diving divers. *SCUBAlife, 1*, 144-145.

Eichinger M., Walterspacher, S., Scholz, T., Tetzlaff, R., Puderbach, M., Tetzlaff, K., Kopp-Schneider, A., Ley, S., Choe, K., Kauczor, H., & Sorichter, S. (2010). Glossopharyngeal Insufflation and Pulmonary Hemodynamics in Elite Breath Hold Divers. *Medicine & Science in Sports & Exercise, 42*(9), 1688-1695.

Nygren-Bonnier, M. (2008). *Glossopharyngeal breathing.* Published doctoral dissertation. Karolinska institute Stockholm, Sweden.

Lemaitre F., Clua E., Andreani B., Castres I., & Chollet D. (2010) Ventilatory function in breath-hold divers: effect of glossopharyngeal insufflation. *European Journal of Applied Physiology, 108*(4), 741-747.

Lindholm, P., & EG Lundgren, C. (2008). The physiology and pathophysiology of human breath – hold diving. *Journal of Applied Physiology, 106*, 284-292.

Liner, M.H., & Andersson, J.P.A. (2008). Pulmonary edema after competitive breath-hold diving. *Journal of Applied Physiology, 104*(4), 986–990.

Loring, S.H., O'Donnell, C.R., Butler, J.P., Lindholm, P., Jacobson, F., & Ferrigno, M. (2007). Transpulmonary pressures and lung mechanics with glossopharyngeal insufflation and exsufflation beyond normal lung volumes in competitive breath-hold divers. *Journal of Applied Physiology, 102*(3), 841–846.

Pelizzari, U., & Tavaglieri, S. (2004). Manual of Freediving. Underwater on a single breath. *Idelson – Gnocchi Ltd.* Naples, Italy

Seccombe, L., Rogers, P., Mai, N., Wong, C., Kritharides, L., & Jenkins, C. (2006). Features of glossopharyngeal breathing in breath-hold divers. *Journal of Applied Physiology, 101*(3), 799-801.

DOI 10.26773/jaspe.190402

Journal of Anthropology of Sport and Physical Education

ORIGINAL SCIENTIFIC PAPER

Differences in Anthropometric Characteristics among Junior Soccer and Volleyball Players

Bojan Masanovic[1], Dusko Bjelica[1], Marin Corluka[2]

[1]University of Montenegro, Faculty for Sport and Physical Education, Niksic, Montenegro, [2]University of Mostar, Faculty of Mathematics and Science Education, Mostar, Bosnia and Herzegovina

Abstract

The aim of this study was to obtain the relevant knowledge about significant differences in some anthropometric characteristics of junior soccer and volleyball players. The sample included 39 male subjects divided into two subsamples, 25 soccer players and 14 volleyball players. The variables sample included 20 anthropometric measures that defined longitudinal and transversal dimensionality of skeleton, volume and mass of the body, and subcutaneous adipose tissue. The results were analysed in a statistical procedure marked as a significance testing of two arithmetic means of the independent samples, a t-test at the level of significance of $p<0.05$. It was concluded, based on these results, that significant differences occur in body height, body weight, elbow diameter, wrist diameter, ankle joint diameter, lower arm circumference (max), lower leg circumference (max) and abdomen skinfold, while the significant difference does not occur in knee diameter, upper arm circumference (min), upper arm circumference (max), lower arm circumference (min), upper leg circumference (min), upper leg circumference (max), lower leg circumference (min), upper arm skinfolf, lower arm skinfold, thigh skinfold, calf skinfold and chest skinfold. Therefore, these findings may give coaches from the region better working knowledge and suggest them to follow recent selection process methods and to be more careful during the process of talent identification.

Key words: *Anthropometric Measurement, Different Sports, Junior League*

Introduction

Athletes, competing in different sports, differ in their physical and physiological characteristics (Stojanovic et al., 2016; Morteza Tayebi, Mahmoudi, Shirazi, & Sangi, 2017; Spaic, Vukasevic, & Masanovic, 2018). Elite sports require that the body performs at the optimal biomechanical and physiological capacity (Bajramovic, Talovic, Alic, & Jeleskovic, 2008; Arifi, Bjelica, & Masanovic, 2019; Saavedra et al., 2018). Accordingly, from junior athlete competing in the strongest leagues in his age group is expected to have the optimal morphology, strength, and endurance for the functional requirements of the sport in question (Mašanović, Vukotić, Popović, & Bjelica, 2018). Morphological characteristics are present in the equation of the specification of almost every sport (Bjelica, Popovic, & Gardasevic, 2016a) so they are of great importance when it comes to orientation and selection in all sports. Since the primarily, due to the development of technique and tactics, coefficients of participation of some morphological dimensions in the equation of the specification are constantly changing, for the effective talent's identification and the efficient conduction of transformational procesess, the continuous involvement of sports science and practice is required (Popovic, Smaic, Joksimovic, & Masanovic, 2010; Bjelica & Fratric, 2011; Bjelica, 2013; Bjelica, Popovic, & Gardasevic, 2016a).

According to previous studies, successful participation in both soccer and volleyball games, requires a high level of technical and tactical skills, and also requires suitable anthropometrical characteristics and body composition from each athlete (Hurst et al., 2017; Masanovic, Popovic, & Bjelica, 2018). Of course, the demands of these two sports are very different

Correspondence:

B. Masanovic

University of Montenegro, Faculty for Sport and Physical Education, Narodne omladine bb, 81400 Niksic, Montenegro

E-mail: bojanma@ucg.ac.me

(Popovic, Akpinar, Jaksic, Matic, & Bjelica, 2013; Popovic, Bjelica, Jaksic, & Hadzic, 2014). Soccer is a team sport which is played on an open field of great dimensions, and therefore requires a high standard of physical preparation, it is also based on a large number of movements, and a series of moderate activities that periodically replace high intensity activities, leading to significant metabolic heat production, and an intensity of 75-90% of the maximum heart rate, or 70-80% of the maximum oxygen consumption (Rexhepi & Brestovci, 2010; Sæther, 2017; Amani, Sadeghi, & Afsharnezhad, 2018). On the other hand, in volleyball, the patterns of movement differ greatly compared to soccer, the basic elements of the game are spiking, jumping, power hitting and blocking. In vooleyball the dominance over the net becomes the most decisive factor for victory (Laporta, Nikolaidis, Thomas, & Afonso, 2015; Masanovic, Milosevic, & Corluka, 2018). The top-level volleyball players do not have VO2 max values on the high level as endurance trained elite players in soccer.

The aim of this research is to describe the morphological profile of young soccer and volleyball players, to determine if here is a difference in anthropometric dimensions between them, and to define its scale.

Methods

The sample included 39 male subjects divided into two subsamples. The first subsample included 25 soccer players (16.64±0.49 yrs.), who trained in the junior selection in the Soccer club "Vojvodina" from Novi Sad, which competed in Serbian Junior League, while the other subsample included 15 volleyball players (17.36±0.74 yrs.), who trained in the junior selection in the Volleyball club "Vojvodina" from Novi Sad, which competed also in Serbian Junior League. Criteria for selection of subjects for the sample were as follows: that they have been members of the first team squad for at least one year, and that they are in good health.

Anthropometric research technique was used for data collection. A total of 20 anthropometric measures were evaluated, that defined the longitudinal and transversal dimensionality of skeleton, body volume and body mass, and subcutaneous adipose tissue: body height, body weight, elbow diameter, wrist diameter, knee diameter, ankle joint diameter, minimum circumference of the upper arm, maximum circumference of the upper arm, minimum circumference of the forearm, maximum circumference of the forearm, minimum circumference of the upper leg, maximum circumference of the upper leg, minimum circumference of the lower leg, maximum circumference of the lower leg, skinfold thickness of the upper arm, skinfold thickness of the forearm, skinfold thickness of the thigh, skinfold thickness of the calf, skinfold thickness of the chest and skinfold thickness of the abdomen.

Anthropometric research was conducted according to IBP standards, while respecting the basic rules and principles related to the selection of parameters, standard conditions and measuring techniques, as well as the standard measuring instruments calibrated before measuring.

The measuring was carried out in the middle of the competitive season. The data obtained in the research were analyzed with the statistical program SPSS 20.0, adapted for use on personal computers. The arithmetic mean, standard deviation and standard errors of the arithmetic mean of the anthropometric characteristics were calculated for respondents who are professional soccer players and professional volleyball players, by testing the differences of arithmetic means of independent samples at a significance level of $p<0.05$. This analysis gave answer to the question whether there is a difference, and the scope of it, between the anthropometric characteristics of the soccer and volleyball players, regulars who compete in union divisions.

Results

This section presents the results of central tendency and dispersion parameters, as well as the results of t-test for independent samples, classified into tables.

Tabela 1. Descriptive Data of 39 males enrolled in the study

	Soccer (N=25),AM ± SD	Volleyball (N=14), AM±SD
Body height (cm)	177.80±6.63	194.28±5.30
Bodyweight (kg)	69.90±6.78	82.04±8.58
Elbow diameter (mm)	70.60±3.17	75.69±3.85
Wrist diameter (mm)	55.67±2.87	59.69±3.71
Knee diameter (mm)	99.74±4.02	97.81±4.79
Ankle joint diameter (mm)	72.20±2.25	74.00±3.00
Upper arm circumference (min) (cm)	27.62±1.90	28.68±1.88
Upper arm circumference (max) (cm)	29.54±2.12	30.57±1.88
Lower arm circumference (min) (cm)	16.96±0.84	16.82±.70
Lower arm circumference (max) (cm)	24.84±1.18	25.72±1.44
Upper leg circumference (min) (cm)	39.80±2.38	40.90±2.30
Upper leg circumference (max) (cm)	54.04±3.63	56.11±3.36
Lower leg circumference (min) (cm)	23.64±1.04	24.25±2.02
Lower leg circumference (max) (cm)	35.46±1.81	37.46±1.99
Upper arm skinfolf (mm)	4.82±1.29	5.29±1.12
Lower arm skinfold (mm)	5.65±1.65	6.21±.90
Thigh skinfold (mm)	9.40±3.23	11.19±3.53
Calf skinfold (mm)	8.10±2.32	7.98±1.58
Chest skinfold (mm)	7.18±1.92	8.39±2.12
Abdomen skinfold (mm)	6.82±1.99	8.38±1.94

Legend: N – number of Subjects, AM – arithmetic mean, SD – standard deviation

Observing the results of the central tendency and dispersion parameters of longithudinal and transversal skeletal dimensionality, body volume and body mass of the soccer and volleyball players, we immediately notice that volleyball players have higher value in 18 variables, while in terms of footballers, we notice higher values in only 2 parameters (Table 1).

On the basis of the results presented it was determined that the subsamples are significantly different in 8 out of 20 anthropometric characteristics (level of significance $p<0.05$). It was concluded, based on these results, that significant differences occur in body height, body weight, elbow diameter, wrist diameter, ankle joint diameter, lower arm circumference (max), lower leg circumference (max) and abdomen skinfold, while the significant difference does not occur in knee diameter, upper arm circumference (min), upper arm circumference (max), lower arm circumference (min), upper leg circumference (min), upper leg circumference (max), lower leg circumference (min), upper arm skinfolf, lower arm skinfold, thigh skinfold, calf skinfold and chest skinfold. For each of the parameters in which a significant difference has been found, higher values can be seen in volleyball players (Table 2).

Tabela 2. Difference between junior soccer and volleyball players tested by Independent t-test

	F	T	Df	Sig	MD	SED	Min	Max
Body height	.68	-7.96	37	.000	-16.47	2.07	-20.66	-12.28
Bodyweight	.15	-4.80	37	.000	-12.14	2.30	-17.26	-7.02
Elbow diameter	.92	-4.45	37	.000	-5.08	1.14	-7.40	-2.77
Wrist diameter	.38	-3.76	37	.001	-4.01	1.07	-6.17	-1.85
Knee diameter	.33	1.34	37	.188	1.92	1.44	-.98	4.84
Ankle joint diameter	.08	-2.13	37	.004	-1.80	.85	-3.52	-.08
Upper arm circumference (min)	.99	-1.68	37	.102	-1.06	.63	-2.34	.22
Upper arm circumference (max)	.71	-1.52	37	.138	-1.03	.68	-2.41	.35
Lower arm circumference (min)	.57	.52	37	.604	.14	.26	-.40	.67
Lower arm circumference (max)	.16	-2.05	37	.047	-.88	.43	-1.73	-.01
Upper leg circumference (min)	.83	-1.39	37	.172	-1.09	.78	-2.68	.50
Upper leg circumference (max)	.69	-1.75	37	.088	-2.07	1.18	-4.46	.32
Lower leg circumference (min)	.06	-1.25	37	.218	-.61	.49	-1.60	.38
Lower leg circumference (max)	.53	-3.21	37	.003	-2.00	.62	-3.27	-.74
Upper arm skinfolf	.51	-1.13	37	.267	-.46	.41	-1.30	.37
Lower arm skinfold	.24	-1.19	37	.243	-.57	.48	-1.53	.40
Thigh skinfold	.52	-1.60	37	.118	-1.78	1.12	-4.05	.47
Calf skinfold	.11	.170	37	.863	.12	.70	-1.30	1.54
Chest skinfold	.41	-1.83	37	.076	-1.22	.67	-2.56	.13
Abdomen skinfold	.87	-2.37	37	.023	-1.56	.66	-2.89	-.22

Legend: F–value of Levene's test of equality of variances, t–value of t-test, df–number of degreeseof freedom, Sig–significance of two-tailed testing of arithmetic mean difference, MD–arithmetic mean difference, SED–standard error of diffeence, Min–the level of lower difference interval, Max–level of upper difference interval

Discussion

The results of this study show that there are significant differences in certain anthropometric characteristics between soccer players and volleyball players who compete in the elite Serbian Junior Leagues. Volleyball players are significantly higher than soccer players, which is in line with previous research (Popović et al., 2014; Masanovic, T. Bavcevic, & I. Bavcevic, 2019). If we consider that official statistical data proved that the average body height of all the participants in the FIFA U-17 World Soccer Championship India 2017 was 176.01 centimeters, while the average height of the of all participants in CEV U17 Volleyball European Championship 2017 in Turkey was 189 centimeters, we can conclude that the players from Serbian soccer and volleyball Junior Premier League with average body height 177.8 and 194.28 centimeters are tall enough and they do not lag behind the World top players. Also, the selection process is quality conducted, which is not a surprise, because it is well known that the number of very tall subjects appears to be high in Dinaric Alpes area (Bjelica, Popovic, Kezunovic, Petkovic, Jurak, & Grasgruber, 2012; Popović, Milašinović, Matić, Gardašević, & Bjelica, 2016; Popovic, Gardasevic, Masanovic, Arifi, & Bjelica, 2017; Masanovic, 2017; Popovic, 2017). The significant body mass difference is not a surprise, as the previous literature indicates a significantly higher body weight of the volleyball players (Ferreira Oliveira, Teixeira Vaz, Pastore, & João, 2018; Vukotic & Georgiev, 2019), which is also the logical consequence of a large difference in body height.

Results related to measures of the skeleton transversal showed significantly higher values for volleyball players for 3 out of 4 variables (elbow diameter, wrist diameter, and ankle joint diameter). Knee diameter showed significantly higher values for soccer players, which is no surprise, because the biggest adaptation in football shows just this joint (Isık, Unlu, Gozubuyuk, Aslanyurek, & Bereceli, 2018). When body volume and subcutaneous adipose tissue are concerned, significantly higher values were shown for volleyball players for 7 out of 8 variables and for 5 out of 6 variables. These results are in line with previous research (Bandyopadhyay, 2007; Sprague, Mokha, & Gatens, 2014) which is also logical because in research, soccer is recognized as an aerobic sport in which activity lasts longer and running distance is greater (Popovic et al., 2013; Popovic, Masanovic, Molnar, & Smajic, 2009; Gardasevic, Bjelica, & Popovic, 2015), which justifies

somewhat higher value of the thickness of the skin folds. Ultimately, considering the higher values of body height and body mass, values of circumference, are expected primarily as a logical consequence.

Professionalism from athletes requires a high level of preparation, both motoric and functional, which must be supported by morphological characteristics that should correspond, to the specifics of the sports and player position, which differ within almost every sport branch (Bjelica, 2005; Radjo et al., 2016; Gardasevic, Popovic, & Bjelica, 2016; Vukasevic, Vukotic, & Masanovic, 2018; Vukasevic, Spaic, Masanovic, 2018).

The goal of this research was to determine whether there is a difference, and what is the scope of it, in anthropometric characteristics between the junior soccer and volleyball players. Also, to characterize, as acurately as possible, the morphological characteristics of subjects. Considering the movement patterns in volleyball, slightly greater body height and body mass are expected primarily for the reason that volleyball is a sport in which body height gives advantage in defence and attack, because taller players have the ability to easily spike the ball over the tall opponent's in defensive block, and vice versa, to set a tall defensive block on the other side of the netthrough, by which opposing attackers have less chance to win points (Smajic et al., 2015; Oliveira, Valladares, Vaz, & João, 2016). Movement patterns in soccer and volleyball are the reason for higher diameters of the ankle joints in volleyball players, and higher values of knee diameter in soccer player (Calbet, Díaz Herrera, & Rodríguez, 1999; Fredericson et al., 2007; Zouch et al., 2008; Stanganelli, Dourado, Oncken, Mançan, & da Costa, 2008). Circumferences are expected as a logical consequence of the difference in the absolute size of the body. Also, movement patterns in soccer are the reason for lower subcutaneous adipose tissue values for soccer players because in research, soccer is recognized as an aerobic sport in which activity lasts longer and running distance is greater (Popovic et al., 2013; Pasa, Vukasevic, & Masanovic, 2019).

Of great interest for some authors are morphological characteristics of topclass soccer and volleyball players (Marques, & Marinho, 2009; Gjonbalaj, Georgiev, & Bjelica, 2018; Krespi, Sporis, & Popovic, 2019), because the particular morphology profile of an athlete, combined with motor and functional abilities, should express its full potential (Gusic et al. 2017). The results of this study may serve as model parameters for estimating the same variables for other players of the same sport and competition rank, or for comparison with the results of similar research. It should be noted that players who want to compete successfully must have the characteristics established by the standards of that sport, which of course also refers to the morphological quality that players have to possess.

Acknowledgements
There are no acknowledgements.

Conflict of Interest
The authors declare that there are no conflicts of interest.

Received: 1 February 2019 | **Accepted:** 1 March 2019 | **Published:** 19 April 2019

References

Amani, A. R., Sadeghi, H., & Afsharnezhad, T. (2018). Interval training with blood flow restriction on aerobic performance among young soccer players at transition phase. *Montenegrin Journal of Sports Science and Medicine, 7*(2), 5-10. doi: 10.26773/mjssm.180901

Arifi, F., Bjelica, D., & Masanovic, B. (2019). Differences in anthropometric characteristics among junior soccer and handball players. *Sport Mont, 17*(1), 45-49. doi: 10.26773/smj.190208

Bajramovic, I., Talovic, M., Alic, H., & Jeleskovic, E. (2008). Nivo kvantitativnih promjena specifiČno-motoriČkih sposobnosti nogometaša pod uticajem situacionog treninga. *Sport Mont, 6*(15-16-17), 104-109.

Bandyopadhyay, A. (2007). Anthropometry and Body Composition in Soccer and Volleyball Players in West Bengal, India. *Journal of Physiological Anthropology, 26*(4), 501-505.

Bjelica, D. (2005). *Sistematizacija sportskih disciplina i sportski trening.* Podgorica: Crnogorska sportska akademija.

Bjelica, D. (2013). *Teorija sportskog treninga.* Podgorica: Univerzitet Crne Gore.

Bjelica, D., & Fratrić, F. (2011). *Sportski trening: teorija, metodika i dijagnostika.* Nikšić: Fakultet za sport i fizičko vaspitanje.

Bjelica, D., Popović, S., i Gardašević, J. (2016a). Modeli fizičke pripreme vrhunskih sportaša i doziranje opterećenja. *Zbornik radova 14. godišnje međunarodne konferencije "Kondicijska priprema sportaša"* (185-189). Zagreb: Udruga kondicijskih trenera Hrvatske.

Bjelica, D., Popović, S., i Gardašević, J. (2016b). Opći principi planiranja i programiranja fizičkih priprema sportaša. *Zbornik radova 14. godišnje međunarodne konferencije "Kondicijska priprema sportaša"* (190-192). Zagreb: Udruga kondicijskih trenera Hrvatske.

Bjelica, D., Popovic, S., Kezunovic, M., Petkovic, J., Jurak, G., & Grasgruber, P. (2012). Body Height and Its Estimation Utilizing Arm Span Measurements in Montenegrin Adults. *Anthropological Noteboos, 18*(2),69–83.

Calbet, J. A. L., Díaz Herrera, P., & Rodríguez, L. P. (1999). High Bone Mineral Density in Male Elite Professional Volleyball Players. *Osteoporosis International, 10*(6), 468–474.

Duncan, M.J., Woodfield, L., al-Nakeeb, Y. (2006). Anthropometric and physiological characteristics of junior elite volleyball players. *British Journal of Sports Medicine, 40*(7), 649-651.

Ferreira Oliveira, A. O. G., Teixeira Vaz, L. M., Pastore, J. C., & João, P. V. (2018). Discriminate scoring skills and non-scoring skills according to results in the Brazilian men's volleyball SuperLeague. *Montenegrin Journal of Sports Science and Medicine, 7*(1), 73-79. doi: 10.26773/mjssm.180310

Ferreira Oliveira, A. O. G., Teixeira Vaz, L. M., Pastore, J. C., & João, P. V. (2018). Discriminate scoring skills and non-scoring skills according to results in the Brazilian men's volleyball SuperLeague. *Montenegrin Journal of Sports Science and Medicine, 7*(1), 73-79. doi: 10.26773/mjssm.180310

Fredericson, M., Chew, K., Ngo, J., Cleek, T., Kiratli, J., & Cobb, K. (2007). Regional bone mineral density in male athletes: a comparison of soccer players, runners and controls. *British Journal of Sports Medicine, 41*(10), 664–668.

Gardasevic, J., Bjelica, D., & Popovic, S. (2015). The effects of the training in the preparation period on the agility transformation with cadet level football players. *Sport Mont, 13*(43-44-45),355-60.

Gardašević, J., Popović, S., & Bjelica, D. (2016). After preparation period ball shooting accuracy at players U15. In *Abstract Book of the 8th Conference for Youth Sport* (88). Ljubljana: University of Ljubljana, Faculty of Sport.

Gjonbalaj, M., Georgiev, G., & Bjelica, D. (2018). Differences in Anthropometric Characteristics, Somatotype Components, and Functional Abilities Among Young Elite Kosovo Soccer Players Based on Team Position. *Int. J. Morphol., 36*(1),41-7.

Gusić, M., Popović, S., Molnar, S., Mašanović, B., & Radaković, M. (2017). Sport-Specific Morphology Profile: Differences in Anthropometric Characteristics among Elite Soccer and Handball Players. *Sport Mont, 15*(1),3-6.

Hurst, M., Loureiro, M., Valongo, B., Laporta, L., Nikolaidis, P., & Afonso, J. (2017). Systemic Mapping of High-Level Women's Volleyball using Social Network Analysis: The Case of Attack Coverage, Freeball, and Downball. *Montenegrin Journal of Sports Science and Medicine, 6*(1), 57-64.

Isık, A., Unlu, G., Gozubuyuk, O. B., Aslanyurek, T., & Bereceli, C. (2018). The relationship between previous lower extremity injury, body weight and bilateral eccentric hamstring strength imbalance in young soccer players. *Montenegrin Journal of Sports Science and Medicine, 7*(2), 23-28. doi: 10.26773/mjssm.180904

Krespi, M., Sporis, G., & Popovic, S. (2019). Exponential versus linear tapering in junior elite soccer players: effects on physical match performance according to playing positions. *Montenegrin Journal of Sports Science and Medicine, 8*(1), Ahead of Print. doi: 10.26773/mjssm.190303

Laporta, L., Nikolaidis, P., Thomas, L., & Afonso, J. (2015). The Importance of Loosely Systematized Game Phases in Sports: The Case of Attack Coverage Systems in High-Level Women's Volleyball. *Montenegrin Journal of Sports Science and Medicine, 4*(1), 19-24.

Marques, M.C. & Marinho, D.A. (2009). Physical parameters and performance values in starters and non-starters volleyball players: A brief research note. *Motricidade, 5*(3), 7-11.

Masanovic, B. (2017). Relationship between Arm Span Measurements and Body Height in Dinaric Alpes Population: a Systematic Review. *Journal of Anthropology of Sport and Physical Education, 1*(1),33–7.

Masanovic, B., Bavcevic, T., & Bavcevic, I. (2019). Comparative study of anthropometric measurement and body composition between junior soccer and volleyball players from the serbian national league. *Sport Mont, 17*(1), 9-14. doi: 10.26773/smj.190202

Masanovic, B., Milosevic, Z., & Corluka, M. (2018). Comparative Study of Anthropometric Measurement and Body Composition between Junior Handball and Volleyball Players from Serbian National League. International *Journal of Applied Exercise Physiology, 7*(4), 1-6. https://doi.org/10.30472/ijaep.v7i4.313

Masanovic, B., Popovic, S., & Bjelica, D. (2018). Comparative Study of Anthropometric Measurement and Body Composition Between Junior Soccer and Volleyball Players From National League. In *Book of Abstracts 15th International Scientific Conference on Transformation Process in Sport "Sport Performance"* (58), Podgorica: Montenegrin Sports Academy.

Masanović, B., Vukotić, M., Popović, S., & Bjelica, D. (2018). Comparative study of anthropometric measurement and body composition between junior basketball and volleyball players from Serbian national league. In *Proceedings World Congress of Performance Analysis of Sport XII* (340). Opatija: International Society of Performance Analysis of Sport.

Morteza Tayebi, S., Mahmoudi, A., Shirazi, E., & Sangi, M. (2017). Acute Response of Some Iron Indices of Young Elite Wrestlers to Three Types of Aerobic, Anaerobic, and Wrestling Exercise. *Montenegrin Journal of Sports Science and Medicine, 6*(1), 5-11.

Oliveira, A., Valladares, N., Vaz, L., & João, P. (2016). Evaluation of Scoring Skills and Non Scoring Skills in the Brazilian SuperLeague Women's Volleyball. *Montenegrin Journal of Sports Science and Medicine, 5*(2), 25-31.

Pasa, Y. C., Vukasevic, V., & Masanovic, B. (2019). Differences in anthropometric characteristics among junior basketball and volleyball players. *Journal of Anthropology of Sport and Physical Education, 3*(1), 35-39. doi: 10.26773/jaspe.190107

Popovic, S. (2017). Local Geographical Differences in Adult Body Height in Montenegro. *Montenegrin Journal of Sports Science and Medicine, 6*(1), 81-87.

Popovic, S., Akpinar, S., Jaksic, D., Matic, R., & Bjelica, D. (2013). Comparative Study of Anthropometric Measurement and Body Composition between Elite Soccer and Basketball Players. *International Journal of Morphology, 31*(2),461-7.

Popović, S., Bjelica, D., Jakšić, D., & Hadžić, R. (2014). Comparative Study of Anthropometric Measurement and Body Composition between Elite Soccer and Volleyball Players. *Int. J. Morphol., 32*(1),267-74.

Popovic, S., Gardasevic, J., Masanovic, B., Arifi, F., & Bjelica, D. (2017). Standing Height and its Estimation Utilizing Foot Length Measurements in Adolescents from Western Region in Kosovo. *Sport Mont, 15*(3), 3-7.

Popovic, S., Masanovic, B., Molnar, S., & Smajic, M. (2009). Determining Body Composition of Top Level Athletes. *Teme, 33*(4), 1534-1549.

Popović, S., Milašinović, R., Matić, R., Gardašević, J., & Bjelica, D. (2016). Body height and its estimation utilizing arm span measurements in male adolescents from southern region in Montenegro. In *Book of Abstracts of the 13th International Scientific Conference on Transformation Process in Sport "Sport Performance"* (29-30), Podgorica: Montenegrin Sports Academy.

Popovic, S., Smajic, M., Joksimovic, A., & Masanovic, B. (2010). The differences in body composition between football players of different rank competitions. *Sport Mont, 8*(23-24),362-7.

Radjo, I., Alic, H., Bajramovic, I., Jeleskovic, E., Covic, N., Likic, S., & Mekic, A. (2016). Functional strength training effects on knee flexors and extensors power output in football players. *Sport Mont, 14*(2), 13-16.

Rexhepi, A.M., & Brestovci, B. (2010). The differences in body volume and skinfold thickness between basketball and football players. *International Journal of Morphology, 28*(4),1069-74.

Saavedra, J. M., Þorgeirsson, S., Kristjansdottir, H., Halldorsson, K., Guðmundsdottir, M. L., & Einarsson, I. Þ. (2018). Comparison of training volumes in different elite sportspersons according to sex, age, and sport practised. *Montenegrin Journal of Sports Science and Medicine, 7*(2), 37-42. doi: 10.26773/mjssm.180906

Sæther, S. A. (2017). Characteristics of professional and non-professional football players - an eight-year follow-up of three age cohorts. *Montenegrin Journal of Sports Science and Medicine, 6*(2),13-8.

Smajic, M., Kuljanin, T., Savic, M., Korac, K., Vasic, G., & Tomic, B. (2015). The influence of some anthropometric characteristics and motor abilities on agility in young female volleyball players. *Sport Mont, 13*(43-44-45), 169-175.

Spaic, S., Vukasevic, V., & Masanovic, B. (2018). Differences in anthropometric characteristics among junior soccer and basketball players. *Journal of Anthropology of Sport and Physical Education, 2*(4), 89-92. doi: 10.26773/jaspe.181016

Sprague, P.A., Mokha, G.M., & Gatens, D.R. (2014). Changes in Functional Movement Screen Scores Over a Season in Collegiate Soccer and Volleyball Athletes. *Journal of Strength and Conditioning Research, 28*(11), 3155–3163. doi: 10.1519/JSC.0000000000000506

Stanganelli, L.C.R., Dourado, A.C., Oncken, P., Mançan, S., & da Costa, S.C. (2008). Adaptations on Jump Capacity in Brazilian Volleyball Players Prior to the Under-19 World Championship. *Journal of Strength and Conditioning Research, 22*(3), 741–749.

Stojanovic, M., Calleja-Gonzalez, J., Mikic, M., Madic, D., Drid, P., Vučković, I., & Ostojić, S. (2016). Accuracy and Criterion-Related Validity of the 20-M Shuttle Run Test in Well-Trained Young Basketball Players. *Montenegrin Journal of Sports Science and Medicine, 5*(2), 5-10.

Vukasevic, V., Spaic, S., & Masanovic, B. (2018). Comparative study of anthropometric measurement and body composition between the basketball player first and second league in Montenegro. *Journal of Anthropology of Sport and Physical Education, 2*(3),61-65. doi: 10.26773/jaspe.180711

Vukasevic, V., Vukotic, M., & Masanovic, B. (2018). Comparative study of morphological characteristics and body composition between basketball players from second leagues in Montenegro and Serbia. *Journal of Anthropology of Sport and Physical Education, 2*(3),21-25. doi: 10.26773/jaspe.180704

Vukotic, M., & Georgiev, G. (2019). Comparative analysis of anthropometric characteristics between athlets of different orientation. *Journal of Anthropology of Sport and Physical Education, 3*(1), 41-45. doi: 10.26773/jaspe.190108

Vukotic, M., & Georgiev, G. (2019). Comparative analysis of anthropometric characteristics between athlets of different orientation. *Journal of Anthropology of Sport and Physical Education, 3*(1), 41-45. doi: 10.26773/jaspe.190108

Zouch, M., Jaffré, C., Thomas, T., Frère, D., Courteix, D., Vico, L., & Alexandre, C. (2008). Long-term soccer practice increases bone mineral content gain in prepubescent boys. *Joint Bone Spine, 75*(1), 41–49.

DOI 10.26773/jaspe.190403

Journal of Anthropology of Sport and Physical Education

SHORT REPORTS

Leg Length Discrepancy in College Students and Its Association with Low Back Pain: a Preliminary Study

Ignatio Rika Haryono[1], Melani Kawilarang[1], Nawanto Agung Prastowo[1]

[1]Universitas Katolik Indonesia Atma Jaya, Department of Physiology, Faculty of Medicine and Health Sciences, Jakarta, Indonesia

Abstract

Leg length discrepancy (LLD) is a condition in which lower extremities have a different length. The discrepancy can cause functional dysfunction and health problem. Low back pain (LBP) is one of a health problem associated with LLD. The prevalence of LBP in young people increases over time. This study aimed to evaluate the association between LLD and LBP in college students. This cross-sectional study involved 75 (40 female) students of Faculty of Medicine, Atma Jaya. Height, weight, and BMI were measured and calculated. True leg length was measured three times using tape measurement in the supine position. The LLD was defined as the difference of 10 mm or more. Numeric data between LLD vs no LLD were compared using independent samples of the t-test. The association between LLD, LBP, and other variables were evaluated using chi-square. A p-value <0.05 was set as statistically significant. Statistics analysis was computed using SPSS (ver. 17). Leg length discrepancy and LBP were found in 31 (22 female) and 36 (22 female), respectively. Among those with LBP, 16 were LLD (44.4%). No association was found between LBP and LLD (p=0.548), BMI (p=0.518), and gender (p=0.164). Gender was associated with LLD (OR 3.53, 95%CI 1.32 - 9.42, p=0.010). Only 5 (13.9%) of affected LBP experienced dysfunctional state. There is no relationship between LLD, gender, BMI and LBP in students of the Faculty of Medicine. Female have a higher risk of LLD.

Key words: *Leg Length Discrepancy, Low Back Pain, Students' College, Gender Different, Body Mass Index*

Introduction

Leg length discrepancy (LLD) is an inequality of the lower limb length. The LLD is commonly found in population and the prevalence is varied widely depending on the magnitude of the discrepancy. It is estimated that 23% of the general population having inequality of 1 cm or more (Gross, 1978). A study by Raczkowski, Daniszewska, & Zolynski (2010) measuring and classifying discrepancy reported that differences of 1 cm were more prevalent in children aged 5 to 17 years.

The cutoff for LLD is usually determined based on the effect of different leg length that results in significant clinical symptoms. Previous studies used different cutoff for leg length discrepancy (Liu, Fabry, Molenaers, Lammens, & Moens, 1998; Shailam, Jaramillo, & Kan, 2013). In one study (Shailam et al., 2013), LLD was assumed as 10 mm whereas another study (Liu et al., 1998) determined 20 mm of LLD that can cause clinical symptoms. The inequality of the leg length will affect posture and induce gait abnormality. Scoliosis, pelvic obliquity, and gait asymmetry are the most common consequences of LLD (Gross, 1978; Liu et al., 1998; Shailam et al., 2013).

The prevalence of LBP is high worldwide. Low back pain is defined as pain on the posterior area between the lower margin of the lowest rib and gluteal folds. Low back pain affects all age group but mostly in young adult (Lunde, Koch, Hanvold, Waersted, & Veiersted, 2015). Many causes of LBP have been documented. Even with no mortality reported, LBP causes functional disturbance leading to disability, decreases pro-

Correspondence:

N.A. Prastowo

Universitas Katolik Indonesia Atma Jaya, Department of Physiology, Faculty of Medicine and Health,Science, Pluit Raya street 2, Jakarta, Indonesia, 14440

E-mail: nawanto2011@gmail.com

ductivity, and being a health and economic burden (Delitto, George, van Dillen, Whitman, Sowa, Shekelle, Denninger, & Godges, 2012; Katz 2006). The association of LBP and LLD has not been established yet. Our study was aimed to examine LLD and its relationship with LBP in college students.

Methods

This is a pilot study with a cross-sectional design. Subjects were 35 male and 40 female students of Faculty of Medicine, Universitas Katolik Indonesia Atma Jaya aged 18-20 years. They were invited to participate voluntarily. Exclusion criteria were set as follow: musculoskeletal trauma affecting gait and leg length and rheumatoid arthritis. Subjects were informed of the study purposes prior to signing informed consent. The study was approved by the local ethics committee of Faculty of Medicine, Universitas Katolik Indonesia Atma Jaya.

Height and weight were measured using standard equipment and methods in standing position. Body mass index (BMI) was calculated according to the established formula, expressed in kg/m2. True leg length was measured three times using a direct tape for each lower extremity in a supine position, from the anterior superior iliac spine (ASIS) to the medial malleolus. The difference of 10 mm between left and right leg was considered as LLD.

Low back pain was obtained from self-reported. The numerical rating scale was used to assess pain intensity. The LBP was classified into acute if less than 12 weeks, and chronic if 12 weeks or more (Koes et al., 2010). Functional disability was assessed using the Rolland Morris Disability Questionnaire (RMQ). Results of RMQ was determined as a functional state if score ≤4, and dysfunctional state if score >4 (Xia et al., 2017).

Descriptive statistics are presented as mean±SD and frequency (percentage). The comparison of the numerical data between normal and LLD was analyzed using an independent sample of the t-test. The association between LLD and gender, BMI, and LBP was evaluated using Chi-square or Fisher's exact test. Significance was determined at $p < 0.05$. The statistic analysis was computed using SPSS ver 17.

Results

Comparison between normal and LLD are presented in Table 1. Independent samples of t-test was applied to compare numeric data whereas Chi-square was for categoric data. Forty participants (53.3%) were female and thirty-one (41.3%) were LLD. Subjects had a significant taller height than LLD (p=0.01). The LLD in female was significantly higher than in male (22 vs 9, p=0.01). Female gender had a risk of 3.53 times higher to have LLD (p=0.010, 95%CI, 1.32-9.42).

Table 1. Characteristics of Subjects

	Normal (n=44)	LLD (n=31)	p
Gender			
Male	26	9	0.010
Female	18	22	
Age (years)	19.52±0.93	19.64±1.05	0.596
Weight (kg)	64.75±15.78	60.34±10.74	0.182
Height (cm)	164.81±9.54	159.39±7.50	0.010
BMI (kg/m2)	23.60±4.17	23.68±3.66	0.922
BMI			
Normal	31	22	0.962
Overweight	13	9	
TLL right cm)	85.95±4.31	84.51±4.54	0.167
TLL left (cm)	85.95±4.31	83.96±4.60	0.058

Note: LLD: leg length discrepancy; BMI: body mass index; TLL: true leg length; p: probability is significant at <0.05

Table 2 demonstrates the association between LBP with gender, BMI, and LLD. Thirty-six (48%) subjects reported having LBP. Gender, BMI, and LLD had no association with LBP (p=0.164 for gender, p=0.518 for BMI, and p=0.548 for LLD).

Table 2. The Association between LBP with Gender, BMI, and LLD

	Low Back Pain		Total	p
	Yes	No		
Gender				
Male	14	21	35	0.164
Female	22	18	40	
Body mass index				
Normal	25	28	53	0.518
Overweight	11	11	22	
Leg legth equality				
Similar	20	24	44	0.548
LLD	16	15	31	

Note: LBP: low back pain; LLD: leg length discrepancy; BMI: body mass index; p: probability is significant at <0.05

Characteristics of LBP is described in Table 3. Most subjects experienced pain in acute (28/77.8%), mild intensity (26/77.2%) with low frequency (seldom and some time) of pain attack (33/91.7%). Only 5 subjects (91.7%) reported having a dysfunctional state.

Table 3. Characteristics of the Low Back Pain

Characteristics		Number (%)
Duration of LBP	Acute	28 (77.8%)
	Subacute-chronic	8 (22.2%)
Frequenty of LBP	Seldom	20 (55.6%)
	Sometime	13 (36.1%)
	Often-very often	3 (8.3%)
Intensity of LBP	Mild	26 (72.2%)
	Moderate	10 (27.8%)
Rolland Morris Disability	Functional State	31 (86/1%)
Questionnaire Scope	Dysfunctional State	5 (13.9%)

Note: LBP: low back pain.

Discussion

Low back pain is a very common musculoskeletal problem and affects large people. Many factors are attributed to low back pain. Leg length discrepancy is known to be strongly associated with LBP. This study evaluated the association between LLD and LBP in college students. Low back pain was found in thirty-six subjects (48%) whereas LLD in 41.3%. Among those with LBP, 16 subjects (44.4%) had LLD. However, the association between LBP with LLD, gender, and BMI were not proven. Female are 3.5 times more likely to have LLD. Among those with LBP, only 5 (13.9%) were indicated to experience dysfunctional state.

There is still disagreement among different studies' findings regarding the association of LBP and LLD. No association between LLD and LBP in our study is in accordance with prior studies. Noormohammadpour et al. (2016) evaluated a small sample of 28 adolescent football players and reported that LBP had no link with LLD. A study by Goss, Moore, Slivka, & Hatler (2006) involved 1100 military cadets and match controls after 1-year participation in military training and athletic participation. The results showed no association between injury and LLD. The association between LBP and LLD was confirmed by Rannisto et al. (2015) involving meat cutters and service workers on their study. The results showed LBP was obviously correlated with LLD. The different cut off of LLD may influence conflicting results in which higher cut off value will usually give more significant results. Another possible mechanism is related to the position during working. Stand while working performed by subjects was supposed to enhance the burden on low back in LLD leading to LBP. It has been proposed that long-standing in LLD could induce a degenerative change in the spine, gait disturbance, and low back pain (Sheha et al., 2018)

Women are more at risk of developing LBP. The recent study found LBP frequency in female is much higher than in male students (55% vs 40%). A previous study supposed that higher incidence of low back pain in women might be related to weaker muscle strength, incorrect posture, low physical fitness (Vujcic et al., 2018). Nevertheless, the association between gender and LBP was not statistically significant. Similarly, a prior study evaluating medical college students reported that no association between gender and musculoskeletal pain (Haroon, Mehmood, Imtiaz, Ali, & Sarfraz, 2018). In addition, a study in India evaluating large sample Indian young also reported that gender was not included as a risk factor for LBP (Ganesan, Acharya, Chauhan, & Acharya, 2017). Epidemiological data seem not to be in line with statistic analysis yet.

Body mass index has been known to be a risk factor of LBP (Leboeuf-Yde, 2004). The logical assumption behind is that increased BMI will increase the mechanical load on the spine and trunk muscles during weight-bearing activity (Boćkowski et al., 2007). In fact, our study did not find any association between BMI and LBP. The result was also supported by Yue, Liu, & Li (2012) evaluating LBP in teachers. They reported that BMI did not relate to LBP. As mentioned above, the working position may play more a role in LBP than BMI per se.

Pain characteristics were also explored in this study. The pain felt by subjects did not appear to be severe and disturbing. Most of them experienced acute pain with mild intensity in a low frequency of pain attack. Rolland Morris Disability Questionnaire indicated that most of the subjects still function normally.

Limitations of this study were noted. As a pilot study, the small sample size is an important limiting factor, especially with a very small amount of subjects with ≥ 20 cm LLD. Small sample size affects the validity of the study and the significance of the statistic results. The limitation also arises due to measurement methods. Radiologic examination of the spine was not planned to do in the study. Some possible LBP etiologies such as spondylolysis, mild scoliosis, HNP, etc, can be identified through x-ray examination.

In conclusion, this study reported there was not an association between low back pain and leg length discrepancy, LBP, and LLD in student college-aged 18-20 years. Female had more risk of having LLD. There were only small amount of students with LBP have a dysfunctional state. However, the conclusion should be taken under cautious consideration due to study limitation especially the small number of subjects.

Acknowledgements
There are no acknowledgements.

Conflict of Interest
The authors declare that there are no conflicts of interest.

Received: 1 March 2019 | **Accepted:** 20 March 2019 | **Published:** 19 April 2019

References

Gross, R.H. (1978). Leg length discrepancy: how much is too much? *Orthopedics, 1*(4), 307-310.

Raczkowski, J.W., Daniszewska, B., & Zolynski, K. (2010). Functional scoliosis caused by leg length discrepancy. *Archives of Medical Science, 6*(3), 393-398.

Shailam, R., Jaramillo, D., & Kan, J.H. (2013). Growth arrest and leg-length discrepancy. *Pediatric Radiology, 43*(S1), 155-165.

Liu, X.C., Fabry, G., Molenaers, G., Lammens, J., & Moens, P. (1998). Kinematic and kinetic asymmetry in patients with leg-length discrepancy. *Journal of Pediatric Orthopaedics, 18*(2), 187-189.

Lunde, L.K., Koch, M., Hanvold, T.N., Waersted, M., & Veiersted, K.B. (2015). Low back pain and physical activity. A 6.5 year follow-up among young adults in their transition from school to working life. *BMC Public Health, 15*, 1115. doi: 10.1186/s12889-015-2446-2.

Delitto, A., George, S.Z., van Dillen, L.R., Whitman, J.M., Sowa, G.A., & Shekelle, P., Denninger, T.R., Godges, J.J. (2012). Low back pain. Clinical Practice Guidelines Linked to the International Classification of Functioning, Disability, and Health from the Orthopaedic Section of the American Physical Therapy Association. *Journal of Orthopaedic & Sports Physical Therapy, 42*(4), A1-7.

Katz, J.N. (2006). Lumbar disc disorders and low back pain: socioeconomic factors and consequences. *Journal of Bone and Joint Surgery America, 88*(S2), 21-24.

Koes, B.W., van Tulder, M., Lin, C.W., Macedo, L.G., McAuley, J., & Maher, C. (2010). An updated overview of clinical guidelines for the management of non-specific low back pain in primary care. *European Spine Journal, 19*(12), 2075-2094.

Xia, T., Long, C.R., Vining, R.D., Gudavalli, M.R., DeVocht, J.W., Kawchuk, G.N., Wilder, D.G., & Goertz, C.M. (2017). Association of lumbar spine stiffness and flexion-relaxation phenomenon with patient-reported outcomes in adults with chronic low back pain - a single-arm clinical trial investigating the effects of thrust spinal manipulation. *BMC Complementary & Alternative Medicine, 17*(1), 303. doi: 10.1186/s12906-017-1821-1.

Noormohammadpour, P., Khezri, A. H., Linek, P., Mansournia, M. A., Hassannejad, A., Younesian, A., Farahbakhsh, F., & Kordi R. (2016). Comparison of lateral abdominal muscle thickness and cross sectional area of multifidus in adolescent soccer players with and without low back pain: A case control study. *Asian Journal of Sports Medicine, 7*(4), e38318. doi: 10.5812/asjsm.38318.

Goss, D.L., Moore, J.H., Slivka, E.M., & Hatler, B.S. (2006). Comparison of injury rates between cadets with limb length inequalities and matched control subjects over 1 year of military training and athletic participation. *Military Medicine, 171*(6), 522–525.

Rannisto, S., Okuloff, A., Uitti, J., Paananen, M., Rannisto, P.H., Malmivaara, A., & Karppinen, J. (2015). Leg-length discrepancy is associated with low back pain among those who must stand while working. *BMC Musculoskeletal Disorder, 16*(1) 110. doi: 10.1186/s12891-015-0571-9.

Sheha, E.D., Steinhaus, M.E., Kim, H.J., Cunningham, M.E., Fragomen, A.T., & Rozbruch, S.R. (2018). Leg-length discrepancy, functional scoliosis, and low back pain. *Journal of Bone & Joint Surgery Review, 6*(8), e6. doi: 10.2106/JBJS.RVW.17.00148.

Vujcic, I., Stojilovic, N., Dubljanin, E., Ladjevic, N., Ladjevic, I., & Sipetic-Grujicic, S. (2018). Low back pain among medical students in Belgrade (Serbia): A cross-sectional study. *Pain Research and Management, 2018,* 1-6 pages. doi: 10.1155/2018/8317906.

Haroon, H., Mehmood, S., Imtiaz, F., Ali, S.A., & Sarfraz, M. (2018). Musculoskeletal pain and its associated risk factors among medical students of a public sector University in Karachi, Pakistan. *Journal of Pakistan Medical Association, 68*(4), 682–688.

Ganesan, S., Acharya, A.S., Chauhan, R., & Acharya, S. (2017). Prevalence and risk factors for low back pain in 1,355 young adults: a cross-sectional study. *Asian Spine Journal, 11*(4), 610–617.

Leboeuf-Yde C. (2004). Back pain - individual and genetic factors. *Journal of Electromyography Kinesiology, 14*(1), 129-133.

Boćkowski, L., Sobaniec, W., Kułak, W., Smigielska-Kuzia, J., Sendrowski, K., & Roszkowska, M. (2007). Low back pain in school-age children: risk factors, clinical features and diagnostic management. *Advance in Medical Science, 52*(S1), 221-223.

Yue, P., Liu, F., Li, L. (2012). Neck/shoulder pain and low back pain among school teachers in China, prevalence and risk factors. *BMC Public Health, 12*, 789. doi.org/10.1186/1471-2458-12-789.

DOI 10.26773/jaspe.190404

Journal of Anthropology of Sport and Physical Education

ORIGINAL SCIENTIFIC PAPER

Comparative Analysis of Anthropometric Characteristics between Athlets of Different Orientation, Basketball and Handball

Marina Vukotic[1], Georgi Georgijev[2]

[1]University of Montenegro, Faculty for Sport and Physical Education, Niksic, Montenegro, [2] Ss. Cyril and Methodius University, Faculty for Physical Education, Sport and Health, Skopje, Macedonia

Abstract

The main goal of this research is to determine whether there are statistically significant differences in the level of anthropometric indicators among athletes of different sports directions (basketball and handball players), that is, to determine the differences in the changes in the anthropometric indicators of athletes. In accordance with the goal, a transversal study was conducted in which the empirical and statistical methods were applied, and the research technique was testing. The study was conducted on a sample of 50 subjects, a male gender divided into two subunits, an age range of 13 to 15 years. In this study, 12 anthropometric variables were tested: body height, arm length, leg length, knee diameter, bicrystalline range, bichromium range, body mass, median volume of the thorax, circumference, upper abdomen, skin abdomen and skin set of lower legs. For all applied variables, the central and dispersion parameters as well as measures of asymmetry and flattening were calculated, and the distribution normality was verified by Kolmogorov-Smirnov test. T-test was applied to verify that the system of applied variables has statistically quantitative differences between groups. On the basis of the obtained results, it can be concluded that there are statistically significant differences in anthropometric indicators in athletes of different sports orientations. This research can be used by trainers who realize training programs with these and other athletes in order to achieve better results.

Key words: *Basketball, Handball, Anthropometric Characteristics, Montenegro*

Uvod

Smatra se da je jedan od osnovnih motiva koji pokreće ljude da se bave sportom upravo težnja za usavršavanjem i mjerenjem svojih sposobnosti i karakteristika, koje se mogu razvijati pod uticajem trenažnog procesa (Bjelica, 2005). Zadovoljenje sportskih potreba i interesa značajno je sa aspekta zdravlja, svestranog razvoja ličnosti sportiste, podizanja radne sposobnosti do nivoa sportske forme, te sposobnosti za učešće u sistemu takmičenja (Bjelica, 2006a; Bjelica, 2006b). Sport u savremenim uslovima života predstavlja složen sistem različitih aktivnosti i oblika organizovanja kroz koje se ispoljavaju brojne i različite potrebe i interesi sportista (Bjelica, 2002; Bjelica, 2013; Popovic, 2017; Vukotic, Corluka, Vasiljevic, i Bubanja, 2018). Poznato je da sportski rezultat koji postižu sportisti u velikoj mjeri zavisi od morfoloških karakteristika, pa se navedene karakteristike smatraju najvažnijim dimenzijama latentne strukture antropološkog statusa (Masanovic, 2009; Vukotic, 2010; Gusic, Popovic, Molnar, Masanovic, & Radakovic, 2017; Vukasevic, Vukotic, i Masanovic, 2018). Bolje upoznavanje morfoloških karakteristika i konstitucije sportista ima za cilj: upravljanje ovim svojstvima i prilagođavanje sportskog treninga individualnim sposobnostima (Masanovic, Vukotic, Popovic, i Bjelica, 2018; Masanović, Vukotic, i Vukasevic, 2018; Vukotic, i Georgiev, 2019).

Košarka i rukomet, kao sportske igre, zahtijevaju različite prethodno navedene dimenzije, a takođe i procese sportskog treninga i obučavanja (Bjelica, 2004; Masanovic, Milosevic, & Corluka, 2018; Vukotic, 2011; Vukotic, 2018). Za sportske

Correspondence:

M. Vukotic

University of Montenegro, Faculty for Sport and Physical Education, Narodne omladine bb, 81400 Niksic, Montenegro

E-mail: marinavuk@ucg.ac.me

trenere je od posebnog značaja da poznaju zakonitosti rasta i razvoja antropometrijskih karakteristika, motoričkih i funkcionalnih sposobnosti da bi primjena različitih treninga bila što efikasnija (Bjelica, 2005, Bjelica, Popovic, i Gardasevic, 2016a; Bjelica, Popovic, i Gardasevic, 2016b; Bjelica, Popović, Kezunovic, Petkovic, Jurak, i Grasgruber, 2012; Bjelica, 2002; Gardasevic, Popovic, i Bjelica, 2016; Masanovic, Vukotic, Bjelica, i Popovic, 2018; Popovic, Bjelica, Vukotic, i Masanovic, 2018).

Antropometrijske karakteristike su izuzetno značajne za uspjeh u košarci i rukometu. U prostoru morfoloških dimenzija košarkaša i rukometaša definisani su posebni faktori označeni kao latentne morfološke dimenzije: longitudinalna dimenzionalnost skeleta, transverzalna dimenzionalnost skeleta, masa i volumen tela i potkožno masno tkivo (Bjelica i Fratric, 2011). Morfološki status vrhunskih sportista su relativno homogeni u zavisnosti od sporta, i mogu biti definisani kao modeli sportskog postignuća (Mišigoj-Duraković, Matković, i Medved, 1995). Visina daje prednost u košarci i rukometu, jer se cilj nalazi na velikoj visini, takođe, visina igračima omogućava da lakše dođu do lopte u odbrani i napadu i blokiraju protivnički napad (Popovic, Bjelica, Jaksic, i Hadzic, 2014). Većina elemenata, naročito onih sa loptom, su veoma složeni i specifični. Za njihovo usvajanje i besprekornu primjenu u igri potreban je visok nivo razvijenosti cjelokupnog motornog aparata (Vukasevic, Vukotic, i Masanovic, 2018).

Osnovni cilj ovog istraživanja je utvrditi da li postoje statistički značajne razlike u nivou antropometrijskih karakteristika između sportista različitog sportskog usmjerenja (košarka i rukomet), odnosno da se definiše njihova veličina.

Metod

Uzorak ovog istraživanja čini ukupno 50 ispitanika muškog pola podijeljenih na dva subuzorka. Prvi subuzorak je činilo 25 dječaka članova Košarkaškog kluba „Sutjeska", prosječne starosti 14.15±4.28 godina, a drugi subuzorak je činilo 25 dječaka članova Rukometnog kluba „Sutjeska", iz Nikšića, prosječne starosti 13.73±6.18 godina.

Antropometrijsko istraživanje sprovedeno je uz poštovanje osnovnih pravila i principa vezanih za izbor mjernih instrumenata i tehnike mjerenja koji su standardizovani, prema upustvima Internacionalnog Biološkog Programa. Odabrane varijable u ovom istraživanju hipotetski pokrivaju prostor antropometrijskih karakteristika (12) i to: visina tijela (MVI), dužina ruke (MDR), dužina noge (MDN), dijametar koljena (MDK), bikristalni raspon (MBR), biakromijalni raspon (MBI), masa tijela (MMS), srednji obim grudnog koša (MSK), obim natkoljenice (MON), kožni nabor nadlaktice (MKD), kožni nabor trbuha (MKN) i kožni nabor potkoljenice (MKP).

Podaci dobijeni ovim istraživanjem obrađeni su postupcima deskriptivne i komparativne statističke procedure. Za sve primijenjene varijable izračunati su centralni i disperzioni parametri kao i mjere asimetrije i spljoštenosti, a normalnost distribucije provjerena je Kolmogorov–Smirnovljevim testom. Razlike u antropomerijskim karakteristikama između dvije grupe ispitanika (košarkaša i rukometaša) utvrđene su primjenom diskriminativne parametrijske procedure, t-testom za male nezavisne uzorke, sa statističkom značajnošću od $p<0.05$.

Rezultati

U Tabelama 1 i 2 prikazani su osnovni deskriptivni statistički parametri antropometrijskih varijabli košarkaša i rukometaša kadetskog uzrasta, gdje su izračunate vrijednosti mjera centralne i disperzione tendencije i to: aritmetička sredina (Mean), standardna devijacija (Std. Dev.), mjera varijabiliteta (KV), minimalne (Min) i maksimalne (Max) vrijednosti, koeficijenti zakrivljenosti (Skewness), izduženosti (Kurtosis) i Kolmogorov-Smirnovljev test (K. S.). Prvo su analizirani centralni i disperzioni parametri varijabli za procjenu antropometrijskih karakteristika košarkaša kadeta (Tabela 1).

Tabela 1. Centralni i disperzioni parametri varijabli za procjenu antropometrijskih karakteristika košarkaša kadetskog uzrasta (N=25)

	Mean	S. D.	KV %	Min	Max	Skewness	Kurtosis	K. S.
MVI	180.58	6.47	3.58	169.00	191.00	- 0.29	- 0.60	0.95
MDR	79.58	3.61	4.54	71.50	85.00	- 0.56	0.01	0.94
MDN	101.62	4.60	4.53	91.00	109.00	- 0.47	0.28	0.83
MDK	8.45	0.76	8.99	6,40	9.90	- 0.90	1.31	0.31
MBR	38.20	3.84	10.05	33.00	51.00	1.48	4.08	0.60
MBI	40.22	3.15	7.83	34.00	46.00	- 0.04	- 0.56	0.90
MMS	65.32	11.34	17.36	49.00	94.00	1.16	0.99	0.44
MSK	85.50	6.43	7.52	77.00	97.00	0.50	- 1.26	0.21
MON	44.42	5.78	13.01	36.00	58.00	0.81	0.09	0.38
MKD	12.26	3.46	28.22	5.30	18.00	- 0.27	- 0.80	1.00
MKN	11.68	4.05	34.67	5.30	21.67	0.34	0.08	0.87
MKP	10.31	3.16	30.65	5.00	17.67	0.30	- 0.31	0.96

Legenda: Mean - Aritmetička sredina; S.D. - Standardna devijacija; KV% - Mjera varijabiliteta; Min – Minimalna vrijednost; Max - Maksimal-na vrijednost; Skewness – Mjera asimetrije; Kurtosis – Mjera spljoštenosti; K.S. Kolmogorov-Smirnovljev test

Inspekcijom tabele uočljivo je da su dobijeni rezultati normalno distribuirani (prema K. S. testu). Na osnovu centralnih i disperzionih parametara, vrijednosti skjunisa i kurtozisa, može se konstatovati da su sve varijable u granicama normalne raspodjele. Vrijednosti skjunisa kod varijabli sa pozitivnim predznakom, govore da su vrijednosti većine ispitanika u zoni slabijih vrijednosti i one su normalno asimetrične ili umjereno asimetrične, dok u mjerama: bikristalni raspon i masa tijela sa odgovarajućim vrijednostima 1,48 i 1,16 su izraženo asimetrične. Negativne vrijednosti kurtozisa kod varijabli pokazuju veću spljoštenost (nagnutost) od normalnog oblika, tj. platikurtičnost. To ukazuje na heterogenost dobijenih rezultata, odnosno izraženiju diskriminativnost među ispitanicima. U mjeri bikristalni raspon (Kurt=4.08) možemo konstatovati da su košarkaši najhomogeniji (leptokurtičnost).

Tabela 2. Centralni i disperzioni parametri varijabli za procjenu antropometrijskih karakteristika rukometaša kadetskog uzrasta (N=25)

	Mean	S. D.	KV %	Min	Max	Skewness	Kurtosis	K. S.
MVI	167.08	8.47	5.07	154.00	186.00	0.29	- 0.69	0.82
MDR	70.76	4.99	7.05	61.00	80.00	- 0.22	- 0.64	0.87
MDN	89.58	7.40	8.26	78.50	104.00	0.02	- 0.93	0.88
MDK	8.88	0.52	5.86	8.00	10.00	0.66	0.12	0.26
MBR	35.06	2.48	7.07	31.00	41.00	0.60	0.40	0.91
MBI	37.39	2.73	7.30	33.00	46.50	1.49	4.16	0.57
MMS	57.28	8.71	15.21	45.00	90.00	2.05	7.94	0.08
MSK	80.42	5.40	6.71	71.00	95.50	0.67	1.13	0.91
MON	41.23	3.93	9.53	34.00	50.50	0.54	0.26	0.60
MKD	11.36	2.01	17.69	6.67	15.30	- 0.28	- 0.14	0.55
MKN	10.51	2.84	27.02	5.67	15.67	0.04	- 0.65	1.00
MKP	11.15	3.11	27.89	3.67	19.67	0.64	2.49	0.31

Inspekcijom tabele 2 uočljivo je da su dobijeni rezultati normalno distribuirani (prema K. S. testu). Na osnovu centralnih i disperzionih parametara, vrijednosti skjunisa i kurtozisa, može se konstatovati da su sve varijable u granicama normalne raspodjele. Vrijednosti skjunisa kod varijabli sa pozitivnim predznakom, govore da su vrijednosti većine ispitanika u zoni slabijih vrijednosti i one su normalno asimetrične ili umjereno asimetrične, dok u mjerama dužina ruke i kožni nabor nadlaktice, koje su sa negativnim predznakom, govore da se vrijednosti većine ispitanika u zoni boljih rezultata. Negativne vrijednosti kurtozisa kod varijabli pokazuju veću spljoštenost (nagnutost) od normalnog oblika, tj. platikurtičnost. To ukazuje na heterogenost dobijenih rezultata, odnosno izraženiju diskriminativnost među ispitanicima. U mjeri masa tijela (Kurt=7.94) možemo konstatovati da su rukometaši najhomogeniji (leptokurtičnost). Da bi se moglo utvrditi da li ima statistički značajnih razlika u analiziranim varijablama kod košarkaša i rukometaša kadetskog uzrasta, primjenjena je statistička procedura t-test (Tabela 3).

Tabela 3. Vrijednosti t-testa između aritmetičkih sredina varijabli za procjenu antropometrijskih karakteristika igrača kadeta košarkaša (N=25) i kadeta rukometaša (N=25)

Variables	Group	Mean	S. D.	t	df	Sig.
MVI	Košarka	180.58	6.47	3.89	48	0.03
	Rukomet	167.08	8.47			
MDR	Košarka	79.58	3.61	2.07	48	0.00
	Rukomet	70.76	4.99			
MDN	Košarka	101.62	4.60	2.59	48	0.01
	Rukomet	89.58	7.40			
MDK	Košarka	8.45	0.76	- 2.21	48	0.00
	Rukomet	8.88	0.52			
MBR	Košarka	38.20	3.84	3.33	48	0.00
	Rukomet	35.06	2.48			
MBI	Košarka	40.22	3.15	2.75	48	0.12
	Rukomet	37.39	2.73			
MMS	Košarka	65.32	11.34	2.55	48	0.22
	Rukomet	57.28	8.71			
MSK	Košarka	85.50	6.43	3.06	48	0.00
	Rukomet	80.42	5.40			
MON	Košarka	44.42	5.78	1.33	48	0.00
	Rukomet	41.23	3.93			
MKD	Košarka	12.26	3.46	1.89	48	0.18
	Rukomet	11.36	2.01			
MKN	Košarka	11.68	4.05	3.23	48	0.15
	Rukomet	10.51	2.84			
MKP	Košarka	10.31	3.16	3.45	48	0.00
	Rukomet	11.15	3.11			

Legenda: Group - Grupe; Mean – Aritmetička sredina; S.D. – Standardna devijacija; Sig. - Značajnost razlike

Na osnovu rezultata se može vidjeti da je došlo do razlika, što nam potvrđuju i signifikantne vrijednosti na nivou $p<0.05$. statističke značajnosti razlika testiranjem T-testom. Prilikom utvrđivanja razlika kod antropometrijskih parametara, očigledna je statistička značajnost kod sljedećih varijabli: visina tijela, dužina ruke, dužina noge, dijametar koljena, mase tijela, srednji obim grudnog koša, obim natkoljenice i kožni nabor trbuha. Statistička razlika ne postoji kod varijabli: bikristalni

raspon, biakromijalni raspon, kožni nabor nadlaktice i kožni nabor potkoljenice.

Diskusija

Na osnovu uvida u dobijene deskriptivne parametre vidimo da su prosječne vrijednosti tjelesne visine i tjelesne mase košarkaša obuhvaćenih ovom studijom (180.58 cm i 65.32 kg) značajno više nego vrijednosti prosječne tjelesne visine i mase tijela košarkaša Srbije istog uzrasta (171.57 cm i 59.97 kg) koje nalazimo u literaturi (Jakovljevic, Karalejic, Pajic, Gardasević, & Mandic, 2011). Ovi podaci su dokaz da je proces selekcije košarkaša obuhvaćenih ovom studijom dobro obavljen, a dokaz dobre selekcije i dobrog rada su izuzetni rezultati kadetske reprezentacije Crne Gore na Evropskom prvenstvu 2017. godine. Na ovom takmičenju igrači Crne Gore su savladali vršnjake iz Srbije i obezbijedili istorijsku srebrenu medalju. Košarka u morfološkom prostoru zahtijeva igrače koji imaju veću tjelesnu visinu, jer znamo da je košarka igra nadprosječno visokih ljudi, zato se od samog početka vrši određena selekcija, i to je proces koji se kontinuirano nastavlja kroz sve uzrasne kategorije. U specifikaciji uspjeha na prvo, a samim tim i najvažnije mjesto autori stavljaju upravo antropometrijske karakteristike košarkaša (Karalejic i Jakovljevic, 2001; Arifi, Bjelica, & Masanovic, 2019) i to tjelesnu visinu, a zatim masu tijela koja je takođe od velike važnosti u košarci. Na osnovu dobijenih deskriptivnih parametara ovog istraživanja prosječna tjelesna visina rukometaša je 167,08 cm, a masa tijela rukometaša je 57,28 kg, što pokazuje da oni imaju veoma slične vrijednosti sa igračima iz Hrvatske koji su istog uzrasta (Ostroski, Milanovic, i Metikos, 2014) gdje je prosječna tjelesna visina rukometaša bila 167,00 cm, a masa tijela je iznosila 62,70 kg. Opšti zaključak je da postoji sličnost crnogorskih i hrvatskih igrača i to ohrabruje, jer hrvatski rukometaši su godinama u svjetskom vrhu. A to može da znači da smo na dobrom putu da se i mi tamo nađemo. Posljednjih godina se u rukomet puno ulaže o čemu govore i rezultati muške kadetske reprezentacije Crne Gore koja je osvojila srebrnu medalju na Mediteranskom prvenstvu u Egiptu 2019. godine. Dosadašnji crnogorski A reprezentativci kao što su Borozan, Lipovina, Čavor i drugi igraju i nose igru u najjačim svjetskim klubovima, tako da naši kadeti imaju od koga da uče, pa se može vrlo brzo očekivati da postignu uspjeh kao njihovi vršnjaci u košarci.

Može se zaključiti da kod primijenjenog sistema antropometrijskih mjera postoje statistički značajne razlike, što se može vidjeti na osnovu rezultata t-testa za nezavisne uzorke. Dobijeni rezultati samo dijelom potvrđuju važnost longitudinalne dimenzionalnosti skeleta, u razlikovanju selekcionisanih košarakaša i rukometaša kadetskog uzrasta (Cselko, Laszlo, Tekus, i Wilhelm, 2013; Katic, Grgantov, i Jurko, 2006), jer razlike ukazuju na povezanost rasta i razvoja i uspješnosti u igri kod mladih košarkaša i rukometaša (Vukotic, 2010). U sportskoj praksi dobro je poznat problem prerane specijalizacije kao i neuvažavanja fiziološke zrelosti (Bjelica, Popovic, i Gardasevic, 2016a), što je pogrešno. U cilju da se procjene krajnje mogućnosti mladih sportista potrebno je da se pokuša pronaći adekvatan somatotip za određene sportove, nivoe takmičenja i igračke pozicije (Massuça i Fragoso, 2011; Gaurav, Singh, i Singh, 2010), jer navedene sportske igre karakteriše dinamička i vrlo brza igra, sa mnogo eksplozivnih pokreta, i skokova, a sportisti mogu odgovoriti navedenim zahtjevima ako imaju visok nivo razvijenosti morfoloških karakteristika (Gaurav, Singh, i Singh, 2010; Masanovic, Popovic, i Bjelica, 2018).

Rezultati koji su dobijeni ovim istraživanjem mogu poslužiti kao modelni parametri u procjenjivanim varijablama za sve ostale igrače istog ranga takmičenja u Crnoj Gori, jer su analizirani igrači članovi dva tima kadetskog uzrasta, Treba napomenuti da igrači koje žele uspješno nastupati u ligama gdje se igra najkvalitetnija košarka i rukomet, moraju imati karakteristike utvrđene standardima za taj sport, a to se prije svega ogleda u antropometrijskim karakteristikama.

Acknowledgements
There are no acknowledgements.

Conflict of Interest
The authors declare that there are no conflicts of interest.

Received: 1 February 2019 | **Accepted:** 24 February 2019 | **Published:** 19 April 2019

References

Arifi, F., Bjelica, D., & Masanovic, B. (2019). Differences in anthropometric characteristics among junior soccer and handball players. *Sport Mont, 17*(1), 45-49. doi: 10.26773/smj.190208

Bjelica, D. (2002). *Opšti pojmovi sportskog treninga: (skraćena verzija)*. Podgorica: Crnogorska sportska akademija.

Bjelica, D. (2004). *Uticaj sportskog treninga na antropomotoričke sposobnosti:* (fudbalskih kadeta Crne Gore). Podgorica: Crnogorska sportska akademija.

Bjelica, D. (2005). *Sistematizacija sportskih disciplina i sportski trening.* Podgorica: Crnogorska sportska akademija.

Bjelica, D. (2006a). *Sportski trening.* Podgorica: Crnogorska sportska akademija.

Bjelica, D. (2006b). *Teorijske osnove tjelesnog i zdrastvenog obrazovanja.* Podgorica: Crnogorska sportska akademija.

Bjelica, D. (2013). *Teorija sportskog treninga.* Podgorica: Univerzitet Crne Gore.

Bjelica, D., & Fratric, F. (2011). *Sportski trening: teorija, metodika i dijagnostika.* Nikšić: Fakultet za sport i fizičko vaspitanje.

Bjelica, D., Popović, S., i Gardašević, J. (2016a). Modeli fizičke pripreme vrhunskih sportaša i doziranje opterećenja. U *zborniku radova 14. godišnje međunarodne konferencije "Kondicijska priprema sportaša"* (185-189), Zagreb: Udruga kondicijskih trenera Hrvatske.

Bjelica, D., Popović, S., i Gardašević, J. (2016b). Opći principi planiranja i programiranja fizičkih priprema sportaša. U *zbornik radova 14. godišnje međunarodne konferencije "Kondicijska priprema sportaša"* (190-192), Zagreb: Udruga kondicijskih trenera Hrvatske.

Cselko, A., Laszlo, Z., Tekus, E., & Wilhelm, M. (2013). Morphological, motor and situation-motor characteristics of elite female handball players according to playing performance and position. *Collegium Antropologicum, 34*(4),1355-61.

Cselko, A., Laszlo, Z., Tekus, E., & Wilhelm, M. (2013). Anthropometric and cardiovascular characteristics of young elite male handball players according to playing positions. *Exercise and Quality of Life, 5*(1), 31-41.

Gusic, M., Popovic, S., Molnar, S., Masanovic, B., & Radakovic, M. (2017). Sport-Specific Morphology Profile: Differences in Anthropometric Characteristics among Elite Soccer and Handball Players. *Sport Mont, 15*(1), 3-6.

Gardasević, J., Popovic, S., & Bjelica, D. (2016). After preparation period ball shooting accuracy at players U15. In *Abstract Book of the 8th Conference for Youth Sport* (88). Ljubljana: University of Ljubljana, Faculty of Sport.

Gaurav, V., Singh, M., & Singh, S. (2010). Anthropometric characteristics, somatotyping and body composition of volleyball and basketball players. *Journal of Physical Education and Sports Management 1*(3), 28-32.

Jakovljevic, S., Karalejic, M., Pajić, Z., Gardasević, B., & Mandic, R. (2011). The influence of antropometric characteristics on the agility abilities of 14 year – old elite male basketball players. *Facta Universitatis – Series: Phisical education and Sport, 9*(2), 141-149.

Karalejic, M., Jakvoljevic, S. (2001). *Osnove košarke*. Beograd: Fakultet sporta i fizičkog vaspitanja.

Masanovic, B. (2009). Differences of anthropometrical status on top level handball players and non sportsmen. *Sport Mont, 6*(18-19-20), 569-575.

Masanovic, B., Milosevic, Z., & Corluka, M. (2018). Comparative Study of Anthropometric Measurement and Body Composition between Junior Handball and Volleyball Players from Serbian National League. *International Journal of Applied Exercise Physiology, 7*(4), 1-6. doi: 10.30472/ijaep.v7i4.313

Masanovic, B., Vukotic, M., & Vukasevic, V. (2018). Comparative Study of Morphological Characteristics and Body Composition between Elite Basketball Players from Different Regions. *Journal of Anthropology of Sport and Physical Education, 2*(4), 103–107. doi: 10.26773/jaspe.180704

Masanovic, B., Vukotic, M., Popovic, S., & Bjelica, D. (2018). Comparative study of anthropometric measurement and body composition between junior basketball and volleyball players from Serbian national league. *World Congress of Performance Analysis of Sport XII* (340). Croatia: University of Zagreb.

Mišigoj-Duraković, M., Matković, B., i Medved, R. (1995). *Morfološka antropometrija u športu.* Zagreb: Fakultet za fizičku kulturu.

Ostroski, S., Milanovic, M., i Metikos, B. (2014). Razlike nogometaša i rukometaša dobi 13 do 14 godina uključenih u školski sportski klub u nekim kondicionim obilježima. U *zborniku radova 23 Ljetnje škole kineziologa Republike Hrvatske* (231-236). Zagreb: Hrvatski kineziološki savez.

Popovic, S. (2017). Local Geographical Differences in Adult Body Height in Montenegro. *Montenegrin Journal of Sports Science and Medicine, 6*(1), 81-87.

Popovic, S., Bjelica, D., Georijev, G., Krivokapic, D. & Milasnović, R. (2016). Body height and its estimation utilizing arm span Measurements in Macedonian. *The anthropologist, 24*(3), 737–745.

Popović, S., Bjelica, D., Molnar, S. Jaksic, D, & Akpinar, S. (2013). Body height and its estimation utilizing arm span Measurements in serbian adults. *Int. J. Morphol., 31*(1), 271-279.

Popovic, S., Bjelica, D., Tanase, G., & Milasinovic, R. (2015). Body Height and Arm Span in Bosnian and Herzegovinian Adults, *Monten. J. Sports Sci. Med. 4*(1), 29–36.

Popovic, S., Bjelica, D., Vukotic, M., & Masanovic, B. (2018). Describing Physical Activity Profile of Older Montenegrin Females Using the International Physical Activity Questionnaire (IPAQ). In *Book of Abstracts 15th International Scientific Conference on Transformation Process in Sport "Sport Performance"* (60-61). Podgorica: Montenegrin Sports Academy.

Popovic. S., Bjelica, D., Jaksic, D., & Hadzic, R. (2014). Comparative Study of Anthropometric Measurement and Body Composition between Elite Soccer and Volleyball Players. *International Journal of Morphology, 32*(1), 267-74.

Vukasevic, V., Vukotic, M., & Masanovic, B. (2018). Comparative Study of Morphological Characteristics and Body Composition between Basketball Players from Second Leagues in Montenegro and Serbia. *Journal of Anthropology of Sport and Physical Education, 2*(3), 21–25. Doi: 10.26773/jaspe.180704

Vukotic, M. (2018). Comparative analysis of anthropometric indicators of sportisis of different soprts guidance. In *Book of Abstracts 15th International Scientific Conference on Transformation Process in Sport "Sport Performance"* (75-76). Podgorica: Montenegrin Sports Academy.

Vukotic, M. (2010). *Nivo morfoloških karakteristika, motoričkih i funkcionalnih sposobnosti sportista različitog sportskog usmjerenja.* Neobjavljena magistarska teza, Nikšić: Fakultet za sport i fizičko vaspitanje.

Vukotic, M. (2011). Differences of anthropometric characteristic and motor abilities of different sport orientation. *Sport Mont, 9*(28-29-30), 112-8.

Vukotic, M., & Georgiev, G. (2019). Comparative analysis of anthropometric characteristics between athlets of different orientation. *Journal of Anthropology of Sport and Physical Education, 3*(1), 41-45. doi: 10.26773/jaspe.190108

Vukotic, M., Corluka, M., Vasiljević, I., & Bubanja, M. (2018). Differences in the Morphological Characteristics and Body Composition of Handball Players WHC Levalea in Montenegro and WHC Grude in Bosnia and Herzegovina. *Journal of Anthropology of Sport and Physical Education, 2*(2), 49–53. doi: 10.26773/jaspe.180409

DOI 10.26773/jaspe.190405

Journal of Anthropology of Sport and Physical Education

ORIGINAL SCIENTIFIC PAPER

Analysis of Body Composition and Specific Motor Movements of Junior Football Players

Izet Bajramovic[1], Slavenko Likic[1], Munir Talovic[1], Haris Alic[1], Eldin Jeleskovic[1], Rasim Lakota[1], Nedim Covic[1]

[1]University of Sarajevo, Faculty for Sport and Physical Education, Sarajevo, Bosnia and Herzegovina

Abstract

The aim of the research was to determine correlations between body composition and situational motor movements in football. The sample consisted of 22 respondents (16-18 years of age, 179.6 ± 5.0 cm, 71.2 ± 7.2 kg), selected from junior football players that compete at the highest competition level for this category in Bosnia and Herzegovina. For the purposes of this research, a set of 7 variables was used. The Pearson correlation coefficient determined a medium high correlation between explosive strength of sprint type - running at 10m with body weight ($r = .473$; $p < .05$), and with body mass index 10m ($r = .576$; $p < .01$). It can be concluded that more corpulent and havier players with optimum body mass index have better results in short sprint distance at 10m. The height of players does not make a significant contribution to the realization of specific footbal movements. Favorable body composition is not sufficient to explain the quality of the performance of specific motor movements in football.

Key words: *Anthropometry, Sprinting, Specific Movements in Football*

Uvod

Informisanost o nivou treniranosti sportista, te uzrocima i posljedicama takvog stanja, bitna je za njihov uspjeh. Poznato je da fudbaleri u igri ostvare veći broj kratkih sprinteva, te da primjenjuju različite načine vođenja lopte, pravolinijski i sa promjenom smjera kretanja. Struktura agilnosti s loptom je mnogo složenija u odnosu na takvo kretanje bez lopte (Sporiš, Milanović, Trajković, & Joksimović, 2011). Brzina i eksplozivna snaga se smatraju preduslovom za uspjeh u omladinskom fudbalu (Reilly, Bangsbo, & Franks, 2000), naglašavajući pritom ubrzanja na kratkim udaljenostima.

Visina i tjelesna težina su značajno povezane sa fizičkom izvedbom u slučaju mladih fudbalera (Mathisen & Petersen, 2015). Ipak se sa sigurnošću ne može izolovati neka osobinu ili sposobnost koja donosi odlučujuću prednost u utakmici. Fudbaleri su tjelesno lakši od osoba koje žive sedentarnim načinom života (Popović, Akpinar, Jaksic, Matic, & Bjelica, 2013), ali i niži u odnosu košarkaše, odbojkaše i rukometaše juniorske kategorije (Masanovic & Vukasevic, 2009; Masanovic, 2018). Međutim, u sportovima gdje se traži velika brzina kretanja, nagla promjena pravca u velikoj brzini kretanja, grubi sudari sa protivnikom (fudbal i hokej), tjelesna visina ne samo da nije dominantna, nego je u određenoj mjeri i nepovoljna (Bjelica & Fratrić, 2011).

Međusobni odnos tjelesne visine i težine (body mass index), te udio masne komponente (% fat mass) u ukupnoj tjelesnoj masi, za trenere može biti važna informacija. Optimalne vrijednosti BMI-a mogu rezultirati u poboljšanju opšteg nivoa tjelesne i anaerobne snage (Nikolaidis, 2014). Fudbaleri imaju povoljan sadržaj mišića sa niskim nivoom tjelesnih masti (Popovic, Bjelica, Jaksic, & Hadzic, 2014). Ipak, višak tjelesnih masti stvara nepotreban teret i umanjuje učinkovitost u igri, te značajno narušava elemente tehnike mladih fudbalera (Nemčić, Fiorentini, & Sporiš, 2018). Vrijednosti tjelesnih masti za vrhunske fudbalere su u prosjeku 7-12%, te su niže nego u slučaju sedentarnih ljudi, ali su takođe više u odnosu na trkače u sportovima izdržljivosti (Shephard, 1999.). Pored optimalizacije voluminoznosti mišića, na količinu potkožnog masnog tkiva se može uticati dopunskim treningom (Conroy i Earle, 2000), i to djelovanjem u pravcu njene redukcije.

S obzirom da se takmičenja omladinskih liga organizuju shodno hronološkoj, a ne biološkoj starosti, često se pojedinci

Correspondence:

S. Likic

University of Sarajevo, Faculty for Sport and Physical Education, Patriotske lige 41, 71000 Sarajevo, Bosnia and Herzegovina

E-mail: slavenkolikic@gmail.com

selekcionišu na temelju dominantnih morfoloških karakteristika. Opravdanost ovakvog postupka ima samo kratkoročne benefite koji mogu biti iskazani kroz stav da teži igrači imaju snažniji udarac po lopti i veću sposobnost sprintanja (Wong, Chamari, Dellal, Wislőff, 2009), međutim ovakav pristup ne može imati opravdanost sa gledišta dugoročnog procesa razvoja igrača.

Metode

Metodom slučajnog odabira sačinjen je uzorak ispitanika (n=22) iz populacije fudbalera juniorske kategorije najkvalitetnijih takmičenja u Bosni i Hercegovini (prosječna starost 17,41±0,51; prosječna visina 179.6±5.0 cm; prosječna težina 71,2±7,2 kg). Osnovni uslov za izbor ispitanika je igrački staž (>5 godina), te 70% učešća u trenažnom i takmičarskom procesu za prethodnu godinu. Ispitanici su prije testiranja upoznati sa temeljnim odredbama Helsinške deklaracije, te su dobrovoljno pristali na testiranje, uz mogućnost odustajanja u bilo kojem trenutku. Golmani su izostavljeni iz uzorka ispitanika s obzirom da, po svojoj morfologiji i specifičnosti zadaća u igri, odstupaju od igrača u polju (S. Gil, J Gil, Ruiz, A. Irazusta, & J. Irazusta, 2007; Gjonbalaj, Georgiev, & Bjelica, 2018).

Testiranje je obavljeno u prvom pripremnom dijelu sezone, na umjetnoj travi. Istom je prethodilo standardizovano zagrijavanje (jogging 5 minuta, dinamičko/statičko istezanje 7 minuta i istrčavanja sa postepenim akceleracijama brzine do 90% 3 minuta). Korišteno je ukupno 7 varijabli: visina tijela (cm); težina tijela (kg); indeks tjelesne mase (BMI); udio masne komponente (%); 0-10m sprint (s); 0-30 vođenje lopte (s) i slalom vođenje lopte (s). Mjerenje visine je izvršeno pomoću antropometra (model Holtain, 610), a prema uputama Međunarodnog biološkog programa. Korištenjem digitalne vage Tanita (model BC-420MA) dobivene su vrijednosti tjelesne težine, tjelesnih masti i BMI-a. Tretirani testovi za procjenu situaciono-motoričkih sposobnosti u fudbalu zadovoljavaju metrijske karakteristike (Sporiš, 2007). Za mjerenje vremena je korišten sistem fotoćelija (model Micro-gate).

Za sve varijable izračunata je prosječna vrijednost (A.S.), apsolutno odstupanje (± S.D.). K.S. testom je provjerena distribucija rezultata. Povezanost tretiranih varijabli je izračunata pomoću Pearsonovog linearnog koeficijenta korelacije. Statistička značajnost je prihvaćen na nivou p≤0,05. Kvadriranjem dobivenih vrijednosti izračunati su koeficijenti determinacije koji ukazuju na dio zajedničke varijanse varijabli tjelesne kompozicije i specifično-motoričkih sposobnosti fudbalera.

Rezultati

Statistički značajne veze uočene su između tjelesne težine i eksplozivne snage tipa sprinta 10m (r=.473; p<.05), te indeksa tjelesne mase i eksplozivne snage tipa sprinta 10m (r=.576; p<.01).

Tabela 1. Deskriptivni pokazatelji mjera tjelesne kompozicije i situaciono-motoričkih sposobnosti mladih fudbalera

	Mean	S.D.
Tjelesna visina (cm)	179.6190	5.04456
Tjelesna težina (kg)	71.9455	7.14701
Indeks tjelesne mase	22.3136	1.77396
Tjelesne masti (%)	6.2682	2.09043
0-10m sprint (s),	1.8727	.10058
0-30 vođenje lopte (s),	4.5555	.25220
Slalom vođenje lopte (s)	9.7732	1.25304

Legenda: Mean – aritmetička sredina; S.D. – standardna devijacija

Apsolutne vrijednosti dobivenih koeficijenata ukazuju na srednje jak intenzitet veze pozitivnog smjera. Koeficijenti determinacije ukazuju na zajednički dio varijanse od 22% između tjelesne težine i eksplozivne snage tipa sprinta 10m, odnosno 33% između indeksa tjelesne mase i eksplozivne snage tipa sprinta 10m. Preostale tretirane varijable međusobno ne koreliraju (p>.05).

Tabela 2. Linearni koeficijenti povezanosti između mjera tjelesne kompozicije i situaciono-motoričkih sposobnosti mladih fudbalera

	0-10m sprint (s)	0-30 vođenje lopte (s)	Slalom vođenje lopte (s)
Tjelesna visina (cm)	- .122	- .094	- .195
	.597	.686	.397
Tjelesna težina (kg)	.473*	.121	.148
	.026	.592	.510
Indeks tjelesne mase	.576**	.053	.135
	.005	.813	.549
Tjelesne masti (%)	.422	- .052	.015
	.050	.817	.948

Legenda: * - Nivo statističke značajnosti 0.05; ** - Nivo statističke značajnosti 0.01

Diskusija

Prosječni rezultati varijabli za procjenu tjelesne kompozicije se mogu smatrati optimalnim za juniorski uzrast fudbalera (Tabela 1). Prosječni rezultati tjelesne visine i težine, te njihovog međusobnog odnosa, se podudaraju sa prethodnim istraživanjima (Masanovic, T. Bavcevic, & I. Bavcevic, 2019), te bez obzira na slične vrijednosti indeksa tjelesne mase, može se konstatovati da sportisti juniorske kategorije imaju znatno niže vrijednosti udjela masne komponente u odnosu na nesportiste. Wong i sar. (2009) navode da vrijednosti BMI-a ne mogu

biti dobar pokazatelj s obzirom da ukazuju na odnos tjelesne visine i težine, ali ne i sastava tijela kojeg čine masna i nemasna komponenta (mišići i skelet). Također, prosječni rezultati su blago veći u odnosu na rezultate mladih fudbalera (Arifi, Bjelica, & Masanovic, 2019), odnosno niži u odnosu fudbalske klubove koji se takmiče u najkvalitenijim nacionalnim ligama Crne Gore, Kosova i Bosne i Hercegovine (Bjelica & Gardasevic, 2019; Gardasevic, Bjelica & Vasiljevic, 2019; Gardasevic, Bjelica & Vasiljevic, 2019a).

Uočeni intenzitet i smjer veza između eksplozivne snage tipa sprinta sa tjelesnom težinom, odnosno indeksom tjelesne mase, potvrđuje rezultate dobivene u prethodnim istraživanjima (Brahim, Bougatfa, & Mohamed, 2013; Mathisen & Petersen, 2015). Posmatrajući sa stanovišta prakse, pojedine komponente tjelesne kompozicije mogu djelovati kao faktori koji olakšavaju ili otežavaju izvođenje različitih kretnih zadatka. Tjelesna visina, pogotovo u korelaciji sa težinom tijela, ima bitan uticaj na one varijable skokova i trčanja kod kojih, poslije savladavanja inertnosti tijela na početku izvođenja kretnog zadatka, postoji i dalje kretanje u istom pravcu (Kurelić, Momirović, Stojanović, Radojević, & Viskić-Štalec, 1975). Kao takve mogu biti remeteći faktor u razvijanju početnog ubrzanja, koje se (Stroyer, Hansen, & Klausen, 2004) dešava svakih 90 sekundi u fudbalskoj igri, pri čemu su (Barros, Valquer, & Sant'anna, 1999.) udaljenosti u 49% slučajeva kraće od 10 metara.

Odsustvo značajnije veze između nivoa masne komponente i testa za procjenu eksplozivne snage tipa sprinta se ne podudara sa nekim prethodnim istraživanjima (Gil i sar., 2007). Međutim, za očekivati je bilo, možda, utvrditi veći intenzitet povezanosti nivoa specifičnih motoričkih sposobnosti fudbalera u odnosu na tjelesnu kompoziciju, sagledavajući neka prethodna istraživanja (Wong i sar., 2009; Mathisen & Petersen, 2015; Hyka, Bicoku, Mysliu, & Cuka, 2017). Vjerovatno da za kvalitetnu realizaciju specifičnih kretnih struktura u fudbalskoj igri nije dovoljno biti sposoban samo brzo trčati, nego i posjedovati vještinu baratanja loptom. Za pretpostaviti je da osjećaj za kontrolu lopte u određenoj mjeri doprinosi njenom brzom vođenju. Pored tjelesnih i motoričkih odlika, Bjelica (2015) naglašava i nivo intelekta pri savladavanju složenog motoričkog kretanja.

Zbog učestalije trenažne aktivnosti kroz situacioni rad zasnovan na modelu igre (treninzi i utakmice), gdje se teži ka rješavanju fudbalskog problema, usvojenost tretiranih kretanja je možda na nižem nivou u odnosu na one koji se realno realizuju u uslovima stvarne igre, gdje su prisutni protivnici, saigrači, pravila, te ostali elementi fudbalske igre. Slabija utreniranost fudbalera je također moguća s obzirom na realizaciju testiranja u prvom dijelu pripremnog perioda. Kvalitet specifičnih kretnih struktura je vjerovatno izraženiji u toku takmičarskog perioda obzirom da su tada prisutni kako treninzi tako i utakmice sa visokim takmičarskim zahtjevima. Tereni sa umjetnom travom su mogli bitnije uticati na konačne rezultate istraživanja, s obzirom da je kontrola lopte otežana.

U konačnici se može zaključiti da teži igrači optimalnog indexa tjelesne mase ostvaraju zajedničko djelovanje pri sprintanju na kratkoj dionici. Visina tijela ne ostvaruje značajniji udio pri realizaciji specifičnih fudbalskih kretnji. Povoljna tjelesna kompozicija nije dovoljna za objašnjenje kvaliteta izvedbe specifičnih fudbalskih zadataka sa loptom.

Acknowledgements
There are no acknowledgements.

Conflict of Interest
The authors declare that there are no conflicts of interest.

Received: 12 February 2019 | **Accepted:** 7 March 2019 | **Published:** 19 April 2019

References

Arifi, F., Bjelica, D., & Masanovic, B. (2019). Differences in Anthropometric Characteristics among Junior Soccer and Handball Players. *Sport Mont 17*(1), 45-49.

Barros, T., Valquer, W., & Sant'anna, M. (1999). High intensity motion pattern analysis of Brazilian elite soccer players in different positional roles. *Medicine and Science in Sports and Exercise, 31*(S5), 260.

Bjelica, D., & Gardasevic, J. (2019). Body Composition and Anthropometric Measures of Soccer Players, Champions of Montenegro and Bosnia and Herzegovina. In *Book of Abstracts 16th Annual Scientifi c Conference of Montenegrin Sports Academy "Sport, Physical Activity and Health: Contemporary Perspectives"* (73). Dubrovnik, Croatia: Montenegrin Sports Academy & University of Montenegro.

Bjelica, D. (2015). *Teorijske osnove tjelesnog i zdravstvenog obrazovanja.* Podgorica - Nikšić: Fakultet za sport i fizičko vaspitanje UCG i Crnogorska sportska akademija.

Bjelica, D., i Fratrić, F. (2011). *Sportski trening: teorija, metodika i dijagnostika.* Nikšić: Fakultet za sport i fizičko vaspitanje.

Brahim, M., Bougatfa, R., & Mohamed, A. (2013). Anthropometric and Physical Characteristics of Tunisians Young Soccer Players. *Advances in Physical Education. 3*(3), 125-130.

Gil, S., Gil, J., Ruiz, F., Irazusta, A., & Irazusta, J. (2007). Physiological and Anthropometric Characteristics of Young Soccer Players According to Their Playing Position: Relevance for the Selection Process. *The Journal of Strength and Conditioning Research 21*(2), 438-45.

Gardasevic, J., Bjelica, D., & Vasiljevic, I. (2019). Body Composition and Anthropometric Measures af Soccer Players, Champions of Bosnia and Herzegovina and Kosovo. In *Book of Abstracts 16th Annual Scientifi c Conference of Montenegrin Sports Academy "Sport, Physical Activity and Health: Contemporary Perspectives"* (74). Dubrovnik, Croatia: Montenegrin Sports Academy & University of Montenegro.

Gardasevic, J., Bjelica, D., & Vasiljevic, I. (2019a). Morphological Characteristics and Body Composition of Elite Soccer Players in Montenegro. *International Journal of Morphology, 37*(1), 284-288.

Gjonbalaj, M., Georgiev, G., & Bjelica, D. (2018). Differences in Anthropometric Characteristics, Somatotype Components, and Functional Abilities among Young Elite Kosovo Soccer Players Based on Team Position. *International Journal of Morphology, 36*(1), 41-7.

Hyka, A., Bicoku, E., Mysliu, A., & Cuka, A. (2017). The Association of Sprint Performance with Anthropometric Parameters in Youth Soccer Players. *Sport Mont 15*(1), 31-33.

Kurelić N., Momirović, K., Stojanović, M., Radojević, Ž. & Viskić-Štalec, N. (1975). *Struktura i razvoj morfoloških i motoričkih dimenzija omladine.* Beograd: Institut za naučna istraživanja, Fakultet za fizičku kulturu.

Masanovic, B., Bavcevic, T., & Bavcevic, I. (2019). Comparative study of anthropometric measurement and body composition between junior soccer and volleyball players from the serbian national league. *Sport Mont, 17*(1), 9-14. doi: 10.26773/smj.190202

Masanovic, B. (2018). Comparative study of anthropometric measurement and body composition between junior basketball and volleyball players from Serbian national league. *Sport Mont, 16*(3), 19-24.

Masanovic, B., & Vukasevic, V. (2009). Diff erences of anthropometrical status on basketball and handball players in junior stature. *Sport Mont, 6*(18-19-20), 576-82.

Mathisen, G., & Petersen, S. (2015). Anthropometric factors related to sprint and agility performance in young male soccer players. *Journal of Sports Medicine, 6*, 337–342.

Nemčić, T., Fiorentini, F., & Sporiš, G. (2013). Latentna struktura morfoloških varijabli na uzorku nogometaša kadeta. U *Zborniku radova 22. ljetne škole kineziologa Republike Hrvatske.* Poreč: Hrvatski kineziološki savez.

Nikolaidis, P.T. (2014). Weight status and physical fitness in female soccer players: is there an optimal BMI? *Sport Sciences for Health, 10*(1), 41–48.

Wragg, C.B., Maxwell, N.S., Doust, J.H. (2000.). Evaluation of the reliability and validity of a soccer-specific field test of repeated sprint ability. *European Journal of Applied Physiology 83*, 77-83.

Reilly, T., Bangsbo, J., & Franks, A. (2000.). Anthropometric and physiological predispositions for elite soccer. *Journal of Sports Sciences 18*, 669-683

Popovic, S., Akpinar, S., Jaksic, D., Matic, R., & Bjelica, D. (2013). Comparative Study of Anthropometric Measurement and Body Composition between Elite Soccer and Basketball Players. *International Journal of Morphology, 31*(2), 461-7.

Popovic, S., Bjelica, D., Jaksic, D., & Hadzic, R. (2014). Comparative Study of Anthropometric Measurement and Body Composition between Elite Soccer and Volleyball Players. *International Journal of Morphology, 32*(1), 267-274.

Sporiš, G., Milanović, Z., Trajković, N., & Joksimović, A. (2011). Correlation between speed, agility and quickness (SAQ) in elite young soccer players. *Acta kinesiologica, 5*(2), 36-41.

Sporiš, G. (2007). *Efekti situacijskog polistrukturalnog kompleksnog treninga na morfološka, motorička, situacijsko-motorička i funkcionalna obilježja.* Neobjavljena doktorska disertacija, Zagreb: Kineziološki fakultet Sveučilišta u Zagrebu.

Stroyer, J. Hansen, L. & Klausen, K. (2004). Physiological profile and activity pattern of young soccer players during match play. *Med. Sci. Sport Exerc. 36*(1), 168-174.

Wong, P.L., Chamari, K., Dellal, A., & Wislőff, U. (2009). Relationship between anthropometric and physiological characteristics in youth soccer players. *The Journal of Strength and Conditioning Research, 23*(4), 1204-1210.

DOI 10.26773/jaspe.190406

Journal of Anthropology of Sport and Physical Education

ORIGINAL SCIENTIFIC PAPER

Anthropometric Measures and Body Composition of Soccer Players of Montenegro and Kosovo

Dusko Bjelica[1], Jovan Gardasevic[1], Ivan Vasiljevic[1], Fitim Arifi[2], Sami Sermaxhaj[3]

[1]University of Montenegro, Faculty for Sport and Physical Education, Niksic, Montenegro, [2]AAB College, Faculty of Physical Education and Sport, Prishtina, Kosovo, [3]Universe College, Department of Physical Culture, Sport and Recreation, Prishtina, Kosovo

Abstract

The aim of this research was to determine the differences among the top soccer players of the Montenegrin club FC Mladost and Kosovian club FC Prishtina, in the anthropometric measures and body composition. A sample of 37 examinees is divided into two sub-samples. The first sub-sample of the examinees consisted of 17 players of FC Mladost of the average age of 24.59±4.66, the vice champions of the Montenegrin Championship in the season 2016/17, while the other sub-sample consisted of 20 players of FC Prishtina of the average age of 24.30±4.99, the vice champions of the Kosovo Championship in the season 2016/17. Soccer players were tested immediately after the end of the competition season 2016/17. Anthropometric measures in the body composition were evaluated by a battery of 10 variables: body height, body weight, waist size, triceps skin set, biceps skin set, back skin set, abdominal skin set, body mass index, fat percentage and muscle mass. The standard central and dispersive parameters of all variables are calculated. The significance of the differences between the players of the top two soccer clubs in the anthropometric measures and variables for assessing body composition was determined by a t-test for independent samples. It was found that the soccer players of the two mentioned clubs have statistically significant differences by the two variables that estimate the body height in a favor of FC Mladost and abdominal skin set in a favor of FC Pristina.

Key words: *Soccer Players, Anthropometric Measures, Body Composition, Montenegro, Kosovo*

Uvod

Fudbal je najvažnija sporedna stvar na svijetu, sa ogromnim brojem gledalaca na samim stadionima i ispred TV ekrana (Gardašević, 2010; Gardašević, Bjelica, Popović, & Milašinović, 2016; Gardasevic & Bjelica, 2019). To je kolektivna igra koju krasi velika brzina i dinamičnost, koja bogatstvom pokreta spada u red polistrukturalnih sportskih igara (Bjelica, 2005; Gardašević i Goranović, 2011; Gardašević i Bjelica, 2013; Gardaševic & Bjelica, 2014a; Gardasevic i Bjelica, 2014b). Fudbal karakterišu mnogobrojne i raznovrsne složene dinamičke aktivnosti sa velikim brojem cikličnih (Gardašević, Vasiljević, i Bojanić, 2015; Bjelica, Popović, & Gardašević, 2016a; Bjelica, Popović, i Gardašević, 2016b; Sermaxhaj, Popovic, Bjelica, Gardasevic, & Arifi, 2017; Gardasevic, Bjelica, & Vasiljevic, 2017a; Gardasevic, Bjelica, & Vasiljevic, 2017b) i acikličnih kretanja (Gardasevic, 2015; Gardašević i sar., 2015; Gardašević, Bjelica, i Vasiljević, 2016a; Gardašević, Bjelica, i Vasiljević, 2016b; Gardasevic, Bjelica, Milasinovic, i Vasiljevic, 2016; Gardaševic i Vasiljević, 2016; Gardasevic, Popovic, & Bjelica, 2016). Da bi se postigli vrhunski rezultati u fudbalu, igrači moraju proći dugogodišnji programirani trenažni proces (Gardašević, Bjelica, i Popović, 2015; Gardasevic & Bjelica, 2018). A da bi se kvalitetno upravljalo procesom sportskog treninga moraju se dobro poznavati strukture pojedinih antropoloških sposobnosti igrača, kao i njihov razvoj (Bjelica i Popović, 2012; Bjelica, 2013). Raznim istraživanjima su utvrđeni određeni

Correspondence:

J. Gardasevic

University of Montenegro, Faculty for Sport and Physical Education, Narodne omladine bb, 81400, Niksic, Montenegro

E-mail: jovan@ucg.ac.me

principi i zakonitosti transformacionih procesa antropoloških karakteristika bitnih za fudbal (Gardašević, Bjelica, Georgiev, & Popović, 2012; Gardasevic, Bjelica, & Corluka, 2018) a među njima naravno i morfoloških karakteristika. Morfološke karakteristike igrača su jako važne u fudbalu (Gardasevic, Bjelica, & Vasiljevic, 2019). Poznato je da morfološki prostor definišu longitudinalna dimenzionalnost skeleta, transverzalna dimenzionalnost skeleta, masa i volumen tijela (Bjelica & Fratrić, 2011). Svrha morfoloških karakteristika je da poboljšaju vještine kod sportista u mnogim sportovima. Uglavnom je kod vrhunskih sportista, u zavisnosti od sporta kojim se bave morfološki status relativno homogen. Istraživanja morfoloških karakteristika među sportistima različitih sportova ukazuju na to da sportisti različitih sportova imaju svoja specifična obilježja. Mišićna masa poboljšava sportsko postignuće u aktivnostima koje zahtijevaju mišićnu snagu i izdržljivost, ali i u onima koje zahtijevaju zavidnu aerobnu sposobnost (Ramadan & Byrd, 1987; Green, 1992; Rico-Sanz, 1998). Pripadnost sportiste jednoj sportskoj grani podrazumijeva njegov biotip, koji mu daje prednost da se bavi baš tim sportom u odnosu na druge.

Ono što se sa sigurnošću može tvrditi da je fudbal danas po gledanosti, popularnosti, količini novca koji se vrti, medijskoj pažnji, sigurno sport broj jedan u svijetu (Gardašević, Georgiev, & Bjelica, 2012; Vasiljević, Gardašević, & Bojanić, 2013). Definitivno da drugačije nije ni u zemljama kao što je Crna Gora i u regionu koji je okružuje. Jedan od većih fudbalskih klubova u Crnoj Gori, koji se svake godine bori za trofeje je FK Mladost iz Podgorice, koji je u sezoni 2018/19 promijenio ime u OFK Titograd, ali u momentu kada su utvrđivane mjere koje su predmet ovog istraživanja imao je naziv FK Mladost pa će i u ovom radu biti korišćeno to ime kluba. Još jedan klub iz regiona, koji je bio veoma poznat i u ligi nekadašnje Jugoslavije i koji ima značajnu tradiciju je FK Pristina iz Kosova. Nastavili su sa dobrim rezultatima i u tamošnjoj ligi i takođe se svake godine bore za jedan od trofeja na Kosovu. Oni su u odigranoj takmičarskoj sezoni 2016/17., svaki u domaćem takmičenju u svojim državama zauzeli drugo mjesto na tabeli i dobili pravo igranja u međunarodnim takmičenjima pod okriljem UEFA-e u sklopu kvalifikacija za Ligu Evrope. Fudbal u regionu je vrlo sličnog kvaliteta (Gardasevic, Bjelica, Vasiljevic, Arifi, & Sermaxhaj, 2019), budžeti klubova su vrlo slični, pa samim tim se očekuje i da utvrđivane varijable koje su predmet ovog istraživanja kod fudbalera ova dva kluba budu na sličnom nivou. Dodatnu težinu ovom istraživanju daje činjenica da su oba kluba stekla pravo igranja na međunarodnoj sceni.

Cilj istraživanja je bio da se utvrde morfološke karakteristike i sastav tijela kod vrhunskih fudbalera ova dva kluba i njihove eventualne razlike.

Metod

Podaci dobijeni u istraživanju morfoloških karakteristika i sastava tijela, kontrolisani su i pripremljeni za obradu u skladu sa postavljenim ciljem. Baze podataka su sređene po praćenim obilježjima i pripremljene za planiranu statističku obradu. Rezultati dobijeni statističkom obradom prikazani su u tabelama i analizirani po pripadajućim logičkim cjelinama. U cjelini posmatrano, prikaz rezultata istraživanja, kroz postupnost u obrazlaganju pojedinačnih veza, omogućava sagledavanje razlika u posmatranim morfološkim mjerama i sastavu tijela, u skladu sa ciljem istraživanja, odnosno doprinosi jasnom određenju prema očekivanoj primjeni dobijenih rezultata u praksi. U pogledu vremenske određenosti istraživanje je transverzalnog karaktera, a sastoji se u jednokratnom mjerenju odgovarajućih morfoloških karakteristika i sastava tijela vrhunskih fudbalera seniora.

Uzorak ispitanika

Ukupan uzorak ispitanika je brojao 37 vrhunskih fudbalera, koji su članovi dva kluba koji nastupaju u Prvoj fudbalskoj ligi Crne Gore (FK Mladost) i u Superligi Kosova (FK Pristina). Prvi subuzorak su činili 17 igrača FK Mladost prosječne starosti 24.59±4.66 godina, koji su u sezoni 2016/17. bili vicešampioni (drugo mjesto) Crne Gore, a drugi subuzorak se sastojao od 20 igrača FK Pristina prosječne starosti 24.30±4.99 godina, koji su takođe bili vicešampioni u ligi Kosova u sezoni 2016/17. Fudbaleri su testirani neposredno nakon okončanja takmičarske sezone 2016/17.

Uzorak mjera

Antropometrijsko istraživanje sprovedeno je uz poštovanje osnovnih pravila i principa vezanih za izbor mjernih instrumenata i tehnike mjerenja koji su standardizovani prema upustvima Internacionalnog Biološkog Programa. Za potrebe ovog istraživanja izmjereno je 7 antropometrijskih mjera: visina tijela (ATV), težina tijela (ATM), obim struka (AOS), kožni nabor tricepsa (ANT), kožni nabor bicepsa (ANB), kožni nabor leđa (ANL), kožni nabor trbuha (ANS), i 3 varijable za procjenu sastava tijela: indeks tjelesne mase (BMI), procenat masti (APM) i mišićna masa (AMM). Za antropometrijsko mjerenje korišćeni su antropometar, kaliper i centimetarska traka. Za procjenu sastava tijela korišćena je tanita vaga, model BC-418MA. Princip rada ove vage je zasnovan na indirektnom mjerenju tjelesnog sastava, tako što se bezbjedan električni signal šalje kroz tijelo preko elektroda smještenih u samostalnoj jedinici. Tanita vaga, zahvaljujući atletskom modu koje posjeduje, omogućava sportistima detaljno praćenje tjelesne težine, zdrastvenog stanja i kondicije, sa svim relevantnim parametrima.

Metode obrade podataka

Podaci dobijeni istraživanjem obrađeni su postupcima deskriptivne i komparativne statističke procedure. Za svaku varijablu su obrađeni centralni i disperzioni parametri kao i mjere asimetrije i spljoštenosti. Razlike u morfološkim karateristikama i sastavu tijela fudbalera ova dva Kluba utvrđene su primjenom diskriminativne parametrijske procedure, Studentovim t-testom za male nezavisne uzorke, sa statističkom značajnošću od $p<0.05$.

Rezultati

U Tabelama 1 i 2 prikazani su osnovni deskriptivni statistički parametri antropometrijskih varijabli i sastava tijela fudbalera dva kluba, gdje su izračunate vrijednosti mjera centralne i disperzione tendencije i to: aritmetička sredina (Mean), standardna devijacija (Std. Dev.), varijansa (Variance), minimalne (Min) i maksimalne (Max) vrijednosti, koeficijenti zakrivljenosti (Skewness) i izduženosti (Kurtosis). Prvo su analizirani centralni i disperzioni parametri varijabli za procjenu morfoloških karakteristika i sastava tijela igrača FK Mladost (Tabela 1.).

Tabela 1. Centralni i disperzioni parametri varijabli za procjenu morfoloških karakteristika i sastava tijela igrača FK Mladost (N=17)

Variable	Min	Max	Mean	S.D.	Variance	Skewness		Kurtosis	
						Stat.	S.E.	Stat.	S.E.
ATV	175.3	195.3	183.476	6.0257	36.309	.350	.550	-1.067	1.063
ATM	71.3	92.8	79.376	5.9193	35.038	.648	.550	.290	1.063
AOS	79.0	93.0	84.59	3.809	14.507	.514	.550	.117	1.063
ANT	3.7	11.6	6.806	2.2064	4.868	.699	.550	-.180	1.063
ANB	3.5	7.0	4.718	1.2320	1.518	.764	.550	-.896	1.063
ANL	6.0	14.0	9.16	1.782	3.174	.872	.550	1.379	1.063
ANS	5.6	17.2	9.718	3.5534	12.627	1.103	.550	.223	1.063
BMI	21.2	25.3	23.524	1.0299	1.061	-.347	.550	.249	1.063
APM	7.9	16.1	11.876	2.3771	5.651	-.048	.550	-.724	1.063
AMM	34.8	46.4	39.600	3.1016	9.620	.783	.550	.752	1.063

Legenda: Min - Minimalna vrijednost; Max - Maksimalna vrijednost; Mean – Aritmetička sredina; S.D. – Standardna devijacija; Variance - Varijansa; Skewness – Mjera asimetrije; Kurtosis – Mjera spljoštenosti; Stat. – Statistička vrijednost; S.E. – Standardna greška

Na osnovu centralnih i disperzionih parametara, vrijednosti skjunisa i kurtozisa igrača FK Mladost, može se konstatovati da su sve varijable u granicama normalne raspodjele. Po vrijednosti skjunisa vidi se da je kod varijable nabor trbuha (ANS) došlo do male nagnutosti u stranu manjih rezultata što je dobro jer je potkožno masno tkivo remeteći faktor za profesionalne sportiste. Vrijednosti kurtozisa kod varijabli nabor leđa (ANL) i koštana masa (AKM) obrazuju blagu leptokurtičnu krivu što govori o priličnoj ujednačenosti igračkog kadra FK Mladost u ovim dvijema varijablama. Varijabla tjelesna visina (ATV) obrazuje blagu platikurtičnost krive, što znači blagu raspršenost rezultata u visini, što je i normalno obzirom da po linijama tima igrači (golmani, odbrana, vezni red i napadači) imaju različitu konstituciju i potrebnu tjelesnu visinu. Kod golmana, centralnih odbrambenih igrača i centralnih napadača uglavnom je dominantna visina, dok kod veznih i bočnih igrača nije toliko bitna i presudna.

Tabela 2. prikazuje centralne i disperzione parametre varijabli za procjenu morfoloških karakteristika i sastava tijela igrača FK Pristina.

Tabela 2. Centralni i disperzioni parametri varijabli za procjenu morfoloških karakteristika i sastava tijela igrača FK Pristina (N=20)

Variable	Min	Max	Mean	S.D.	Variance	Skewness		Kurtosis	
						Stat.	S.E.	Stat.	S.E.
ATV	168.0	188.5	179.725	5.1898	26.934	-.406	.512	-.177	.992
ATM	63.9	90.1	75.430	7.8136	61.053	.342	.512	-.609	.992
AOS	75.0	95.0	83.600	4.6043	21.200	.246	.512	1.251	.992
ANT	3.4	11.0	6.255	2.1659	4.691	.898	.512	.019	.992
ANB	2.8	8.4	4.460	1.4332	2.054	1.655	.512	2.619	.992
ANL	6.4	14.8	8.890	2.0264	4.106	1.382	.512	2.762	.992
ANS	4.8	13.2	7.795	1.8878	3.564	.979	.512	2.310	.992
BMI	19.6	26.6	23.315	1.6493	2.720	-.464	.512	.568	.992
APM	2.0	16.4	10.405	3.8282	14.655	-.558	.512	-.186	.992
AMM	32.6	44.8	38.180	3.4567	11.949	.213	.512	-.939	.992

Na osnovu centralnih i disperzionih parametara, vrijednosti skjunisa i kurtozisa igrača FK Pristina, može se konstatovati da su sve varijable u granicama normalne raspodjele i da su vrijednosti vrlo slične fudbalerima FK Mladost. Takođe se može konstatovati da su igrači FK Pristina u prosjeku niži i lakše tjelesne težine od igrača FK Mladost, kao i da imaju niže vrijednosti svih kožnih nabora, istina neznatno, međutim da li i statistički značajno, pokazaće komparativna statistička procedura, t-test (Tabela 3.). Po vrijednosti skjunisa vidi se da je kod varijabli nabor bicepsa (ANB) i nabor leđa (ANL) došlo do male nagnutosti u stranu manjih rezultata što je dobro jer je potkožno masno tkivo remeteći faktor za profesionalne fudbalere. Vrijednosti kurtozisa kod varijable obim struka (AOS) obrazuje blagu leptokurtičnu krivu što govori o priličnoj ujednačenosti igračkog kadra FK Pristina u ovoj varijabli, a kod tri varijable nabor bicepsa (ANB), nabor leđa (ANL) i nabor trbuha (ANS) obrazuje leptokurtične krive i pokazuje statistički značajnu izoštrenost što govori da je veliki broj rezultata u ovim varijablama raspoređen oko aritmetičke sredine.

Da bi se utvrdilo da li ima statistički značajne razlike u analiziranim varijablama kod vrhunskih fudbalera ova dva kluba, FK Mladost iz Crne Gore i FK Pristina sa Kosova, primjenjena je statistička procedura t-test za male nezavisne uzorke (Tabela 3.).

Na osnovu dobijenih vrijednosti rezultata t-testa, može se primijetiti da postoji statistički značajna razlika u dvije varijable na nivou značajnosti $p<0.05$, a to je tjelesna visina u korist fudbalera FK Mladost i kožni nabor stomaka, u korist fudbalera članova FK Pristina. Može se primijetiti da fudbaleri FK Pristina imaju neznatno bolje rezultate i u ostalim varijablama koje procjenjuju potkožno masno tkivo i procenat masti od fudbalera FK Mladost, međutim ne i statistički značajno.

Tabela 3. Vrijednosti t-testa između aritmetičkih sredina varijabli za procjenu morfoloških karakteristika i sastava tijela igrača FK Mladost (N=17) i FK Pristina (N=20)

	Club	Mean	S.D.	S.E.	F	Sig.	M.D.
ATV	MLA	183.476	6.0257	1.4615	2.035	.049	3.7515
	PRI	179.725	5.1898	1.1605			
ATM	MLA	79.376	5.9193	1.4356	1.706	.097	3.9465
	PRI	75.430	7.8136	1.7472			
AOS	MLA	84.588	3.8089	.9238	.703	.486	.9882
	PRI	83.600	4.6043	1.0296			
ANT	MLA	6.806	2.2064	.5351	.764	.450	.5509
	PRI	6.255	2.1659	.4843			
ANB	MLA	4.718	1.2320	.2988	.581	.565	.2576
	PRI	4.460	1.4332	.3205			
ANL	MLA	9.159	1.7815	.4321	.425	.674	.2688
	PRI	8.890	2.0264	.4531			
ANS	MLA	9.718	3.5534	.8618	2.099	.043	1.9226
	PRI	7.795	1.8878	.4221			
BMI	MLA	23.524	1.0299	.2498	.451	.655	.2085
	PRI	23.315	1.6493	.3688			
APM	MLA	11.876	2.3771	.5765	1.374	.178	1.4715
	PRI	10.405	3.8282	.8560			
AMM	MLA	39.600	3.1016	.7523	1.305	.200	1.4200
	PRI	38.180	3.4567	.7730			

Legenda: MLA – FK Mladost; PRI – FK Pristina; Club - klub; Mean – Aritmetička sredina; S.D. – Standardna devijacija; S.E. – Standardna greška; F - Vrijednost T testa; Sig. - Značajnost razlike; M.D. - Srednja razlika

Diskusija

Cilj ovog istraživanja je bio da se utvrdi nivo antropometrijskih karakteristika i sastav tijela vrhunskih igrača dva fudbalska kluba, FK Mladost iz Crne Gore i FK Pristina iz Kosova, kao i njihove eventualne razlike. Ovo je nastavak niza istraživanja koje je ovaj istraživački tim napravio u regionu kada se javila ideja da se upoređuju fudbaleri iz susjednih država koji su nekada igrali u zajedničkoj ligi, kakav je sada njihov odnos i eventualna razlika u pomenutim istraživanim varijablama. Uzorak od ukupno 37 ispitanika je podijeljen na dva subuzorka. Prvi subuzorak ispitanika su činili 17 igrača FK Mladost prosječne starosti 24.59±4.66 godina, koji su u sezoni 2016/17. zauzeli drugo mjesto na prvenstvenoj tabeli, a drugi subuzorak se sastojao od 20 igrača FK Pristina prosječne starosti 24.30±4.99 godina, koji su takođe zauzeli drugo mjesto u ligi Kosova u sezoni 2016/17. Kao što se vidi igrači oba kluba su bili skoro iste prosječne starosti. Rezultati u prostoru antropometrijskih karakteristika i sastava tijela su dali osnov za diskusiju. Uvidom u osnovne deskriptivne statističke parametre se može zaključiti da se radi o profesionalnim sportistima i da su njihovi rezultati vrlo slični rezultatima fudbala koji igraju u istim ligama (Corluka & Vasiljevic, 2018; Gardasevic, Bjelica, Popovic, Vasiljevic, & Milosevic, 2018; Bjelica, Gardasevic, & Vasiljevic, 2018) ili u regionu (Gardasevic, Bjelica, Vasiljevic, Sermaxhaj, & Arifi, 2018; Corluka et al., 2018; Bjelica, Gardasevic, Vasiljevic, & Corluka, 2018). Vidi se da su igrači oba kluba približnih srednjih vrijednosti analiziranih varijabli, što i ne čudi jer se radi o jednom klubu koji ima dugu tradiciju i dobre rezultate u Crnoj Gori i jednom klubu iz Kosova koji je po tim parametrima sigurno najveći u svojoj državi. Oni su u sezoni iz koje su izašli ostvarili značajne rezultate, pa se moglo očekivati da je u ta dva kluba značajna koncentracija boljih igrača u ovim dvijema državama. Rezultati i ovog istraživanja su potvrdili hipotezu da je kvalitet igrača fudbala vrlo sličan u regionu. Prosječna tjelesna visina igrača FK Mladost odgovara i rezultatima istraživanja (Bjelica et al, 2012; Popovic, Bjelica, Tanase, & Milasinovic, 2015), koji su pokazali da su Crnogorci među najvišim narodima u Evropi.

Rezultati t-testa su pokazali postojanje statistički značajne razlike samo u dvije od svih analiziranih varijabli, u tjelesnoj visini i kožnom naboru stomaka. Što se tiče tjelesne visine, ona u modernom fudbalu nije presudna, jer je opšte poznato da, danas dvije ponajbolje ekipe na svijetu po rezultatima FK Barselona i FK Mancester siti, se ne mogu pohvaliti prosječnom visinom svojih fudbalera. Postoje ekipe koje tu prednost koriste u skoku i tjelesna visina iz tog razloga može biti veoma dobro oružje kod pojedinih ekipa.

Uvidom u tabele, evidentno je da igrači FK Pristina imaju manje vrijednosti potkožnih nabora kao i procenat masti od fudbalera FK Mladost, međutim te razlike, osim nabora stomaka, nijesu statistički značajne, pa se može zaključiti da su procenti masti kod svih fudbalera u okvirima normativnih vrijednosti procenata masti koje iznose od 6-13%. Treneri obje ekipe mogu biti zadovoljni sa stanjem svojih igrača u pomenutim varijablama, međutim, sigurno da i tu može doći do određenog poboljšanja. Ovo je samo jedan od segmenata koje treba analizirati kod igrača, a vrlo značajno bi bilo provjeriti i funkcionalno-motorički status pomenutih igrača, zatim njihov psihološki profil, kao i nivo taktičke obučenosti, što bi dalo korisnu ukupnu sliku njihovim stručnim štabovima, koji bi kroz sveobuhvatnu analizu došli do zaključka šta bi se moglo poboljšati u radu sa igračima i dovesti do boljih rezultata. Rezultati koji su dobijeni ovim istraživanjem mogu poslužiti kao modelni parametri u procjenjivanim varijablama za ostale igrače, članove fudbalskih klubova u Crnoj Gori i na Kosovu, jer analizirani fudbaleri igraju za dva kluba koji su napravili u toj takmičarskoj godini značajne rezultate u svojim državama, a samim tim su među najboljim i najuspješnijim u njima.

Acknowledgements
There are no acknowledgements.

Conflict of Interest
The authors declare that there are no conflicts of interest.

Received: 5 February 2019 | **Accepted:** 25 March 2019 | **Published:** 19 April 2019

References

Bjelica, D. (2005). *Sistematizacija sportskih disciplina i sportski trening.* Podgorica: Crnogorska sportska akademija.

Bjelica, D. (2013). *Teorija sportskog treninga.* Podgorica: Univerzitet Crne Gore.

Bjelica, D., & Fratrić, F. (2011). *Sportski trening: teorija, metodika i dijagnostika.* Nikšić: Fakultet za sport i fizičko vaspitanje.

Bjelica, D., i Popović, S. (2012). *Fudbal-teorija, tehnika i taktika.* Podgorica: Crnogorska sportska akademija.

Bjelica, D., Popovic, S., Kezunovic, M., Petkovic, J., Jurak, G., & Grasgruber, P. (2012). Body Height and Its Estimation Utilizing Arm Span Measurements in Montenegrin Adults. *Anthropological Notebooks, 18*(2):69–83.

Bjelica, D., Popović, S., i Gardašević, J. (2016a). Modeli fizičke pripreme vrhunskih sportaša i doziranje opterećenja. U *Zborniku radova 14. godišnje međunarodne konferencije "Kondicijska priprema sportaša"* (185-189), Zagreb: Udruga kondicijskih trenera Hrvatske.

Bjelica, D., Popović, S., i Gardašević, J. (2016b). Opći principi planiranja i programiranja fizičkih priprema sportaša. U *Zborniku radova 14. godišnje međunarodne konferencije "Kondicijska priprema sportaša"* (190-192). Zagreb: Udruga kondicijskih trenera Hrvatske.

Bjelica, D., Gardasevic, J., & Vasiljevic, I. (2018). Differences in the morphological characteristics and body composition of soccer players FC Sutjeska and FC Mladost in Montenegro. *Journal of Anthropology of Sport and Physical Education, 2*(2), 31-35. doi: 10.26773/jaspe.180406

Bjelica, D., Gardasevic, J., Vasiljevic, I., & Corluka, M. (2018). Body composition and anthropometric measures of soccerers, cup winners of Montenegro and Bosnia and Herzegovina. *Journal of Anthropology of Sport and Physical Education, 2*(4), 3-7. doi: 10.26773/jaspe.181001

Corluka, M., Bjelica, D., Vasiljevic, I., Bubanja, M., Georgiev, G., & Zeljko, I. (2018). Differences in the morphological characteristics and body composition of soccer players of HSC Zrinjski Mostar and FC Siroki Brijeg in Bosnia and Herzegovina. *Sport Mont, 16*(2), 77-81. doi: 10.26773/smj.180614

Corluka, M., & Vasiljevic, I. (2018). Differences in the morphological characteristics and body composition of soccer players in Montenegro. *Journal of Anthropology of Sport and Physical Education, 2*(1), 3-7. doi: 10.26773/jaspe.180101

Gardašević, J. (2010). *Efekti programiranog rada u pripremnom periodu na transformaciju bazično-motoričkih i situaciono-motoričkih sposobnosti kod fudbalera kadetskog uzrasta.* Neobjavljena magistarska teza, Nikšić: Fakultet za sport i fizičko vaspitanje.

Gardašević, J., i Goranović, K. (2011). Efekti programiranog rada u pripremnom periodu na transformaciju eksplozivne snage kod fudbalera kadeta. *Sport Mont, 9*(28-30), 55-62.

Gardašević, J., Georgiev, G., & Bjelica, D. (2012). Qualitative changes of basic motor abilities after completing a six-week training programme. *Acta Kinesiologica, 6*(1), 70-74.

Gardašević, J., Bjelica, D., Georgiev, G., & Popović, S. (2012). Transformation of situational motor abilities with soccer players–cadets. In *Proceeding book, XVI International Scientific Congress "Olympic Sports and Sport for All" & VI International Scientific Congress „Sport, Stress, Adaptation"* (373-377). Sofia: National Sports Academy "Vassil Levski".

Gardašević, J., i Bjelica, D. (2013). Efekti programiranog trenažnog rada u trajanju od šest nedjelja na transformaciju fleksibilnosti kod fudbalera kadetskog uzrasta. *Sport Mont, 11*(37-39), 212-217.

Gardaševic, J., & Bjelica, D. (2014a). The effects of the training in the preparation period on the dribbling speed with fifteen years old soccer players. In *Book of Abstracts of the 11th International Scientific Conference on Transformation Process in Sport "Sport Performance"* (22-23). Podgorica: Montenegrin Sports Academy.

Gardasevic, J., i Bjelica, D. (2014b). Efekti rada u pripremnom periodu na brzinu vođenja lopte petnaestogodišnjih fudbalera. *Sport Mont, 12*(40-42), 160-166.

Gardašević, J., Vasiljević, I., & Bojanić, D. (2015). Six-week preparation period and its effects on coordination transformation with soccer players under 16. In *Book of Abstracts 11th International Scientific Conference Management, Sport, Olympism* (36). Beograd: Fakultet za menadžment u sportu, Alfa univerzitet.

Gardasevic, J. (2015). The effects of the training in the preparation period on the agility transformation with cadet level soccer players. In B*ook of Abstracts of the 12th International Scientific Conference on Transformation Process in Sport "Sport Performance"* (76-77). Podgorica: Montenegrin Sports Academy.

Gardašević, J., Vasiljević, I., Bojanić, D., Muratović, A., Ljubojević, M., Milašinović, R., & Bubanja, M. (2015). Six-week Preparation Period and its Effects on Transformation Movement Speed with Soccer Players Under 16. In *Book of Abstracts, International Scientific Conference "Effects of Physical Activity Application to Anthropological Status with Children, Youth and Adults"* (148). Belgrade:University of Belgrade: Faculty of Sport and Physical Education.

Gardašević, J., Bjelica, D., i Popović S. (2015). Efekti programiranog rada tokom pripremnog perioda na transformaciju agilnosti kod fudbalera kadetskog uzrasta. *Sport Mont, 13*(43-45), 355-360.

Gardašević, J., Bjelica, D., & Vasiljević, I. (2016a). Six-Week Preparation Period and its Effects on Transformation Movement Speed with Soccer Players Under 16. *Sport Mont, 14*(1), 13-16.

Gardašević, J., Bjelica, D., & Vasiljević, I. (2016b). The Effects of the Training in the Preparation Period on the Repetitive Strength Transformation With Cadet Level Soccer Players. In *Book of Abstracts of the 13th International Scientific Conference on Transformation Processes in Sport "Sport Performance"* (43). Podgorica: Montenegrin Sports Academy.

Gardasevic, J., Bjelica, D., Milasinovic, R., & Vasiljevic, I. (2016). The Effects of the Training in the Preparation Period on the Repetitive Strength Transformation with Cadet Level Soccer Players. *Sport Mont, 14*(2), 31-33.

Gardaševic, J., & Vasiljević, I. (2016). Effects of Preparation Period on Endurance in U16 Soccer Players. In *Book of Abstracts of the 4TH International Scientific Conference "Exercise and Quality of Life"* (108). Novi Sad: University of Novi Sad, Faculty of Sport and Physical Education.

Gardašević, J., Bjelica, D., Popović, S., & Milašinović, R. (2016). Preparation Period and its Effects on the Speed of Ball Leading at Players U16. In *Book of Summaries of 11th FIEP European Congress "Anthropological Aspects of Sport, Physical Education and Recreation"* (30-31). Banjaluka: University of Banjaluka, Faculty of Physical Education and Sport.

Gardasevic, J., Popovic, S., & Bjelica, D. (2016). After preparation period ball shooting accuracy at players U15. In *Abstract Book of the 8th Conference for Youth Sport* (88), Ljubljana: University of Ljubljana, Faculty of Sport.

Gardasevic, J., Bjelica, D., & Vasiljevic, I. (2017a). The strength of kicking the ball after preparation period with U15 soccer players. In *Book of Abstracts of the 14th International Scientific Conference on Transformation Processes in Sport "Sport Performance"* (65-66). Podgorica: Montenegrin Sports Academy.

Gardasevic, J., Bjelica, D., & Vasiljevic, I. (2017b). The Strength of Kicking the Ball after Preparation Period with U15 Soccer Players. *Sport Mont, 15*(2), 39-42.

Gardasevic, J., Bjelica, D., & Corluka, M. (2018). The impact of the preparation period on endurance at soccer players U16. *Sport Mont, 16*(1), 21-24. doi: 10.26773/smj.180204

Gardasevic, J., Bjelica, D., Popovic, S., Vasiljevic, I., & Milosevic, Z. (2018). Differences in the morphological characteristics and body composition of soccer players FC Buducnost and FC Mladost in Montenegro. *Journal of Anthropology of Sport and Physical Education, 2*(1), 51-55. doi: 10.26773/jaspe.180109

Gardasevic, J., Bjelica, D., Vasiljevic, I., Sermaxhaj, S., & Arifi, F. (2018). Differences in the morphological characteristics and body composition of soccer players FC Trepca ´89 and FC Prishtina in Kosovo. *Journal of Anthropology of Sport and Physical Education, 2*(3), 105-109. doi: 10.26773/jaspe.180718

Gardasevic, J. & Bjelica, D. (2018). Preparation period and its impact on the ball control with U16 soccer players. *Kinesiologia Slovenica, 24*(3), 31–36.

Gardasevic, J., & Bjelica, D. (2019). Shooting ball accuracy with u16 soccer players after preparation period. *Sport Mont, 17*(1), 29-32. doi: 10.26773/smj.190205

Gardasevic, J., Bjelica, D., Vasiljevic, I., Arifi, F., & Sermaxhaj, S. (2019). Differences in anthropometric measures of footballers, cup winners of Montenegro and Kosovo. *Journal of Anthropology of Sport and Physical Education, 3*(1), 23-27. doi: 10.26773/jaspe.190105

Gardasevic, J., Bjelica, D., & Vasiljevic, I. (2019). Morphological characteristics and body composition of elite soccer players in Montenegro. *Int. J. Morphol., 37*(1), 284-288.

Green, S. (1992). Anthropometric and physiological characteristics of south Australian soccer players. *Australian Journal of Science and Medicine in Sport, 24*, 3-7.

Popovic, S., Bjelica, D., Tanase, G.D., & Milasinovic, R. (2015). Body Height and Its Estimation Utilizing Arm Span Measurements in Bosnian and Herzegovinian Adolescents. *Montenegrin Journal of Sports Science and Medicine, 4*(1), 29-36.

Ramadan, J., & Byrd, R. (1987). Physical characteristics of elite soccer players. *Journal of Sports Medicine and Physical Fitness, 27*, 424-428.

Rico-Sanz, J. (1998). Body composition and nutritional assessments in soccer.

International Journal of Sport Nutrition, 8, 113-123.

Sermaxhaj, S., Popovic, S., Bjelica, D., Gardasevic, J., & Arifi, F. (2017). Effect of recuperation with static stretching in isokinetic force of young soccer players. *Journal of Physical Education and Sport, 17*(3), 1948-1953. doi: 10.7752/jpes.2017.03191

Vasiljević, I., Gardašević, J., i Bojanić, D. (2013). Uporedna analiza motoričkog prostora između aktivnih fudbalera kadetskog uzrasta i učenika srednje škole. U *Zborniku naučnih i stručnih radova VI međunarodni simpozijum "Sport i zdravlje"* (212-215), Tuzla: Fakultet za tjelesni odgoj i sport.

DOI 10.26773/jaspe.190407

Journal of Anthropology of Sport and Physical Education

ORIGINAL SCIENTIFIC PAPER

Comparative Analysis of Certain Morphological Characteristics of Top Tennis Players in Different Periods

Jovanka Mimic[1], Veljko Vukicevic[1], Nadja Vujacic[1]

[1]University of Serbia, Faculty of Sport and Physical Education, Novi Sad, Serbia

Abstract

An interdisciplinary approach to solving the issue of professional tennis playing is all the more becoming a condition for further development and planning regarding the sport. The aim of this study is to determine statistically relevant differences among top tennis players over the various periods expressed in the measures used for assessing morphological characteristics. A survey has been conducted with the objective of putting a bigger focus on the selection of tennis players based on body height, body mass, BMI and the age in various periods of tennis playing. The sample of respondents consisted of 50 tennis players for a period of 40 years. Data were taken regarding 10 most successful tennis players for the respective year on the account of their ATP ranking. The results derived from the univariate analysis of variance indicated that the examinees from various periods of playing tennis differentiated among each other with respect to body mass, nutrition state and years of age. Examinees from a group of tennis players active in 1986, on average had better and statistically more relevant BMI values when compared to the examinees from the 2006 group and 2016 group. Moreover, it was noted that the examinees from 1986 were statistically younger in relation to the examinees from 2016. It can be assumed that for successful tennis playing in the last decade certain experience is required, as well as age, including body mass which needs to be slightly bigger, but to the advantage of muscle mass.

Key words: *Tennis Players, Morphology, Differences, Selection*

Uvod

Razvoj i napredak vrhunskog tenisa uslovljen je naučnim pristupom toj problematici (Crespo & Miley, 1999). Interdisciplinarni pristup rješavanja problema vrhunskog bavljenja tenisom postaje sve više uslov za dalji razvoj i planiranje tog sporta, jer bez saradnje sa drugim naukama, upoređivanjem rezultata između grupa i pojedinaca, ne postoji mogućnost postizanja vrhunskih rezultata (Roetert, 2003). Izrazita dinamika i brzina, igre kao i sve veći broj mladih tenisera uključenih u programe sportskog treninga i takmičenja zahtijevaju odličnu fizičku pripremljenost tih sportista i visok nivo funkcionalnih sposobnosti perspektivnih igrača (Saavedra et al., 2018). Naravno, u vrhunskom tenisu većina trenera obraća pažnju i na statističke pokazatelje svojih igrača nakon meča, kao i za vrijeme njegovog toka. Tenis je polistrukturalna aktivnost sa acikličkim tipom kretanja koja je tokom godina evaluirala i postala moderna sportska igra u kojoj sportisti posjeduju atletski izgled. Nastale situacije u teniskoj igri (tehničkih i taktičkih varijanti) ukazuju da je uspješnost tenisera određena nivoom i strukturom velikog broja motoričkih sposobnosti, morfoloških karakteristika, znanja i osobina od kojih se neke mogu izmjeriti i analizirati pa potom evaluirati sa standardima. Mjerenje tih sposobnosti i osobina omogućuje kvalitetnije planiranje, programiranje i kontrolu trenažnog procesa te poboljšanje sportske forme.

Dijagnostika u sportu, pa tako i u tenisu, podrazumijeva prikupljanje upotrebljivih informacija o inicijalnom, tranzitivnom i finalnom stanju sportista u prostoru sposobnosti i osobina koje su bitne za uspješnost u takmičarskom sportu (Guyton, 2006; Popovic, Akpinar, Jaksic, Matic, & Bjelica,

Correspondence:
V. Vukicevic
Faculty of Sport and Physical Education, Lovćenska 16, 21000 Novi Sad, Serbia
E-mail: vukicevicveljko9@gmail.com

2013). Važno je izmjeriti i utvrditi one sposobnosti, osobine ali i parametre uspješnosti, koje znatno učestvuju u jednačini uspjeha u određenoj sportskoj disciplini (Masanovic, Milosevic, & Corluka, 2018), a u našem slučaju vezano za tenis, koji postaje sve popularniji u našoj zemlji, kako bismo što ranije otkrili talentovanu djecu i omladinu za ovaj sport.

Vrhunska sportska dostignuća rezultat su čitavog niza različitih faktora, od nasljeđa do sportskog treninga i sistema takmičenja (Arifi, Bjelica, & Masanovic). U tenisu je većina dobrih i slabih karakteristika i motoričkih sposobnosti igrača, u prvom redu posljedica određenog načina treniranja i cjelokupnog trenažnog i takmičarskog procesa. Međutim, jedan broj karakteristika i sposobnosti je određen tjelesnom konstitucijom igrača (Bala, 1997; Armenulić, 2001; Fernandez, Mendez-Villanueva, Pluim, 2006).

Optimalne morfološke karakteristike sportista u velikoj mjeri zavise od izabranog sporta, međutim, generalno bolje rezultate postižu oni čija je građa tijela prilagođena zahtjevima određenog sporta (Popovic, Bjelica, Jaksic, & Hadzic, 2014; Masanovic, Corluka, & Milosevic, 2018). Potreba za navedenim prilagođavanjem izraženija je što je sportista na višem takmičarskom nivou (Vukasevic, Spaic, & Masanovic, 2018). Uspjeh u tenisu svakako zavisi i od morfoloških karakteristika formiranog tenisera, od kojih su osnovne tjelesna visina i masa, a koje se valoriziraju s obzirom na trenutni uzrast tenisera (Girard & Millet, 2004). Posebno u zadnjih desetak godina, utvrđena je vrlo uska povezanost između morfoloških karakteristika tenisera i njihovih takmičarskih uspjeha (Friščić, 2004). Tjelesna građa nije isključivo uslov za uspijeh, ali je u svakom slučaju faktor koji će odrediti stil igre pojedinca (Castellani, D'Aprile, & Tamorri, 1992; Novak, Milanović, i Barbaros-Tudor, 2015). Na osnovu građe svojih igrača, kvalitetni će teniski treneri znati u trenažnom procesu naglasiti one elemente tehnike i taktike koje će omogućiti da igrač postigne svoj takmičarski maksimum, optimalno koristeći svoje karakteristike. Rezultati sprovednih istraživanja ukazuju na statistički značajne razlike među mladim teniserima Hrvatske. Značajne razlike su dobijene u većini posmatranih mjera za procjenu morfoloških karakteristika, ali se najznačajnije razlike ogledaju u varijabli za procjenu longitudinalne dimenzionalnosti skeleta, tjelesne mase i voluminoznosti tijela. Studija je pokazala da se ovi parametri moraju posmatrati u perspetkivi razvoja mladih tenisera jer se selekcija i u ovom sportu počinje zasnivati na izraženim morfološkim karakteristikama (Novak i sar., 2015). Kada bi željeli definisati prototip tenisera, obavezno bi morali uvažiti sljedeće parametre, raspon gornjih ekstremiteta (ruku) pojedinca bi trebao biti veći od njegove visine, visina tijela bi trebala biti iznad prosječnih vrijednosti (Janković, 2011). Već ova dva parametra daju jednu hipotetsku sliku idealnog tenisera. Prednosti ovako koncipirane tjelesne strukture su evidentne u svakoj fazi igre, te su naučno objašnjive elementarnim principom mehanike, a to je ugaona brzina. Pojednostavljeno, ovaj princip govori sljedeće: što je poluga podvrgnuta ugaonoj brzini duža, to će linearna brzina biti veća na ekstremitetu te iste poluge. Ovaj mehanički zakon je primjenjiv na svim osnovnim udarcima u tenisu (Janković, 2011). Istraživanja ukazuju na postojanje razlika u morfološkom prostoru između elitnih tenisera juniorskog uzrasta koji su najviše rangirani i tenisera slabijeg ranga. Najveće razlike uočavaju se u obimu nadlaktice, natkolenice i tjelesnoj visini kako u muškoj, tako i u ženskoj konkurenicji (Sánchez-Muñoz, Sanz, & Zabala, 2007). Za tenisere je danas najprihvatljivija Kretschmerova klasifikacija (1921) koja kaže da se sportski tip tenisera i pored svoje vitkosti i atletske konstitucije sve više približavaju leptosomnom konstitucionalnom tipu. Prema toj klasifikaciji dominantna je visina, a svi ostali parametri obima i širine (osim obima podlaktice dominantne ruke), a time i čitavog tijela, su mali. Osobe ovog tipa su vitke, gracilnog skeleta, uzanih ramena, dok je grudni koš dug, uzan od naprijed, nazad pljosnat, te je epigastrični ugao oštar. Mišići su kao i udovi dugi i tanki, lice izduženo, nos dug i uzan, brada slabo izražena, a vrat tanak i dug.

Cilj istraživanja je utvrđivanje statistički značajne razlike između vrhunskih tenisera (vodećih 10 na ATP listi) u različitim vremenskim periodima (1973. – 2016. godine) u mjerama za procjenu morfoloških karakteristika, kao i da se na osnovu rezultata ukaže na potrebu većeg akcentovanja selekcije tenisera na osnovu pojedinih morfoloških karakteristika.

Metod

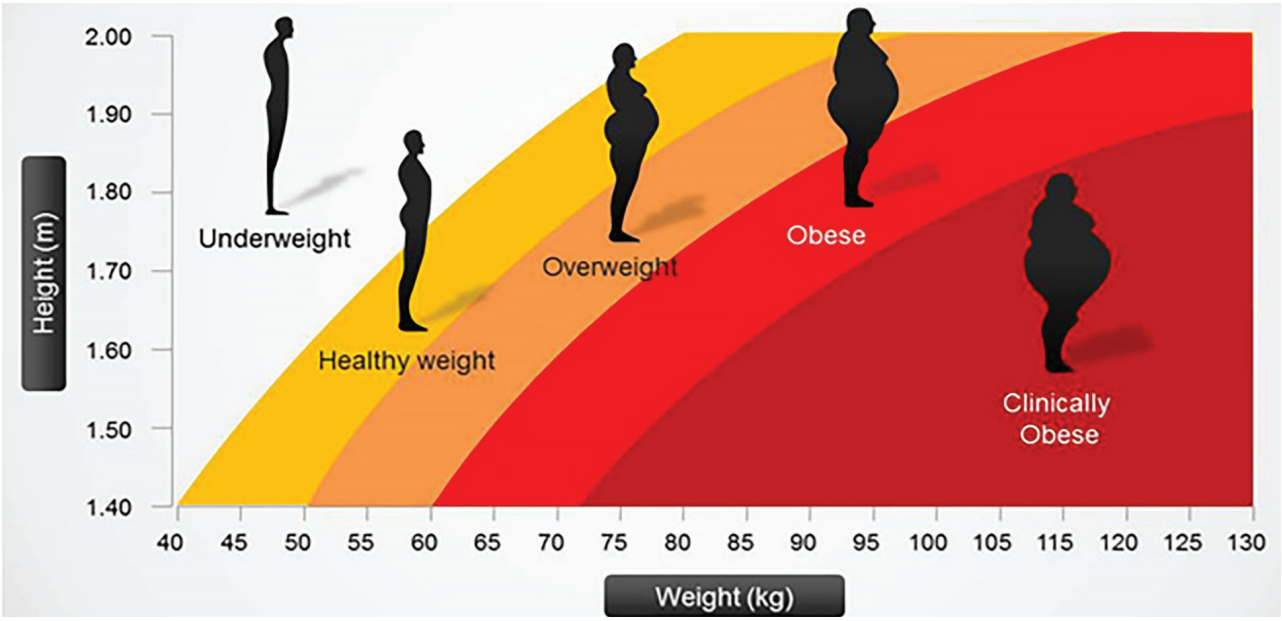
Uzorak ispitanika čine teniseri koji su se prema zvaničnim podacima ITF nalazili u prvih deset na ATP listi u period između 1973-2016. Prvih deset tenisera iz 1973. godine (prvih 10 na ATP listi za tu godinu) su činili prvu grupu (28.40±5.44 SD godina); drugu grupu je činilo 10 vodećih tenisera (24.10±4.25 SD godina) iz 1986. godine (prvih 10 na ATP listi za tu godinu); treće grupu je sačinjavalo prvih 10 na ATP listi za 1996. godinu (25.20±2.39 SD godina); četvrtu grupu je činilo prvih 10 na ATP listi za 2006. godinu (24.40±2.17 SD godina); petu grupu ispitanika činilo je prvih 10 tenisera na ATP listi za 2016. godinu (30.30±2.79 SD godina).

Metod rada koji je korišćen podrazumijevao je ravnopravan tretman empirijskih i teorijskih istraživanja, tj. induktivni i deduktivni pristup u zaključivanju. Prema prirodi naučnih istraživanja, ovo istraživanje pripada kategoriji empirijskih, dok prema cilju preduzimanja predstavlja primijenjeno, odnosno aplikativno istraživanje koje ima za cilj sticanje novih znanja i informacija potrebnih za praktičnu primjenu u oblasti tenisa, a šire posmatrano, i u nastavnoj praksi u vaspitnoobrazovnim institucijama, Morfološke karakteristike vrhunskih tenisera preuzete su sa zvaničnog sajta ATP-a. Rezultati sprovedenog istraživanja su podijeljeni na dva djela: predstavljanje deskriptivnih karakteristika analiziranih mjera za procjenu morfoloških karakteristika, kao i rezultata razlika između grupa u mjerama za procjenu morfoloških karakteristika. Ukupno su u istraživanju bili korišćeni osnovni podaci za 50 tenisera u rasponu od 40 godina. Za procjenu morfoloških karakteristika izabrane su sljedeće antropometrijske mjere: tjelesna visina (cm) – za procjenu longitudinalne dimenzionalnosti skeleta, tjelesna masa (kg) – za procjena mase tijela, i body mass index - BMI (kg/m2). Kao još jedan bitan parametar uzeta je starost tenisera na kraju kalendarske godine. Podaci za ovo istraživanje su preuzeti sa zvaničnog sajta ATP-a. Preuzeti su podaci o dostupnim morfološkim karakteristikama za 10 vodećih tenisera za 1973., 1986., 1996., 2006. i 2016. godinu u pojedinačnoj muškoj (singl) konkurenciji. BMI je naknadno izračunat, a kategorizacija stanja uhranjenosti izvršena je na osnovu Harisonove kategorizacije (Kristiforović-Ilić, 2004) i prikazana u tabeli 1, odnosno na grafikonu 1.

Tabela 1. Kategorizacija BMI prema Harisonu (Kristiforović – Ilić, 2004)

Ocjena BMI	kg / m²
BMI	Kategorija
<16	Ozbiljna pothranjenost
16 - 16.9	Srednja pothranjenost
17 - 18.4	Umjerena pothranjenost
18.5 - 24.9	Normalan obim uhranjenosti
25 - 29.9	Prekomjerna težina
30 - 39.9	Gojaznost
>40	Patološka gojaznost

Podaci dobijeni istraživanjem obrađeni su postupcima deskriptivne i komparativne statističke procedure. Za svaku varijablu su obrađeni centralni deskriptivni parametri kao što su: aritmetička sredina (AS), standardna devijacija (S) minimalne (MIN) i maksimalne (MAX) vrijednosti rezultata mjerenja, koeficijent varijacije (CV), normalnost distribucije (Shapiro Wilk test). Od metoda komparativne statistike primijenjena je univarijatna analiza varijanse (ANOVA) - da bi se utvrdilo postojanje statistički značajne razlike između grupa, i Bonferonijev test - da bi se utvrdilo tačno između kojih grupa postoje statistički značajne razlike. Podaci su izračunati korišćenjem softverskog paketa za obradu podataka SPSS 20.0. Nakon obrade podataka rezultati su prodiskutovani i izvedeni su zaključci.



Grafikon 1. BMI kategorije

Rezultati

Vrijednosti deskriptivne statistike (Tabela 2) ukazuju na izrazitu homogenost tenisera u svim posmatranim mjerama kod svih analiziranih subuzorka formiranih unaprijed. Veći varijabilitet rezultata primjetan je samo kod mjere Godine, za ispitanike koji su se nalazili na prvih 10 vodećih mjesta u 1976. i 1986. godine što je posljedica velikog raspona rezultata ispitanika u tim kalendarskim godinama.

Tabela 2. Deskriptivni statistici mjera za procjenu morfoloških karateristika cjelokupnog uzorka

Mjera	Grupa	MIN	MAX	A. S.	S. D.	C. V.	S. W.
Tjelesna visina (cm)	1973	173	193	180.90	5.76	3.18	0.42
	1986	178	193	187.90	4.73	2.52	0.28
	1996	175	196	186.70	6.78	3.63	0.48
	2006	178	196	185.30	5.74	3.10	0.41
	2016	175	196	186.50	6.88	3.70	0.71
Tjelesna masa (kg)	1973	68	84	75.20	5.83	7.75	0.23
	1986	70	85	78.50	5.23	6.66	0.22
	1996	73	89	82.00	5.19	6.33	0.75
	2006	70	92	82.10	6.30	7.67	0.88
	2016	73	91	83.10	6.28	7.56	0.55

(nastavak je na sledećoj strani)

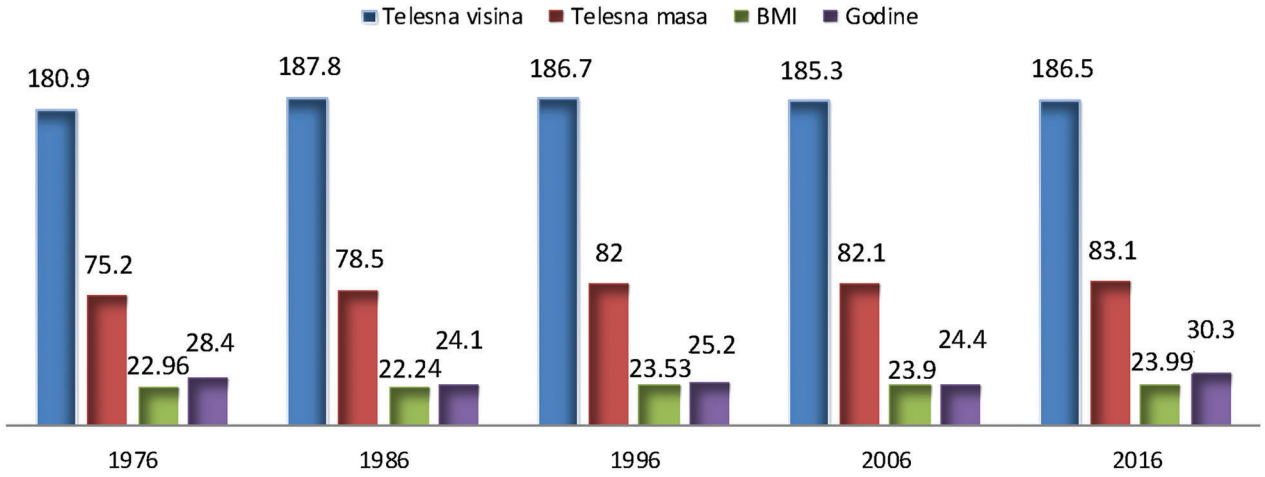
(nastavak sa prethodne strane)

Mjera	Grupa	MIN	MAX	A. S.	S. D.	C. V.	S. W.
	1973	21.33	24.49	22.96	1.06	4.62	0.43
	1986	19.81	23.30	22.24	0.99	4.45	0.03
BMI (kg/m^2)	1996	22.01	24.84	23.53	0.90	3.82	0.92
	2006	21.35	24.90	23.90	1.27	5.31	0.01*
	2016	22.07	25.75	23.88	1.08	4.52	0.97
	1973	21	39	28.40	5.44	19.15	0.64
	1986	19	34	24.10	4.25	17.63	0.11
Godine	1996	22	29	25.20	2.39	9.48	0.14
	2006	20	27	24.40	2.17	8.89	0.37
	2016	26	35	30.30	2.79	9.21	0.71

Legenda: A.S. – aritmetička sredina; S.D. – standardna devijacija; MIN–minimalne vrijednosti rezultata mjerenja; MAX–maksimalne vrijednosti rezultata mjerenja; C.V.- koeficijent varijacije; S.W. - Shapiro Wilk test

Vrijednosti stanja uhranjenosti (BMI) za sve tenisere u svim decenijskim periodima ukazuju na izbalansiran odnos između tjelesne mase i tjelesne visine (što je i karakteristično za sportiste), pa se može konstatovati prosječno normalno stanje uhranjenosti kod svih subuzorka ako se u obzir uzme Harisonova klasifikacija (Kristiforović-Ilić, 2004). Na osnovu Shapiro Wilk testa može se uočiti normalnost distribucije u skoro svim mjerama. Odstupanja od normalne distibucije uočene su samo u mjeri BMI kod subuzorka tenisera za period 2006. godine.

Na osnovu dobijenih podataka (Grafikon 2) može se uočiti da su najuspješniji teniseri, bili prosječno najviši 1986. godine (187.70 cm), a najniži 1976. godine (180.90 cm). Primjetan je izuzetan pomak u tjelesnoj visini tenisera u najznačenim periodima. Današnja prosječna visina tenisera najbližnija je teniserima iz 1996. godine. Prosječno najveća tjelesna masa uočena je 2016. godine (83.10 kg), dok je najmanja prosječna tjelesna masa bila 1973. godine (75.20 kg).



Grafikon 2. Prosječne vrijednosti parametara kod analiziranih subuzoraka tenisera

Teniseri različitih perioda se statistički značajno razlikuju (Tabela 3) u mjerama za procjenu mase tijela, Tjelesna masa (p=0.02), stanju uhranjenosti BMI (p=0.01) i godina starosti, Godine (p=0.00). U mjeri za procjenu longitudinalnosti skeleta, Tjelesna visina, za razliku od ostalih nije uočena statistički značajna razlika zbog sličnog stanja longitudinalnosti skeleta (p=0.11).

Tabela 3. Razlike između ispitanika u mjerama za procjenu morfoloških karakteristika (ANOVA)

Mjera	F	P
Tjelesna visina (cm)	1.99	.110
Tjelesna masa (kg)	3.22 *	.020
BMI (kg/m^2)	4.33 *	.010
Godine	5.67 *	.000

Legenda: F - F test; p - nivo statističke značajnosti; * - statistički značajna razlika

Rezultati Bonferoni testa (Tabela 4) pokazuju da postoje statistički značajne razlike kada je u pitanju tjelesna masa između ispitanika iz 1973. i grupa iz 2016. godine (p=0.38).

Tabela 4. Razlike između ispitanika u različitim vremenskim periodima za tjelesnu masu (Bonferonijevo poređenje)

(I) grupa	(J) grupa	Razlika AS (I-J)	p
grupa 1973	grupa 1986	- 3.300	1.000
	grupa 1996	- 6.800	.117
	grupa 2006	- 6.900	.106
	grupa 2016	- 7.900 *	.038
grupa 1986	grupa 1973	3.300	1.000
	grupa 1996	- 3.500	1.000
	grupa 2006	3 3.600	1.000
	grupa 2016	- 4.600	.821
grupa 1996	grupa 1973	6.800	.117
	grupa 1986	3.500	1.000
	grupa 2006	- .100	1.000
	grupa 2016	- 1.100	1.000
grupa 2006	grupa 1973	6.900	.106
	grupa 1986	3.600	1.000
	grupa 1996	.100	1.000
	grupa 2016	- 1.000	1.000
grupa 2016	grupa 1973	7.900 *	.038
	grupa 1986	4.600	.821
	grupa 1996	1.100	1.000
	grupa 2006	1.000	1.000

Legenda: I grupa – podjela tenisera u različitim vremenskim periodima; J grupa - podjela tenisera u različitim vremenskim periodima; Razlika AS - razlika u vrijednostima aritmetičkih sredina između dvije grupe: p - nivo statističke značajnosti Bonferonijevog poređenja; * - statistički značajna razlika

Rezultati Bonferoni testa (Tabela 5) pokazuju da postoje statistički značajne razlike kada je u pitanju BMI između grupe ispitanika iz 1986. i grupa iz 2006. godine (p=0.01) i 2016. godine (p=0.01).

Tabela 5. Razlike između ispitanika u različitim vremenskim periodima za indeks tjelesne mase (Bonferonijevo poređenje)

(I) grupa	(J) grupa	Razlika AS (I-J)	p
grupa 1973	grupa 1986	.715	1.000
	grupa 1996	- .565	1.000
	grupa 2006	- .937	.558
	grupa 2016	- .920	.602
grupa 1986	grupa 1973	- .715	1.000
	grupa 1996	- 1.280	.102
	grupa 2006	- 1.652 *	.012
	grupa 2016	- 1.634 *	.013
grupa 1996	grupa 1973	.564	1.000
	grupa 1986	1.280	.102
	grupa 2006	-.371	1.000
	grupa 2016	-.354	1.000
grupa 2006	grupa 1973	.936	.558
	grupa 1986	1.652 *	.012
	grupa 1996	.371	1.000
	grupa 2016	.017	1.000
grupa 2016	grupa 1973	.919	.602
	grupa 1986	1.634 *	.013
	grupa 1996	.354	1.000
	grupa 2006	- .017	1.000

Rezultati Bonferoni testa (Tabela 6) pokazuju da postoje statistički značajne razlike kada su u pitanju godine između grupe 1986. i grupe 2016. (p=0.01), pri čemu su ispitanici iz 1986. godine prosječno bili mlađi za 6 godina.

Tabela 6. Razlike između ispitanika u različitim vremenskim periodima varijabla godina (Bonferonijevo poređenje)

(I) grupa	(J) grupa	Razlika AS (I-J)	p
grupa 1973	grupa 1986	4.300	.111
	grupa 1996	3.200	.550
	grupa 2006	4.000	.177
	grupa 2016	- 1.900	1.000
grupa 1986	grupa 1973	- 4.300	.111
	grupa 1996	- 1.100	1.000
	grupa 2006	- .300	1.000
	grupa 2016	- 6.200 *	.004
grupa 1996	grupa 1973	- 3.200	.550
	grupa 1986	1.100	1.000
	grupa 2006	.800	1.000
	grupa 2016	- 5.100 *	.030
grupa 2006	grupa 1973	- 4.000	.177
	grupa 1986	.300	1.000
	grupa 1996	- .800	1.000
	grupa 2016	- 5.900 *	.007
grupa 2016	grupa 1973	1.900	1.000
	grupa 1986	6.200 *	.004
	grupa 1996	5.100 *	.030
	grupa 2006	5.900 *	.007

Razlike takođe postoje između ispitanika Grupe 2006. i Grupe 2016. (p=0.01), pri čemu su ispitanici iz 2006. godine bili prosječno mlađi od ispitanika iz 2016. godine i to za skoro 6 godina (5.90 godina).

U ostalim analiziranim mjerama statistički značajne razlike između grupa nijesu bile primjetne zbog sličnih rezultata.

Diskusija

Primijenjeno istraživanje je imalo za cilj da utvrdi određene razlike u pogledu morfoloških karakteristika najuspješnijih tenisera (prvih 10 na ATP listi) u proteklih 40 godina što je podrazumijevalo ukupno 50 tenisera, ističući osnovne antropometrijske karakteristike uz starosno doba i indeks tjelesne mase koji je izračunat na osnovu prikupljenih podataka visine i mase tijela. Razlike su uočene, a najviše se odnose na BMI i godine starosti tenisera. Nije bilo statistički značajnih razlika u mjeri za procjenu longitudinalnosti skeleta (Tjelesna visina) iako je ona bila dosta veća u odnosu na 1976. godinu kada su zabilježene najniže prosječne vrijednosti. Nakon 1980. godine, očito je došlo do akcentovanja selekcije tenisera u pravcu longitudinalnosti skeleta, čemu je mogla da doprinese i sama evolucija čovječanstva, gdje su i ljudi današnjice prosječno viši u odnosu na neke ranije periode (Rakić, 2009).

Posmatrajući tenis sa evolutivnog stanovništva može se uvidjeti da je za dostizanje i opstajanje među 10 najboljih na svijetu potrebno vrijeme, iskustvo igranja tenisa, jer se danas teniseri odlikuju prosječnom starošću od 30.3 ±2.79 godine, što je ubjedljivo najviše u odnosu na prethodne tenisere u proteklih 40 godina. Najuspješniji teniseri su u toku 2016. godine imali najveći prosjek godina (30.30 godina), dok su najmlađi bili 1986. godine (24.10 godina). Ovdje se uočavaju i najveće razlike između subuzoraka. Ovo može biti posljedica adekvatnijih i bolje isplaniranih, stručno vođenih trenažnih sadržaja, iskustava trenera u radu sa profesionalnim igračima i adekvatnija rehabilitacija tenisera današnjice. Iako su turniri veoma naporni, veliki broj tenisera, koji su među deset najboljih na planeti, u prosjeku je stariji nego što je to bio slučaj sa ranijim periodima razvoja teniske igre. Kroz istoriju bilo je igrača koji su završavali rangirani među deset najboljih na svijetu sa samo jednim osvojenim Grand Slam turnirom u toku godine i to im je obezbjeđivalo dovoljan broj poena da se nađu na kraju godine među 10 najboljih, a bili su mlađi od 25 godina (npr. Lejton Hjuit, Majkl Čeng). Danas, sistem bodovanja turnira se promijenio i sada je takav da obavezuje tenisere da se pojavljuju na svim većim turnirima tipa ATP 500 ili 250, turnirima iz serije Mastera, Grand Slamovima, jer u protivnom gube poene koje su stekli u prethodnoj sezoni. Iz ovoga proizilazi da je sistem bodovanja možda uticao na ovakve promjene u godinama starosti u odnosu na prethodne etape. Ovakav način bodovanja primorava tenisere da rade kvalitetnije i biraju turnire na kojima će nastupati.

Sa obzirom da vrijednosti BMI proističu iz vrijednosti tjelesne mase i tjelesne visine, rezultati veće varijabilnosti rezultata i odstupanja od normalne distribucije kod subuzorka iz 2006. godine ukazuju na veće razlike u tjelesnoj građi tenisera te godine. Uočene niže vrijednosti BMI indeksa kod ranijih grupa tenisera iz 1986. godine u odnosu na 2006. i 2016. mogu biti posljedica drugačije morfološke građe tenisera. Tjelesna masa i tjelesna visina tenisera su bile nižih vrijednosti nego danas (1986. godine prosječna masa iznosila je 75.2 kg, deset godina kasnije 78.5 kg, 1996. i 2006. oko 82 kg i 82,1 kg). Danas je prosječna tjelesna masa elitnih profesionalnih tenisera najviša u poslednjih 40 godina i iznosi 83.1 kg. Veća masa može da doprinese većoj silini udaraca, snazi koja je neophodna za moderan tenis. Može se konstatovati porast tjelesne mase tenisera, ali uz normalan, izbalansiran obim uhranjenosti (BMI). U zadnjih desetak godina, tjelesna masa tenisera se povećala (ali ostala u granicama normalnog obima uhranjenosti), što ide vjerovatno na račun povećanja mase mišića. Praktična vrijednost rada se ogleda u dobijenim podacima na uzorku vrhunskih tenisera (po 10 najboljih u periodu od 1976. do 2016. godine) u periodu od 40 godina. Postavlja se pitanje

za dalja istraživanja koje je optimalno vrijeme za ulazak teniskih igrača među prvih 10 na svijetu i koliko je njegovo vrijeme zadržavanja među njima najduže moguće, pošto Novak Đoković iz dana u dan obara i postavlja nove rekorde, primoravajući ostale igrače da igraju na mnogo višem nivou. U ovom istraživanju uočene su statistički značajne razlike u mjerama Tjelesna masa (p=0.02), stanje uhranjenosti BMI; (p=0.01) i godina starosti Godine (p=0.00); Ispitanici grupe tenisera iz 1986. godine su imali prosječno niže i statistički značajnije vrijednosti BMI u odnosu na ispitanike iz Grupe 2006 i Grupe 2016; Uočeno je da su ispitanici iz perioda 1986. godine bili statistički značajno mlađi u odnosu na ispitanike iz 2016. godine. Tjelesna visina se dosta povećala u svim etapama u odnosu na prosječne vrijednosti iz 1976. godine, kada je bila najniža, što govori o pravcu selekcije tenisera na osnovu longitudinalnosti skeleta.

U budućim istraživanjima ovoga tipa potrebno je istražiti i dužinu teniskog staža, odnosno ulazak na ATP listu tenisera i dužinu igranja profesionalnog tenisa, jer bi ona mogla da utiče na godine igrača i njihovo iskustvo. Danas se igrači tenisa odlikuju najvišim prosjekom života. Današnji savremeni profesionalni sport je postao dosta surov i traži od tenisera maksimalna naprezanja i konstatno takmičenje iz nedjelje u nedjelju, što može dovesti do većih broja povreda, kao posljedica neadekvatnog odmora (Lyons Al-Nakeeb, Hankey, & Nevill, 2013). Međutim, trenažna opterećenja, dijagnostika i kontrola treniranosti očito prevazilaze ove prepreke i omogućavaju duže bavljenje ovim sportom na veoma visokom nivou.

Limitiranost istraživanja je nedovoljan broj morfoloških parametara među koje se mora uvrstiti transferzalna dimenzionalnost skeleta, volumen i masa tijela i veličine kožnih nabora. U budućim istraživanjima, rezultati navedenih parametara bi bili od velike koriste stručnjacima iz ove oblasti kako bi selekciju mogli još adekvatnije primijeniti što bi pomoglo da se dobiju još kvalitetniji igrači. Ali ipak to ne umanjuje značajnost ove studije, jer bi ovaj rad mogao dati prilog antropološkim disciplinama poput biološke antropologije tenisa, sportskog treninga, a on bi se ogledao u analizi stanja pojedinih morfoloških karakteristika. Prije svega treba da pomogne stručnjacima iz oblasti tenisa da veću pažnju posvete selekcionisanju djece za ovaj sport na osnovu morfoloških karakteristika. Tu se prije svega misli na tjelesnu visinu, ako su u pitanju mlađi igrači. Takođe je interesantno dodati kako je primijećeno da igračko iskustvo igra veoma važnu ulogu u vrhunskom tenisu što je svakako podatak koji će teniskim stručnjacima biti od koristi.

Acknowledgements
There are no acknowledgements.

Conflict of Interest
The authors declare that there are no conflicts of interest.

Received: 1 January 2019 | **Accepted:** 11 March 2019 | **Published:** 19 April 2019

References

Arifi, F., Bjelica, D., & Masanovic, B. (2019). Differences in anthropometric characteristics among junior soccer and handball players. *Sport Mont, 17*(1), 45-49. doi: 10.26773/smj.190208

Armenulić, R. (2001). *Teniski trener.* Beograd: Sportska knjiga.

Bala, G. (2000). Zavisnost definisanja modela morfoloških dimenzija od manifestnih antropometrijskih varijabli. *Glanik Antropološkog društva Jugoslavije, 35*, 95-102.

Castellani, A., D' Aprile, A., & Tamorri, S. (1992). *Tennis Training. Allenamento tecnico, fisico, mentale, esercitazioni e programmi, aspetti biologici*. Roma: Societa' stampa sportiva.

Crespo, M. & Miley, D. (1999). *Advanced Coaches Manual.* London: ITF.

Fernandez, J., Mendez-Villanueva, A., & Pluim, B.M. (2006). Intensity of tennis match play. *Britisch Journal of Sports Medicine, 40*(5), 387–391.

Friščić, V. (2004). *Tenis bez tajni.* Zagreb: Biblioteka Tenis.

Girard, O., & Millet, G.P. (2004). Effects of ground surface on the physiological and technical responses in young tennis players. In: A. Less, J.F. Kahn, I.W. Maynard (Eds.) *Book of Proceedings „Science and recket sports III"* (43-48). London: Routledge.

Janković, G. (2011). Dijagnostika funkcionalnih i antropometrijskih karakteristika tenisača. U V. Findak (Ur.) *Zbornik radova „20. Ljetna škola kineziologa Republike Hrvatske - Dijagnostika u područjima edukacije, sporta, sportske rekreacije i kineziterapije"* (291-295). Poreč: Hrvatski kineziološki savez.

Kristoforović-Ilić, M. (2004). *Higijena-priručnik sa parktikumon*. Novi Sad: Medicinski fakultet.

Lyons, M., Al-Nakeeb, Y., Hankey, J., & Nevill, A. (2013). The Effect of Moderate and High-Intensity Fatigue on Groundstroke Accuracy in Expert and Non-Expert Tennis Players Sports. *Science Medicine, 12*(2), 298–308.

Masanovic, B., Corluka, M., & Milosevic, Z. (2018). Comparative Study of Anthropometric Measurement and Body Composition of Junior Soccer and Handball Players from the Serbian National League. *Kinesiologia Slovenica, 24*(3), 37-46.

Masanovic, B., Milosevic, Z., & Corluka, M. (2018). Comparative Study of Anthropometric Measurement and Body Composition between Junior Handball and Volleyball Players from Serbian National League. *International Journal of Applied Exercise Physiology, 7*(4), 1-6. https://doi.org/10.30472/ijaep.v7i4.313

Novak, D., Milanović, D., & Barbaros-Tudor, P. (2015). Differences among Tennis Players Aged 12, 14 And 16 Years in Certain Morphological Characteristics: A Croatian Prospective. *Collegium Antropologicum, 39*(3), 591-599.

O'Donoghue, P., & Ingram, B. (2001). A notational analysis of elite tennis strategy. *Journal of Sport Science, 19*(2), 107-115.

Popovic, S., Akpinar, S., Jaksic, D., Matic, R., & Bjelica, D. (2013). Comparative Study of Anthropometric Measurement and Body Composition between Elite Soccer and Basketball Players. *International Journal of Morphology, 3*1(2), 461-7.

Popovic, S., Bjelica, D., Jaksic, D., & Hadzic, R. (2014). Comparative Study of Anthropometric Measurement and Body Composition between Elite Soccer and Volleyball Players. Int. J. Morphol., 32(1), 267-74.

Rakić, R. (2009). *Značaj nekih faktora sredine na rast i razvoj djece i adolescenata u Vojvodini.* Neobjavljena doktorska disertacija, Novi Sad: PMF - Departman za biologiju i ekologiju.

Saavedra, J. M., Þorgeirsson, S., Kristjansdottir, H., Halldorsson, K., Guðmundsdottir, M. L., & Einarsson, I. Þ. (2018). Comparison of training volumes in different elite sportspersons according to sex, age, and sport practised. *Montenegrin Journal of Sports Science and Medicine, 7*(2), 37-42. doi: 10.26773/mjssm.180906

Sánchez-Muñoz, C., Sanz, D., & Zabala, M. (2007). Anthropometric characteristics, body composition and somatotype of elite junior tennis players. *Britisch Journal of Sports Medicine, 41(11), 793-799.*

Simić, N. (2004). *303 saveta za vas uspešniji takmičarski tenis.* Beograd: CISIM.

Vukasevic, V., Spaic, S., & Masanovic, B. (2018). Comparative study of anthropometric measurement and body composition between the basketball player first and second league in Montenegro. *Journal of Anthropology of Sport and Physical Education, 2*(3), 61-65. doi: 10.26773/jaspe.180711

DOI 10.26773/jaspe.190408

JASPE Journal of Anthropology of Sport and Physical Education

ORIGINAL SCIENTIFIC PAPER

Anthropometric Indices as Indicators of Obesity of Children from Elementary School in Montenegro

Pavle Malovic[1]

[1]University of Montenegro, Faculty for Sport and Physical Education, Niksic, Montenegro

Abstract

The aim of this research was to determine anthropometric indices as indicators of obesity of children in Montenegro. The research involved 135 children from Montenegro and sample of examinees is divided into two sub-samples. The first sub-sample of the examinees consisted of 66 boys aged 7-8 years from Nikšić and Kotor, while the other sub-sample consisted of 69 girls also aged 7-8 years from Niksic and Kotor. Anthropometric characteristics were evaluated by a battery of 4 variables: body height, body weight, waist and hip circumference. Mentioned variables were used to calculate following anthropometric indices which gave as informations about obesity: Body mass index (BMI), waist-to-hip ratio (WHR), waist-to-height ratio (WHtR). The standard central and dispersive parameters of all variables are calculated. The significance of the differences between the children in the ratios was determined by a t-test for small independent samples. It was not found that the children with different gender have statistically significant differences in analyzed ratios as indicators of obesity. Thus, it was found that 16.3% of children were obese and those results will help us to realize that we have to adequately affect on detected problem.

Key words: *Children, Obesity, Montenegro*

Uvod

Još 1997. godine, prema saopštenju Svjetske zdravstvene ogranizacije (WHO), gojaznost je okarakterisana kao javni zdravstveni problem. U saopšetenju se navodi da je uticaj gojaznosti toliko veliki i ekstreman da bi ga trebalo smatrati jednim od najvećih zapostavljenih zdravstvenih problema našeg vremena, a negativan uticaj na zdravlje poredi se čak sa onim koje prouzrokuje pušenje. Povećanje gojaznosti kod đece uočeno je kako u razvijenim zemljama, tako i u zemljama u razvoju (Wang & Lobstein, 2006). Nedavni izvještaji ukazuju da je ovaj porast mnogo veći u zemljama u razvoju, nego što je to u razvijenim zemljama (de Onis, Blossner, & Borghi, 2010). Ukoliko je gojaznost prisutna u ranom djetinjstvu postoji tendencija da dijete ima problem sa gojaznošću i tokom daljeg odrastanja, sa rizikom od ranog obolijevanja od hronično nezaraznih bolesti, kao što su dijabetes, povišen krvni pritisak i koronarna arterijska bolest. (Lobstein, Baur, & Uauy, 2004; de Onis i sar., 2010; Popović, Bjelica, Mašanović, & Vukotić, 2018). Štaviše, gojazna đeca su pod rizikom od kožnih oboljenja, ortopedskih komplikacija i psihosocijalnih problema kao što su zadirkivanje, odbijanje vršnjaka i depresija (Lobstein i sar., 2004). Takođe, u Sjevernoj Americi i Evropi je zapažen sve veći porast gojaznosti đece poslednje dvije decenije (Gortmaker, Dietz, Sobol, & Wehler, 1987). Ovo zapažanje izaziva ozbiljnu zabrinutost, a upravo iz razloga što se gojaznost koja se pojavila tokom djetinjstva može zadržati i tokom odrastanja (Power, Lake, & Cole, 1997; Must, Jacques, Dallal, Bajema, & Dietz, 1992), što kasnije može prouzrokovati ozbiljna oboljenja u odrasloj dobi, kao što su ateroskleroza i povećani kardiovaskularni morbiditet (Srinivasan, Bao, Wattigney, & Berenson, 1996). U zemljama sa srednjim i niskim dohotkom gojaznost i neuhranjenost su čest problem (Wang & Lobstein, 2006). Dakle, u zemljama sa pomenutim nivoom dohotka problem, sa prekomjernom težinom i gojaznošću uglavnom je povezan sa neuhranjenošću u toku fetalnog perioda i prve dvije godine života (Palloni, McEniry, Davila, & Gurucharri, 2005; Fung, 2009). Epidemiološke studije u nekim od ovih zemalja pokazale su da đeca koja su bila neuhranjena i nedovoljno razvijena imaju veće šanse za nakupljanje masnog tkiva u centralnoj (abdominalnoj) regiji i razvoja metaboličkih

Correspondence:

P. Malovic

University of Montenegro, Faculty for Sport and Physical Education, Narodne omladine bb, 81400 Niksic, Montenegro

E-mail: pavle.m@ucg.ac.me

komplikacija u kasnijem životu (Schroeder, Martorell, & Flores, 1999; Gigante, Victora, Horta, & Lima, 2007; Uauy, Kain, & Corvalan, 2011; Bjelica, 2006). Praćenje antropometrijskih promjena u populaciji može biti ključno u sprečavanju budućih problema javnog zdravlja, kao što je gojaznost (Popovic, Bjelica, Vukotic, & Masanovic, 2018; Masanovic, Vukotic, Bjelica, & Popovic, 2018). Istraživanja ovog tipa mogu pomoći u objašnjavanju važnih uloga obrazovanja i fizičke aktivnosti mladih u prevenciji negativnih zdravstvenih ishoda povezanih sa adipozitetom. Iz svega navedenog, jasno se može zaključiti da je gojaznost široko rasprostranjena u cijelom svijetu, pa samim tim bi se trebalo osvrnuti i na našu zemlju, kao zemlju u razvoju, i napraviti presjek stanja na određenom uzorku ispitanika, u ovom slučaju đece uzrasta 7 i 8 godina, koji odrastaju u centralnom i južnom dijelu, odnosno regionu Crne Gore. S obzirom na navedeno, u ovoj studiji će se, na osnovu upotrebe određenih antropometrijskih indeksa, utvrditi distribucija tjelesne masti i stepen uhranjenosti, odnosno gojaznosti kod pomenutog uzorka ispitanika. Nakon sprovedenog istraživanja dobiće se validni podaci na osnovu kojih će moći da se iznesu određeni zaključci, daju smjernice za dalja istraživanja i ukaže na limitiranost sprovedene studije.

Metod

U pogledu vremenske određenosti istraživanje je transverzalnog karaktera, a sastoji se u jednokratnom mjerenju odgovarajućih antropometrijskih karakteristika đece uzrasta 7-8 godina koji žive i pohađaju osnovnu školu u Centralnoj (Nikšiču) i Južnoj (Kotoru) regiji Crne Gore. Ukupan broj ispitanika je 135. Svi ispitanici su podijeljeni na dva subuzorka. Prvi subuzorak je činilo 66 učenika Osnovne škole "Ratko Žarić" iz Nikšića i Osnovne škole "Savo Ilić" iz Kotora, dok je drugi subuzorak činilo 69 učenica Osnovne škole "Ratko Žarić" iz Nikšića i Osnovne škole "Savo Ilić" iz Kotora.

Antropometrijsko mjerenje je sprovedeno uz poštovanje osnovnih pravila i principa vezanih za izbor mjernih instrumenata i tehnike mjerenja koji su standardizovani prema uputstvima Internacionalnog Biološkog Programa. Za potrebe ovog istraživanja izmjerene su sljedeće antropometrijske varijable: tjelesna visina (ATV), tjelesna masa (ATM), obim struka (AOS), obim kukova (AOK). Pomenute antropometrijske mjere upotrijebljenje su kako bi bili određeni sljedeći odnosi tjelesne kompozicije i proporcije: indeks tjelesne mase (BMI), odnos opsega struka i kukova (WHR) i odnos struka i visine (WHtR).

Za mjerenje antropometrijskih karakteristika korišćeni su antropometar i digitalna vaga. Prema smjernicama Nacionalnog Centra za Zdravstvenu Statistiku/Svjetske Zdravstvene Organizacije (NCHC/WHO) za procjenu prekomjerne težine i gojaznosti korišćen je indeks tjelesne mase - BMI (World Health Organization expert committee, 1995). BMI svakog đeteta je izračunat tako što se tjelesna težina podijelila sa kvadratom visine (Kg/m^2), a nakon toga upoređen sa referentnim vrijednostima za uzrast i pol. Indeks tjelesne mase (BMI) za đecu i mlade osobe se izračunava u zavisnosti od starosti i pola, što je veoma specifično zbog njihovog rasta i razvoja (Vasiljevic, Bjelica, Popovic, & Gardasevic, 2015). Prilikom procijene stepena uhranjenosti, smatralo se da je učenik/ca u kateogiriji ispod normalne uhranjenosti ukoliko su vrijednosti iznosile ispod 5. percentila, normalne uhranjenosti ukoliko su vrijednosti iznosile od 5. do 85. percentila, dok su u kategoriji za prekomjernu težinu uračunati oni kojima je BMI iznosio za njihov uzrast i pol >85., a ≤95. percentila, na kraju, gojaznost je ustanovljena ukoliko je vrijednost prelazila 95. percentil. Odnos struka i kukova (WHR) za đecu je značajan indikator distribucije masti, naročito abdominalne masti i dobar indikator za procjenu zdravstvenog rizika, a izračunava se tako što se vrijednost obima struka podijeli sa vrijednosti obima kuka. Vrijednosti ovog odnosa za muškarce 1, za žene 0.8 uzimaju se kao donje granične vrijednosti za procjenu gojaznosti. Vrijednosti preko datog normativa ukazuju na rizik od oboljenja koje su vezane sa prekomjernom težinom i gojaznošću. Odnos struka i visine (WHtR) dobijen je dijeljenjem vrijednosti obima struka sa vrijednostima tjelesne visine. Dijete se smatralo da je gojazno ukoliko je WHtR iznosio više od 0.5 (McCarthy, & Ashwell, 2006).

Svi podaci potrebni za ovo istraživanje obrađeni su u specijalizovanom programu za obradu podataka IBM SPSS statistics 23. Podaci su obrađeni postupcima deskriptivne i komparativne statističke procedure. Razlike u tjelesnim parametrima za procjenu stepena uhranjenosti, odnosno gojaznosti, učenika uzrasta 7 i 8 godina iz Nikšića i Kotora, utvrđene su primjenom diskriminativnih parametrijskih procedura i primjenom t-testa za male nezavisne uzorke, sa statističkom značajnošću od $p<0.05$.

Rezultati

U tabelama su prikazani osnovni deskriptivni statistički parametri prediktora gojaznosti učenika, đe su izračunate sljedeće vrijednosti mjera centralne i disperzione tendencije: aritmetička sredina (Mean) i standardna devijacija (Std. Dev.).

Tabela 1. Raspodjela indeksa tjelesne mase po polu đece

BMI	M		F		Total	
Percentile	N	%	N	%	N	%
<5 (<13.6Kg/m²)	3	2.22	1	0.75	4	2.96
5-85 (13.6 - 17.3Kg/m²)	38	28.15	41	30.39	79	58.52
85-95 (17.3 - 18.5 Kg/m²)	12	8.88	18	13.33	30	22.22
>95 (> 18.5 Kg/m²)	13	9.62	9	6.66	22	16.3
Total	66	48.87	69	51.13	135	100

Legenda: BMI - Indeks tjelesne mase, M - Dječaci, F- Djevojčice, N - Broj ispitanika

U tabeli 1 data je struktura svih ispitanika po polu. Na osnovu vrednosti BMI sa povišenom tjelesnom masom (17,3-18,5 Kg/m²) bilo je 30 ispitanika (22,22%), od toga 12 dječaka (8,88%) i 18 djevojčica (13,33%), a 22 ispitanika bilo je gojazno (> 18,5 Kg/m²) što je 16,3 %, od čega 13 dječaka (9,62%) i 9 djevojčica (6,66%).

Tabela 2. Centralni i disperzioni parametri varijabli za procjenu gojaznosti i distribuciju tjelesne masti dječaka OŠ "Savo Ilić" i OŠ "Ratko Žarić"

	N	Mean	S. D.
BMI	66	17.566	3.124
WHR	66	.938	.037
WHtR	66	.473	.052

Legenda: BMI - Indeks tjelesne mase, WHR - Odnos opsega struka i kukova, WHtR - Odnos struka i visine, N - Broj ispitanika, Mean - Aritmetička sredina. S.D. - Standardna devijacija

Na osnovu vrijednosti indeksa tjelesne mase (BMI), što je prikazano u tabeli 2, može se konstatovati da se dječaci, koji su ušli u uzorak istraživanja, nalaze iznad 85. percentila, ali ne prelaze 95. percentil i shodno tome pripadaju kategoriji prekomjerne tjelesne težine. Rezultati varijable WHR nam jasno pokazuju da se dječaci nalaze ispod 1, što je i normativ za njihov pol i uzrast i samim tim se nalaze ispod zone koja bi ih okarakterisala kao gojazne. Isto se može reći i za vrijednosti varijable WHtR u kojoj su rezultati ispod granice koja je postavljena na 0.5. Na osnovu ovih statističkih parametara može se konstatovati da su dječaci koji su ušli u uzorak na samoj granici gojaznosti.

Tabela 3. Centralni i disperzioni parametri varijabli za procjenu gojaznosti i distribuciju tjelesne masti djevojčica OŠ "Savo Ilić" i OŠ "Ratko Žarić"

	N	Mean	S. D.
BMI	66	17.388	2.720
WHR	66	.943	.043
WHtR	66	.484	.046

Nakon analize dobijenih rezultata u tabeli 3, prema vrijednostima Indeksa tjelesne mase (BMI) može se konstatovati da djevojčice, koje su obuhvaćene ovim istraživanjem, pripadaju grupaciji koja se nalazi na samoj donjoj granici prekomjerne tjelesne težine. Ono što se takođe primjećuje jeste prekomjerna vrijednost u odnosu na postavljenu normu (0.8), srednje vrijednosti rezultata varijable WHR, što bi djevojčice ove dvije škole okarakterisalo gojaznim. Nasuprot tome, vrijednosti varijable odnosa obima struka i tjelesne visine (WHtR) pokazuju da su blago ispod graničnih vrijednosti (0.5), koje bi ih okarakterisale gojaznim.

Tabela 4. Vrijednosti t-testa između aritmetičkih sredina varijabli za procjenu gojaznosti i distribucije tjelesne masti učenika OŠ "Savo Ilić" i OŠ "Ratko Žarić" u odnosnu na pol

	Genger	N	t-test	Sig.
BMI	M	66	.354	.724
	F	69		
WHR	M	66	- .766	.445
	F	69		
WHtR	M	66	- 1.345	.181
	F	69		

Legenda: BMI - Indeks tjelesne mase, WHR - Odnos opsega struka i kukova, WHtR - Odnos struka i visine, M - Dječaci, F - Djevojčice, N - broj ispitanika, Sig. - Značajnost razlike

Na osnovu dobijenih vrijednosti rezultata t-testa, koje su prikazane u tabeli 4, može se primijetiti da ne postoje statistički značajne razlike između dječaka i djevojčica, na nivou značajnosti $p<0.05$. Uvidom u numeričke vrijednosti testiranih varijabli, može se konstatovati da dječaci imaju veće numeričke vrijednosti u varijabli BMI, dok djevojčice imaju veće vrijednosti u varijablama WHR i WHtR, ali nijedna ne pokazuje statističku značajnost.

Diskusija

Rezultati ispitivanja pokazuju da je sa povišenom tjelesnom masom 30 ispitanika (22.22%), dok su 22 ispitanika (16.3%) gojazni. Znači da je opšta gojaznosti kod ispitivane đece 16.3%. U istraživanju koje su sproveli Bukara-Radujkovic i Zdravkovic (2008) na uzorku đece i njihovih roditelja na teritoriji okoline Banja Luke, rezultati pokazuju da je gojaznost dječaka zastupljena na uzrastu od 6 do 10 godina 10.4%, dok

je sa povišenom tjelesnom masom bilo 15.7% ispitanika. Na istom uzrastu samo kod djevojčica gojaznost je bila zastupljena kod 7.8%, dok je sa povišenom tjelesnom masom bilo 14.7% ispitanica. Krajem prošlog vijeka u SAD bilo je 13% đece sa prekomjernom tjelesnom masom u uzrastu 6–11 godina, u Kini 11.3% u uzrastu 6–9 godina, dok je u Brazilu istog uzrasta čak 17.4% (Bukara-Radujkovic i Zdravkovic, 2008). Očigledno je da je opšta gojaznost kod ispitivane đece naše populacije od 16.3% krajnje zabrinjavajuća činjenica, što se može zaključiti na osnovu pomenutog procenta koji je dobijen u našem istraživanju, a koji je veći nego u istraživanjima sa kojima se izvršila komparacija rezultata.

Što se tiče varijable WHR, u poređenju sa istraživanjem koje su sproveli Senbanjo, Oshikoya, Olutekunbi, & Njokanma (2013), vrijednosti za dječake uzrasta 7 i 8 godina, koji su obuhvaćeni ovom studijom, relativno su približne vrijednostima koje su dobijene njihovim istraživanjem na uzorku ispitanika istog uzrasta. Naime, kod dječaka u njihovom istraživanju zabilježene su vrijednosti od 0.92, dok su kod dječaka obuhvaćenim ovom studijom 0.93, što je ispod graničnih vrijednosti centralne (abdominalne) gojaznosti. Što se tiče WHR vrijednosti kod djevojčica, u okviru istraživanja sprovedenog u Nigeriji, koja iznosi 0.90, a kod djevojčica obuhvaćene ovim istraživanjem 0.94, vidimo veće vrijednosti centralne (abdominalne) gojaznosti, iako su i djevojčice u Nigeriji takođe prešle dozvoljenu granicu (0.8). Dakle, djevojčice generalno u oba istraživanja pokazuju veće vrijednosti centralne gojaznosti u okviru varijable WHR, nego što je to slučaj sa dječacima. Varijabla WHtR kod dječaka istog uzrasta, u istraživanju koje su sproveli Senbanjo i saradnici (2013), izražena je vrijednošću od 0.43, dok je kod dječaka istog uzrasta u ovom istraživanju 0.47. Što se tiče djevojčica u Nigeriji vrijednost WHtR je takođe 0.43, što je ispod granične vrijednosti za procjenu centralne gojaznosti, što je i slučaj kod djevojčica obuhvaćenih ovim istraživanjem, čije su vrijednosti 0.48.

Dakle, ovim istraživanjem smo dobili presjek stanja na pomenutom uzorku ispitanika i utvrdili da situacija nije za zanemariti. Na osnovu ovog saznanja, čim prije bi trebalo sprovesti još istraživanja na ovu temu i nakon toga sagledati cjelokupnu situaciju i dati određene savjete i smjernice ka rješavanju dobijene situacije, ukoliko bude pratila stanje dobijeno ovim istraživanjem. Dakle, što se tiče stanja dobijenog ovim istraživanjem može se preporučiti da treba, kao osnovno, u preventivne mjere protiv gojaznosti u djetinjstvu uključiti fizičku aktivnost, kao i promjenu faktora koji utiču na prekomjernu tjelesnu masu i gojaznost, a koji prvenstveno potiču iz socijalne sredine i edukacije roditelja (Despotović, Alekxopulos, Despotović, i Ilić, 2013). Da bi se preventivno djelovalo na problem sa kojim se suočava ispitivana populacija, potrebno je agresivno djelovati na smanjenje hipokinezije podizanjem svijesti o značaju fizičke aktivnosti. Kineziolozi i nastavnici bi trebali pravovremeno da detektuju ove probleme i roditeljima, kao i đeci, daju odgovarajuće savjete o pravilnom načinu života, kako bi održali status zdrave osobe sa normalnom tjelesnom težinom. Da bi se iznijeli neki konkretniji zaključci, u nekim narednim istraživanjima bi trebalo uzeti u obzir veći broj faktora, kao i veći broj ispitanika različitog uzrasta, a sve sa namjerom da se stane na put zdravstvenom problemu 21. vijeka.

Limitiranost ove studije se može ogledati u tome da uzorak obuhvaćen ovim istraživanjem nije dovoljno velik u odnosu na cjelokupnu populaciju. Samim tim, u narednim studijama ovog karaktera bi trebalo uključiti đecu i iz Sjeverne regije, kao i iz ruralnih i polu ruralnih područja, a na taj način bi sigurno dobili preciznije podatke za postavljeno istraživačko pitanje. Navedena konstatacija, svakako, ne umanjuje doprinos ove preliminarne studije, jer su u njoj iznešeni zaključci koji su izutetno bitni za dalji tok istraživanja na ovu temu u okviru pomenute populacije. Kao preporuka za buduća istraživanja ovog karaktera je da se, na nivou Crne Gore, uključe i roditelji ispitivane đece, odnosno da se izmjeri stepen gojaznosti roditelja đece koja su određena da uđu u uzorak istraživanja. Naime, smatra se da rezultati uhranjenosti roditelja koreliraju u velikoj mjeri sa rezultatima uhranjenosti đece, što je potvrđeno u studiji koju su sproveli Bukara-Radujkovic i Zdravkovic (2008), a to bi valjalo potvrditi i na teritoriji Crne Gore i samim tim skrenuti pažnju roditeljima da su oni jedni od glavnih odgovornih za stanje uhranjenosti njihove đece.

Acknowledgements
There are no acknowledgements.

Conflict of Interest
The authors declare that there are no conflicts of interest.

Received: 8 January 2019 | **Accepted:** 13 March 2019 | **Published:** 19 April 2019

References

Bjelica, D. (2006). *Teorijske osnove tjelesnog i zdrastvenog obrazovanja*. Podgorica: Crnogorska sportska akademija.

Bukara-Radujkovic G. i Zdravkovic, D. (2008). Determinante gojaznosti kod dece i adolescenata. *Srpski Arhiv za Celokupno Lekarstvo, 136*(1–2), 22–7.

de Onis, M., Blossner, M., & Borghi, E. (2010). Global prevalence and trends of overweight and obesity among preschool children. *The American Journal of Clinical Nutrition, 92*, 1257–64.

Despotović, M., Alekxopulos, H., Despotović, M., & Ilić, B. (2013). Stanje uhranjenosti dece predškolskog uzrasta. *Medicinski časopis, 47*(2), 62-8.

Fung, W. (2009). Early childhood malnutrition and adult obesity: Evidence from the 1959–61 China famine. *Harvard University, Mimeograph.* Preuzeto sa: http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.189.1517

Gortmaker, S. L., Dietz, W. H. Jr., Sobol, A. M., & Wehler, C. A. (1987). Increasing obesity in the United States. *American journal of diseases of children, 141*, 535-40.

Gigante, D. P., Victora, C. G., Horta, B. L., & Lima, R.C. (2007). Undernutritionin early life and body composition of adolescent malesfrom a birth cohort study. *British Journal of Nutrition, 97*(5), 949–54.

Lobstein, T., Baur, L., & Uauy, R. (2004). IASO International Obesity Task Force. Obesity in children and young people: a crisisin public health. *Obesity Reviews, 5*(1), 4–85.

Masanovic, B., Vukotic, M., Bjelica, D., & Popovic, S. (2018). Describing Physical Activity Profile of Older Montenegrin Males Using the International Physical Activity Questionnaire (IPAQ). In *Book of Abstracts 15th International Scientific Conference on Transformation Process in Sport "Sport Performance"* (61). Podgorica: Montenegrin Sports Academy.

Must, A., Jacques, P. F., Dallal, G. E., Bajema, C. Y., & Dietz, W. H. (1992). Long-term morbidity and mortality of overweight adolescents. *The New England Journal of Medicine, 327*, 1350-5.

McCarthy, H. D., & Ashwell, M. (2006). A study of central fatnessusing waist-to-height ratios in UK children and adolescents over two decades supports the simple message—'keep your waist circumference to less than half your height'. *International Journal of Obesity, 30*, 988–92.

Palloni, A., McEniry, M., D avila, A. L., & Gurucharri, A. G. (2005). The influence of early conditions on health status among elderly Puerto Ricans. *Social biology, 52*(3-4), 132–63.

Popović, S., Bjelica, D., Mašanović, B., & Vukotić, M. (2018). Describing physical activity profile of young Montenegrin females using the international physical activity questionnaire (IPAQ). In *Proceedings World Congress of Performance Analysis of Sport XII* (344). Opatija: International Society of Performance Analysis of Sport.

Popovic, S., Bjelica, D., Vukotic, M., & Masanovic, B. (2018). Describing Physical Activity Profile of Older Montenegrin Females Using the International Physical Activity Questionnaire (IPAQ). In *Book of Abstracts 15th International Scientific Conference on Transformation Process in Sport "Sport Performance"* (60-61). Podgorica: Montenegrin Sports Academy.

Power, C., Lake, J. K., & Cole, T. J. (1997). Measurement and long-term health risks of child and adolescent fatness. *International Journal of Obesity, 21*, 507-26.

Schroeder, D. G., Martorell, R., & Flores, R. (1999). Infant and childgrowth and fatness and fat distribution in Guatemalan adults. *American Journal of Epidemiology, 149*(2), 177–85.

Senbanjo, I. O., Oshikoya, K. A., Olutekunbi, O. A., & Njokanma, O.F. (2013). Body Fat Distribution of Children and Adolescents in Abeokuta, Southwest Nigeria. *American Journal Physical Anthropology, 150*(4), 647-54. doi: 10.1002/ajpa.22241

Srinivasan, S. R., Bao, W., Wattigney, W. A., & Berenson, G. S. (1996). Adolescent overweight is associated with adult overweight and related multiple cardiovascular risk factors. *Metabolism, 45*(2), 235-40.

Uauy, R., Kain, J., & Corvalan, C. (2011). How can the Developmental Origins of Health and Disease (DOHaD) hypothesis contributeto improving health in developing countries? *The American Journal of Clinical Nutrition, 94*(6), 1759–64.

Vasiljević, I., Bjelica, D., Popović, S. i Gardašević, J. (2015). Analysis of nutrition of preschool-age and younger school-age boys and girls. *Journal of Physical Education and Sport, 15*(3), 426-28.

Wang, Y.F., & Lobstein, T. (2006). Worldwide trends in childhood overweight and obesity. *International Journal of Pediatric Obesity, 1*(1), 11–25.

World Health Organization expert committee. (1995). *Physical status, the use and interpretation of anthropometry.* Geneva: World Health Organization.

DOI 10.26773/jaspe.190409

Journal of Anthropology of Sport and Physical Education

ORIGINAL SCIENTIFIC PAPER

The Differences in Morphological Structure of Handball Player's from Junior League in Kosovo

Admire Hasani-Toverlani[1], Vullnet Ameti[1], Shpresa Memishi[1]

[1]University of Tetova, Faculty of Physical Education, Tetovo, Macedonia

Abstract

The aim of this study was to recognize the differences in the morphological structure of handball players from junior leagues in Kosovo. The sample included 20 male active handball players from four handball junior teams. They compete in irregular competition in Handball Federation, Kosovo, divided into 4 subsamples: five players were from H.C. "Trepca" - Mitrovica, five players were from H.C. "Kastrioti" - Ferizaj, five players were from H.C. "Bashkim Idrizi" - Gjakova, and five players were from H.C. "Prishtina" - Prishtina. Anthropometric characteristics were evaluated by a battery of five variables: body weight, body height, length of arms, length of hands and breadth of hand. The data were analyzed by a statistical package, they are processed in the SPPS program, version 20.0 for Windows. Scientific research is done in the composition of the anthropometric space. The standard central and dispersive parameters are calculated for all variables. The significance of the differences between the group was determined by a t-test for independent samples, at the significance level of $p<0.05$. Based on the results of this study, a significant difference was confirmed between anthropometric variables between most groups. These facts show that there are differences from the first-place team to the fourth place team in the Kosovo junior championship.

Key words: *Handball, Junior League, Anthropometric Space, Kosovo*

Introduction

Handball is a part of a sport collective game which is specific and has too much characteristic movement, like coordination and speed, when we need force, resistance and high precision. Like in every sport, if we want to have considerable success and result, the main goal of every handball player and professional collaborator in this field should be to train hard and with contemporary methods (Selimi, 2001; Srhoj, Marinovic, & Rogulj, 2002; Ghobadi, Rajabi, Farzad, Bayati, & Jeffreys, 2013; Alaj et al., 2015; Hoppe, Brochhagen, Baumgart, Bauer, & Juergen, 2017). In scientific literature, it is known that for playing handball many complex anthropological characteristics, intensity, agility, explosive strength and speed are needed to have, which are essential in performing many motoric structures. Similar researches in this field of handball were done by the author (Koca, 2009; Vuleta, Milanovic, Grujic, & Jaksic 2006; Arifi, Bjelica, & Masanovic, 2019). When choosing a sport discipline, body constitution plays a significant role (Bjelica & Fratric, 2011). All competitive sports practiced at a higher level require that the body performs at the optimal biomechanical and physiological capacity (Saavedra et al., 2018). Logically, a junior handball player competing in the strongest leagues in his age group is expected to have the optimal physical requirements of the sport in question (Masanovic, 2018). Morphological characteristics are of great importance when it comes to orientation and selection in all sports disciplines, since they are present in the equation of the specification of almost every sport (Gjonbalaj, Georgiev, & Bjelica, 2018). The anthropometric characteristics of the junior handball body can directly affect the positions they play, as well as the high skills of physical preparation, speed, durability, and so on. Anthropometric body characteristics affect the development of tactical and technical skills, the performance of each handball player, as well as anthropometric parameters, which are of particular importance in identifying and selecting talented players for handball sports (Ghobadi, et.al 2013; Srhoj et al.,

Correspondence:

A. Hasani-Toverlani

The University of Tetova, Faculty of Physical Education, Ilinden nn, 1200 Tetova, Republic of North Macedonia

E-mail: admire.hasani@yahoo.com

2002). It is very important to identify the differences between the variables in the anthropometric space of players who compete in the same rank in the Kosovo Handball Championship, and establish whether the differences are related to quality.

The aim of this research was to evaluate the morphological structure of the handball players from Kosovo, and to evaluate the morphological structure of players from each team separately, and to analyze the differences in some morphological characteristics among junior handball players, players of H.C. "Trepça" - Mitrovica, H.C. "Kastrioti" - Ferizaj, H.C. "Bashkim Idrizi" - Gjakova and H.C. "Prishtina" - Prishtina., who compete in the Kosovo Handball Championship.

Material & Method

In this research was included 20 male handball player of 18.25±0.54 years old, active players from four handball junior teams which compete in a regular competition in Handball Federation, Kosovo. Sample is divided into 4 subsamples: five players were from H.C. "Trepça" - Mitrovica (18.3±0.43), five players were from H.C. "Kastrioti" - Ferizaj (18.1±0.58), five players were from H.C. "Bashkim Idrizi" - Gjakova (18.4±0.70), and five players were from H.C. "Prishtina" - Prishtina (18.2±0.58). All of them were from the left and right back position in the field.

In this research battery of five anthropometric variables are applied: body weight, body height, length of arms, length of hand, and breadth of hand. These measurements are made indoor, in the place where they train and in the morning time. Measurements are realized by a professional team, respecting rules of International Scientific of Advanced Kinanthropometric (ISAK) form (Marfell-Jones, Olds, Stewart, & Carter, 2006). The players were measured with the following measuring instruments: anthropometer according to Martin with an accuracy of 0.1cm - for length of arms, length of hand and breadth of hand; decimal scale - body weight accurate to within 0.1kg.

The data were analyzed by the statistical package SPPS, version 20.0 for Windows. The standard central and dispersive parameters are calculated for all variables. The significance of the differences between the group was determined by a t-test for independent samples, at the significance level of $p<0.05$.

Results

Table 1 shows the basic descriptive statistical parameters of the anthropometric variables for all junior handball teams, which competed in Handball Championship League in the Republic of Kosovo (the teams are Trepca, Kastrioti, Prishtina, and Bashkim Idrizi).

Based on the central and dispersive parameters, and the values of the skewness and kurtosis, it can be noted that all variables are within the normal distribution boundaries. It can be seen from the value of the skewness that the variables of body weight, length of hand and breadth of hand have mild asymmetry for the weaker results because they have a positive sign; while the variables of body height and length of arms have a negative sign which indicates that the results reside right from the value of the arithmetic mean, i.e. among the higher values. By the value of the kurtosis, it can be seen that the all variables show that the distribution is flatter than normal, that is, there are more results accumulated in the tails of distribution.

Tabela 1. Basic statistical indicators in anthropometric space in handball players' measurements

Variables	N	Min.	Max.	Mean±SD	Skew.	Kurt.
Body Weight	20	61.54	91.53	75.51 ±8.04	.374	- .051
Body Height	20	172.73	196.34	184.55 ± 6.36	- .150	- .306
Length of Arms	20	77.23	85.46	81.35 ± 2.58	- .228	- 1.144
Lenght of Hand	20	19.45	23.82	20.85 ± 1.24	.767	- .221
Breadth of Hand	20	20.31	25.44	22.35 ± 1.42	.386	- .260

Note: N – number of number of respondents; Min – minimum value; Max – maximum value; Mean – arithmetic mean, SD – standard deviation; Skew. - Measure of asymmetry; Kurtosis - Measure of flattening

Based on the results presented in Table 2 we can find out valuable statistic difference in anthropometric and motoric space between the two groups, H.C „Kastrioti" and H.C "Trepça", valuable changes are presented in two anthropometric variables in favor of H.C "Trepça" from Mitrovica: length of hand and breadth of hand.

Tabela 2. A T-test between the two groups which are tested in anthropometric spaces

Variables	Group	N	Mean±SD	Sig.
Body Weight	Kastrioti	5	73.91 ± 3.53	.171
	Trepca	5	80.91 ± 9.19	
Body Height	Kastrioti	5	182.83 ± 7.85	.264
	Trepca	5	187.94 ± 5.13	
Length of Arms	Kastrioti	5	80.21 ± 2.25	.284
	Trepca	5	82.16 ± 3.02	
Lenght of Hand	Kastrioti	5	20.00 ± .40	.048 *
	Trepca	5	21.64 ± 1.32	
Breadth of Hand	Kastrioti	5	20.96 ± .68	.009 *
	Trepca	5	23.03 ± 1.06	

Note: N - number of number of respondents; Sig. - significance level; * - significant difference between groups

In Table 3 are presented the differences between H.C "Kastrioti" and the H.C "Prishtina" on the anthropometric spaces are presented, and do not show that we have significant differences between these two groups.

Tabela 3. A T-test between the two groups which are tested in anthropometric spaces

Variables	Group	N	Mean±SD	Sig.
Body Weight	Kastrioti	5	73.91 ± 3.53	.185
	Pristina	5	68.89 ± 6.62	
Body Height	Kastrioti	5	182.83 ± 7.85	.276
	Pristina	5	187.73 ± 4.83	
Length of Arms	Kastrioti	5	80.21 ± 2.25	.153
	Pristina	5	82.31 ± 1.92	
Lenght of Hand	Kastrioti	5	20.00 ± .40	.130
	Pristina	5	21.15 ± 1.35	
Breadth of Hand	Kastrioti	5	20.96 ± .68	.125
	Pristina	5	22.66 ± 1.94	

Table 4 presents the results between H.C "Kastrioti" and H.C "Bashkim Idrizi", and significant differences are presented for breadth of hand in favor of H.C "Bashkim Idrizi".

Tabela 4. A T-test between the two groups which are tested in anthropometric spaces

Variables	Group	N	Mean±SD	Sig.
Body Weight	Kastrioti	5	73.91 ± 3.53	.302
	B. Idrizi	5	38.31 ± 7.89	
Body Height	Kastrioti	5	182.83 ± 7.85	.472
	B. Idrizi	5	179.72 ± 4.61	
Length of Arms	Kastrioti	5	80.21 ± 2.25	.779
	B. Idrizi	5	80.71 ± 3.12	
Lenght of Hand	Kastrioti	5	20.00 ± .40	.369
	B. Idrizi	5	20.60 ± 1.30	
Breadth of Hand	Kastrioti	5	20.96 ± .68	.010 *
	B. Idrizi	5	22.74 ± .93	

In table 5 the results between H.C "Trepca" and H.C "Prishtina" are presented. On this occasion are gained significant differences in variable body weight in favor of H.C "Trepca".

Tabela 5. A T-test between the two groups which are tested in anthropometric spaces

Variables	Group	N	Mean±SD	Sig.
Body Weight	Trepca	5	80.91 ± 9.19	.048 *
	Pristina	5	68.89 ± 6.62	
Body Height	Trepca	5	187.94 ± 5.13	.948
	Pristina	5	187.73 ± 4.83	
Length of Arms	Trepca	5	82.16 ± 3.02	.929
	Pristina	5	82.31 ± 1.92	
Lenght of Hand	Trepca	5	21.64 ± 1.32	.587
	Pristina	5	21.16 ± 1.35	
Breadth of Hand	Trepca	5	23.03 ± 1.06	.726
	Pristina	5	22.66 ± 1.94	

In Table 6 the results are given between H.C "Trepça" and H.C "Bashkim Idrizi", where significant differences are presented in favor of H.C "Trepça" to the body height.

Tabela 6. A T-test between the two groups which are tested in anthropometric spaces

Variables	Group	N	Mean±SD	Sig.
Body Weight	Trepca	5	80.91 ± 9.19	.645
	B. Idrizi	5	78.31 ± 7.89	
Body Height	Trepca	5	187.94 ± 5.13	.029 *
	B. Idrizi	5	179.72 ± 4.61	
Length of Arms	Trepca	5	82.16 ± 3.02	.477
	B. Idrizi	5	80.71 ± 3.12	
Lenght of Hand	Trepca	5	21.64 ± 1.32	.247
	B. Idrizi	5	20.60 ± 1.30	
Breadth of Hand	Trepca	5	23.03 ± 1.06	.662
	B. Idrizi	5	22.74 ± .93	

In table 7 the results between H.C "Prishtina" and H.C „Bashkim Idrizi" are presented. Significant differences are presented in favor of H.C "Prishtina", in variables of body height.

Tabela 7. A T-test between the two groups which are tested in anthropometric spaces

Variables	Group	N	Mean±SD	Sig.
Body Weight	Pristina	5	68.89 ± 6.62	.076
	B. Idrizi	5	78.31 ± 7.89	
Body Height	Pristina	5	187.73 ± 4.83	.028 *
	B. Idrizi	5	179.72 ± 4.61	
Length of Arms	Pristina	5	82.31 ± 1.92	.359
	B. Idrizi	5	80.71 ± 3.12	
Lenght of Hand	Pristina	5	21.16 ± 1.35	.526
	B. Idrizi	5	20.60 ± 1.30	
Breadth of Hand	Pristina	5	22.66 ± 1.94	.940
	B. Idrizi	5	22.74 ± .93	

Discussion

The results measured by handball players from four different teams can give us the opportunity to compare stature of handball players, and the average measure of body height of handball players from Kosovo. H.C. Trepça with 187,94cm are taller than H.C Prishtina with the average of 187,73cm, these two teams are taller than players from H.C Kastrioti, with the average body height of 182,83cm, and H.C Bashkim Idrizi, with 179,72cm. These teams represent the first four teams of junior handball championship of Kosovo.

In modern handball the average stature is very important. Interestingly, players from H.C Bashkim Idrizi with 179,72cm are lower than the player from the first junior league in Serbia with an average body height of 181,51cm (Masanovic, Milosevic, & Corluka, 2018), which has a long tradition in this sport. This fact shows that the players from Kosovo have a good morphological potential. This is no surprise because the Kosovo population is among the highest in the world (Arifi et al., 2017; Arifi, Sermaxhaj, Zejnullahu-Raçi, Alaj, & Metaj, 2017; Popovic, Gardasevic, Masanovic, Arifi, & Bjelica, 2017; Masanovic, Gardasevic, & Arifi, 2018; Gardasevic, Masanovic, & Arifi, 2018; Arifi, Gardasevic, & Masanovic, 2018).

Also, in the modern handball game the appropriate body weight is very important. H.C. Trepça with 80.91kg and H.C Bashkim with 78.31kg have higher body mass than the mentioned Serbian (74.73kg) and Norwegian handball players (76.5kg) of the same age (Ingebrigtsen, Jeffreys, & Rodahl, 2013). H.C Kastrioti is just a little bit behind them (73.91) and H.C Pristina players have lower body height than players from Serbian and Norwegian junior league (68.98kg).

To reach the authentication of statistical differences between the four groups, on this occasion we started verification of the differences of "Kastrioti" from Ferizaj which is the first group, in the second group is "Trepca" from Mitrovica, in third group is "Prishtina" from Prishtina, and the fourth in this group is "Bashkim Idrizi" from Gjakova. One of the main importance of this research was to evaluate the anthropometric space and the differences between the four handball teams. During operation, obtained results were treated through descriptive analyses and T-test for independent groups. The main aim of this research has been the anthropometric structure of 4 handball junior teams in Kosovo championship. Analyzing the results achieved by handball players from Kosovo can give us the opportunity to compare some variables with handball players of the same age from other countries who have developed the handball game at a high level. Based on the type of research of this paper we think that theoretical and practical values of this paper are discovering relation between anthropometric space in achieving the high results (Hoppe et al., 2017; Koca, 2009; Vuleta et al., 2006; Ghobadi,H. et.al 2013; Srhoj et al., 2002). The results of this study confirmed the differences between anthropometric variables in anthropometric space to 5 variables, which confirm those morphological characteristics that are presented in important statistical differences. These

facts show that there are differences from the first-place team to the fourth place in the Kosovo junior championship. Finally, we may say that gained results of this research have realized the main purpose. The results of this scientific paper also confirm the necessity for developing the same models for other handball teams in Kosovo.

Analyzing the results achieved by handball players from Kosovo can give us the opportunity to compare some variables with handball players of the same age from other countries who have developed the handball game at a high level.

Acknowledgements
There are no acknowledgements.

Conflict of Interest
The authors declare that there are no conflicts of interest.

Received: 28 December 2018 | **Accepted:** 20 March 2019 | **Published:** 19 April 2019

References

Alaj, I., Arifi, F., Metaj, Z., Cula, L., Nebiu, J., & Sermaxhaj, S., (2015). Differences In Anthropometric Space And Motor Dimensions Between The Two Clubs In The Category Of Cadets. *Sports Mont, 13*(2),43-45.

Arifi, F., Bjelica, D., & Masanovic, B. (2019). Differences in anthropometric characteristics among junior soccer and handball players. *Sport Mont, 17*(1), 45-49. doi: 10.26773/smj.190208

Arifi, F., Bjelica, D., Sermaxhaj, S., Gardasevic, J., Kezunovic, M., & Popovic, S. (2017). Stature and its Estimation Utilizing Arm Span Measurements in Kosovan Adults: National Survey. *International Journal of Morphology, 35*(3),1161-1167.

Arifi, F., Gardasevic, J., & Masanovic, B. (2018). Relationship between foot length measurements and body height: A prospective regional study among adolescents in central region of Kosovo. *Sport Mont, 16*(3),75-79. doi: 10.26773/smj.181013

Arifi, F., Sermaxhaj, S., Alaj, I., Metaj, Z., & Toverlani, A. (2017). Body Height and Its Estimation Utilizing Arm Span Measurements of both gender Adolescents from Central Region in Kosovo. *Sports Mont, 15*(2),31-34.

Arifi, F., Sermaxhaj, S., Zejnullahu-Raçi, P., Alaj, I., & Metaj, Z. (2017). Stature and its estimation utilizing arm span measurements of both gender adolescents from the northern region in Kosovo. *Acta Kinesiologica, 11*(9),49-52.

Bjelica, D., & Fratrić, F. (2011). *Sportski trening: teorija, metodika i dijagnostika*. Nikšić: Fakultet za sport i fizičko vaspitanje.

Gardasevic, J., Masanovic, B., & Arifi, F. (2018). Relationship between tibia length measurements and standing height: A prospective regional study among adolescents in southern region of Kosovo. *Sport Mont, 16*(3),51-55. doi: 10.26773/smj.181009

Ghobadi, H., Rajabi, H., Farzad, B., Bayati, M., & Jeffreys, I. (2013). Anthropometry of world-class elite handball players according to the playing position: Reports from men's handball world championship 2013. *Journal of Human Kinetics, 39*(1),213-220.

Gjonbalaj, M., Georgiev, G., & Bjelica, D. (2018). Differences in Anthropometric Characteristics, Somatotype Components, and Functional Abilities among Young Elite Kosovo Soccer Players Based on Team Position. *Int. J. Morphol., 36*(1),41-7.

Hoppe, W.M., Brochhagen, J., Baumgart, Ch., Bauer, J., & Juergen. (2017). Differences in anthropometric characteristics and physical capacities between junior and adult top-level handball players. *Asian Journal Sports Medicine. 8*(4),e60663.

Ingebrigtsen, J., Jeffreys, I., & Rodahl, S. (2013). Physical Characteristics and Abilities of Junior Elite Male and Female Handball Players. *Journal of Strength and Conditioning Research, 27*(2),302–309.

Koca, A. (2009) Relacionet dhe ndryshimet ne hapeiren antropometrike funksionale dhe aftesive levizore bazike e te levizjeve situacionale ndermjet hendbollisteve (juniore) te superliges dhe liges se pare te kampionatit te kosoves ne hendboll. *Disertacion doktorature,* Prishtine: Fakulteti i Kultures Fizike.

Marfell-Jones, M., Olds, T., Stew, A.D., & Carter, J.E.L. (2006). *International standards for anthropometric assessment.* Potchesfstroom: International Society for the Advancement of Kinanthropometry.

Masanovic, B. (2018). Comparative study of anthropometric measurement and body composition between junior basketball and volleyball players from Serbian national league. *Sport Mont, 16*(3),19-24. https://doi.org/10.26773/smj.181004

Masanovic, B., Gardasevic, J., & Arifi, F. (2018). Relationship between foot length measurements and standing height: a prospective regional study among adolescents in southern region of kosovo. *Sport Mont, 16*(2),27-31. doi: 10.26773/smj.180605

Masanovic, B., Milosevic, Z., & Corluka, M. (2018). Comparative Study of Anthropometric Measurement and Body Composition between Junior Handball and Volleyball Players from Serbian National League. *International Journal of Applied Exercise Physiology, 7*(4),1-6. https://doi.org/10.30472/ijaep.v7i4.313

Popovic, S., Gardasevic, J., Masanovic, B., Arifi, F., & Bjelica, D. (2017). Standing Height and its Estimation Utilizing Foot Length Measurements in Adolescents from Western Region in Kosovo. *Sport Mont, 15*(3),3-7.

Saavedra, J.M., Þorgeirsson, S., Kristjansdottir, H., Halldorsson, K., Gudmundsdottir, M.L., & Einarsson, I.Þ. (2018). Comparison of training volumes in different elite sportspersons according to sex, age, and sport practised. *Montenegrin Journal of Sports Science and Medicine, 7*(2),37-42.

Selimi, M. (2001). Punim Magjistrature Fakulteti i Kultures Fizike, Prishtine, Kosove.

Srhoj, V., Marinovic, M., & Rogulj,N., (2002). Position specific morphological characteristics of top-level male handball players. *Coll. Antropol. 26*(1),219-227.

Vuleta, D., Milanovic, D., Gruic, I., & Jukic, I., (2006). Changes in physical conditioning status of female handball players during the preparation period. In *Proceedings book of 3rd International Scientific Conference on Kinesiology, "Kinesiology new perspective"* (386-389). Zagreb: Faculty of Kinesiology, University of Zagreb.

DOI 10.26773/jaspe.190410

Journal of Anthropology of Sport and Physical Education

REVIEW PAPER

Content Analyses of Scientific Articles Published in Sport Mont Journal Year 2007

Boris Banjevic[1]

[1]Army of Montenegro, Airforce Military of Montenegro, Podgorica, Montenegro

Abstract

Sport Mont is a scientific journal which has been existing since 2003 and it has published a great number of works of renowned scientists in the field of sport sciences and medicine. The journal has been indexed in more international database, it is released three times a year, and the published works are mostly presented on the scientific conference of the Montenegrin Sport Academy. Sport Mont, in addition to the original scientific works, publishes reviews, editorials, short reports, as well as the calls and awards for works in the field of sport sciences and medicine. This work deals with the analysis of the content of published articles in the journal Sport Mont in 2007. They have been sorted according to the scientific fields they belong to, and through discussion, a short overview of the obtained results has been given. This way makes possible an easier search of the mentioned articles for the authors who express their interest for them.

Key words: *Sport science, Sport Mont Journal, Medicine*

Uvod

Crnogorska sportska akademija je osnovana 2003. godine, kada je pokrenut i naučni časopis Sport Mont. Ovaj naučni časopis ima dugogodišnju tradiciju, koja baštini visoke standarde i norme stručnog, naučnog, moralnog i etičkog digniteta. Prepoznatljiv u okruženju, regionalno i mnogo šire, Sport Mont predstavlja značajnu naučnu bazu u kojoj se mogu naći radovi eminentnih stručnjaka iz oblasti sportskih nauka, medicine i fizičkog vaspitanja. Zapravo, on pokriva veliki broj naučnih disciplina čiji su izvori saznanja od posebnog značaja za razumijevanje brojnih kineziloških fenomena. To se prije svega odnosi na biomehaniku, fiziologiju, kineziterapiju, fizikalnu terapiju, traumatologiju sportskih povreda, trenažnu tehnologiju, antropologiju sporta, pedagogiju-sociologiju i psihologiju sporta, sportski menadžment i sve ostale aspekte vježbanja, zdravlja i sporta. Časopis je indeksiran u 23 međunarodne naučne baze podataka, od kojih je Scopus najprestižnija baza. Izlazi tri puta godišnje i radovi koji su objavljeni u njemu su većinom predstavljeni na naučnoj konferenciji Crnogorske sportske akademije, koja se tradicionalno održava svake godine.

Pored originalnih naučnih radova, Sport Mont objavljuje pregledne radove, uvodnike, kratke izvještaje, nagrade radova u oblasti sportskih nauka i medicine i funkcioniše kao otvoreni forum za diskusiju o značajnim aktuelnim pitanjima. Ovaj časopis obezbjeđuje transparentnost i dostupnost naučnim radnicima širom svjetskih meridijana. Stoga, on pruža online otvoren pristup, brzo objavljivanje, mišljenje stručnjaka i istraživača, post publikacijske alate za pokazivanje kvaliteta i učinka, zajednicu zasnovanu na zajedničkom jeziku članaka i svjetsku medijsku pokrivenost.

Sport Mont je, doživljavajući brojne transformacije, prelazio evolutivni put napretka, čije ga tekovine danas postavljaju u ravan najpriznatijih časopisa istog stvaralačkog područja u cijelom svijetu. Egzistiranje časopisa u današnjem obliku je rezultat stručnog, posvećenog i pregalačkog rada glavnih urednika časopisa i članova uredničkog odbora, koji su uspjeli na ovaj način značajno doprinijeti razvoju kineziološke nauke na našim prostorima. Glavni i odgovorni urednici časopisa su prof. dr Duško Bjelica sa Univerziteta Crne Gore i prof. dr Zoran Milošević sa Univerziteta u Novom Sadu. Izvršni urednik je mr Jovica Gardašević sa Univerziteta Crne Gore. Uređivački odbor čini 15 profesora iz Crne Gore, regiona, Evrope i Sjeverne Amerike.

Correspondence:

B. Banjevic

Army of Montenegro, Airforce military of Montenegro, Military airport "Knjaz Danilo" Podgorica, Montenegro

E-mail: boris.banjevic@gmail.com

Do sada su izvršene brojne analize sadržaja iz časopisa Sport Mont, a cilj ovog rada je selektovanje članaka objavljenih 2007. godine, po odgovarajućim naučnim oblastima kojima pripadaju. Na ovaj način će biti omogućen lakši pristup i pretraga onim autorima koji se budu služili radovima objavljenim u pomenutom vremenskom periodu.

Metod rada

U ovom radu biće korišćena metoda analize sadržaja, koja se efikasno primjenjuje u raznovrsnim područjima ljudskog rada i stvaralaštva. Ona podrazumijeva korišćenje pisanih izvora kao osnovne jedinice izvora informacija. Ovdje su to svi naučni članci objavljeni kroz tri broja (12,13 i 14) časopisa Sport Mont 2007. godine. Ukupno je objavljeno 119 članaka, koji će biti klasifikovani prema sljedećim naučnim oblastima: biomehanika; korektivna gimnastika; sportska medicina; antropologija sporta; psihologija, sociologija i pedagogija sporta; fiziologija sporta; sportski trening i metodika treninga; istorija sporta i bibliografija; turizam, menadžment i marketing u sportu.

Rezultati

Nakon sprovedene kompletne analize sadržaja iz Sport Monta, izvršena je klasifikacija radova u devet oblasti, kako je prikazano u tabeli 1.

Tabela 1. Podjela radova prema naučnim oblastima

Naučna oblast	Broj radova
Biomehanika	5
Korektivna gimnastika	5
Sportska medicina	6
Antropologija sporta	43
Psihologija, sociologija i pedagogija sporta	23
Fiziologija sporta	4
Sportski trening i metodika treninga	20
Istorija sporta i bibliografija	3
Turizam, menadžment i marketing u sportu	10

Biomehanika je naučna disciplina koja svojim sadržajem sjedinjuje mehaniku i anatomiju ispitujući zakone relativnog kretanja i mirovanja čovjeka. Radovi iz ove oblasti su: "Dinamika biomehaničke tehnologije" (Bjelica, 2007), "Biomehanical model of the sprint start" (Čoh, 2007), "Mišićni disbalans fudbalera ustanovljen izokinetičkom dijagnostikom" (Doder i Golik-Perić, 2007), "Biomehanika karvinog zavoja u alpskom skijanju" (Hadžić, 2007) i Biomehanička analiza slobodnog zamaha (Opavsky, 2007).

Korektivna gimnastika predstavlja strukturalni segment kineziterapije i primjenjuje se u prevenciji i korekciji funkcionalnih poremećaja i promjena na lokomotornom aparatu. Iz ove oblasti su objavljeni sljedeći naučni radovi: "Dijagnostika stanja građe stopala kod djece predškolskog uzrasta u ustanovi za predškolsko vaspitanje i obrazovanje "Sokolac" u Sokocu" (Bjeković i Arnaut, 2007), "Prisustvo posturalnih poremećaja kod mlađeg školskog uzrasta u zavisnosti od nivoa informisanosti roditelja o lošem držanju tela" (Bogdanović, 2007), "Uloga nastavnika na formiranje pravilnog držanja tela" (Bogdanović, 2007), "Transverzalna analiza učestalosti lordotičnih poremećaja kod dvanaestogodišnjih dječaka i djevojčica" (Jovović, 2007) i "Prisutnost skoliotičnog lošeg držanja i razlike u morfološkim karakteristikama odbojkašica i rukometašica" (Milenković i Nejić, 2007).

Sportska medicina je naučna disciplina koja se bavi primjenom medicine i nauke u sprječavanju, prepoznavanju, liječenju i rehabilitaciji povreda izazvanih sportom, vježbanjem ili rekreativnim aktivnostima. Ova naučna oblast u Sport Mont časopisu je bila zastupljena kroz sljedeće radove: "Doping i nedozvoljene metode u sportu" (Bjelica, 2007), "Iznenadne smrti kod sportista" (Đukanović i Ražnatović, 2007), "Fizička aktivnost djece u gradskoj sredini" (M. Joksimović i V. Joksimović, 2007), "Funkcionalno osposobljavanje i fizikalni tretman sportista nakon povrede kolateralnih ligamenata zgloba koljena" (M. Joksimović i V. Joksimović, 2007), "Hijerarhijski pristup dijagnostičkom materijalu B.I.A. parametara" (Obradović i Rajković, 2007) i "Najčešće korišćeni steroidi kod sportista" (Vasić i Jakonić, 2007).

Antropologija je naučna disciplina koja se bavi konstrukcijom antropoloških modela, utvrđivanjem strukture i relacija antropoloških karakteristika, kao i utvrđivanjem relacija u odnosu na odgovarajuće kineziološke fenomene. Zastupljeni radovi iz ove oblasti su sljedeći: "Kanoničke relacije bazično-motoričkih sposobnosti i uspješnosti u nogometnoj igri kod juniora premijer lige" (Bajramović i Mekić, 2007), "Kategorizacija sportskih disciplina prema nivou elementarnih biomotornih dimenzija" (Bjelica, 2007), "Prediktivna vrijednost nekih testova opšte motorike na formiranje ocjene u nastavi fizičkog vaspitanja" (Bulatović, 2007), "Povezanost eksplozivne snage sa vrhunskim rezultatima u karateu" (Doder i Babiak, 2007), "Razlike u morfološkim i motoričkim pokazateljima grupa vrhunskih rvača i boksera" (Drapšin i Drid, 2007), "Razlike u funkcionalnim i motoričkim pokazateljima grupa vrhunskih karatista i džudistkinja" (Drid i Vujkov, 2007), "Uticaj step aerobika na transformaciju antropometrijskih karakteristika i motoričkih sposobnosti studenata" (Đug i Mikić, 2007), "Uticaj motoričkih sposobnosti i konativnih karakteristika na brzinu vođenja lopte i preciznost u košarci" (Hadžić, 2007), "Motoričke sposobnosti dečaka mlađeg školskog uzrasta" (Janković i Stojiljković, 2007), "Neke antropometrijske karakteristike dvanaestogodišnje djece u Nikšiću" (Jovović, 2007), "Uticaj različitih programa nastave fizičkog vaspitanja na antropometrijske karakteristike ispitanika" (Kljajević, 2007), "Razlike motoričkih sposobnosti studenata kriminalističko-policijske akademije iz Beograda i dobro treniranih osoba" (Koropanovski i Janković, 2007), "Neke morfološke karakteristike fudbalera" (Lilić, 2007), "Doprinos fakultativnih aktivnosti rukometa u transformaciji motoričkog statusa učenica prvog razreda srednje škole" (Marković i Višnjić, 2007), "Selekcija u rukometu" (Marušić, 2007), "Regresiona analiza testova za

procjenu bazično-motoričkih i situaciono-motoričkih sposobnosti nogometaša-juniora premijer lige u prostoru konativnih karakteristika" (Mekić i Bajramović, 2007), "Uticaj motoričkih sposobnosti na uspješnost izvođenja specifičnih motoričkih testova u rvanju" (Mikić i Ahmeti, 2007), "Prediktivna vrijednost nekih testova motoričkih sposobnosti za predviđanje uspjeha u brzini prelaska preko konopca" (Mujanović i Nožinović, 2007), "Struktura morfoloških karakteristika bodibildera" (Mutavdžić i Milenović, 2007), "Relacije između morfoloških karakteristika i preciznosti dodavanja lopte kod košarkaša pionirskog uzrasta" (Nikolić, 2007), "Relacije između motoričkih sposobnosti i preciznosti dodavanja lopte kod košarkaša pionirskog uzrasta" (Nikolić, 2007), "Povezanost morfoloških karakteristika studenata sa uspjehom u izvođenju narodnih igara" (Nožinović-Mujanović, 2007), "Da li su dečaci mlađeg školskog uzrasta gojazni?" (Obradović i Srdić, 2007), "Da li su devojčice mlađeg školskog uzrasta gojazne?" (Obradović i Srdić, 2007), "Odnos morfoloških dimenzija mehanizma energetske regulacije" (Pavlović, 2007), "Razlike u povezanosti motoričkih sposobnosti sa uspješnošću u realizaciji programskih sadržaja sportske gimnastike u odnosu na uzrast ispitanika" (Petković, 2007), "Povezanost motoričkih sposobnosti učenika IV razreda srednje škole sa uspješnošću u realizaciji programskih sadržaja sportske gimnastike" (Petković, 2007), "Komparativna analiza kraniofacijalne antropometrije učenica i učenika V razreda osnovnih škola u Nišu" (Purenović, 2007), "Indeks telesne mase i dijametri glave učenika V razreda osnovnih škola u Nišu" (Purenović, 2007), "Morfofunkcionalni status taekwon-do sportista reprezentacije Srbije" (Rajković i Obradović, 2007), "Razlike u morfološkim karakteristikama sportista u sportskim igrama" (Rakočević, 2007), "Uticaj repetitivne snage na razvoj specifične koordinacije i uspješnost savladavanje tehnike fudbalera-početnika" (Rakočević, 2007), "Relacije bazično-motoričkih sposobnosti i specifične preciznosti fudbalera uzrasta 10-12 godina" (Smajić i Molnar, 2007), "Neka od atletskih kretanja kao osnova za motoričku sposobnost vrhunskih fudbalera" (Stefanović i Milenković, 2007), "Istraživanje senzitivnih perioda preciznosti kod učenika osnovne škole" (Stijepić i Nićin, 2007), "Razlike u morfološkom prostoru između učenika sportista i ostalih učenika srednjeg školskog uzrasta" (Stojiljković i Janković, 2007), "Relacije bazično-motoričkih sposobnosti sa situaciono-motoričkim sposobnostima u fudbalu" (Šabotić i Drobnjak, 2007), "Selekcija mladih za sprint" (Šolaja, 2007), "Razlike između motoričkih sposobnosti studenata kriminalističko-policijske akademije iz Beograda i kategorisanih sportista-karatisti" (Vučković i Koropanovski, 2007), "Uticaj osnovne obuke u gađanju kod policajaca u funkciji pola" (Vučković i Dopsaj, 2007), "Biotipska determinisanost modela mladih rukometaša uzrasta 16-18 godina" (Vujović, 2007), "Morfološke karakteristike učenika prvog, drugog i trećeg razreda osnovne škole" (Zrnzević, 2007) i "Motoričke sposobnosti učenica prvog, drugog i trećeg razreda osnovne škole" (Zrnzević, 2007).

Iz oblasti psihologije, sociologije i pedagogije sporta, koje objašnjavaju brojna stanja psihe spotrista u različitim okolnostima, položaj jedinke u sportskom kolektivu, odnose pojedinca prema grupi ili šire društvenoj zajednici, kao i zakonitosti unutar složenih pedagoških okvira, zastupljeni su sljedeći radovi: "Korektivno-kompenzatorna uloga rekreacije u životu i radu savremenog čovjeka" (Bijelić, 2007), "Metodološko modelno zasnivanje dopunskog profesionalnog usavršavanja profesora fizičkog vaspitanja sa aspekta njihove sociokulturne i pedagoške usmjerenosti" (Bjeković, 2007), "Sport i kultura mira" (Bjelica, 2007), "Povezanost fizičke aktivnosti devojčica i njihovih roditelja sa pozitivnim odnosom devojčica prema fizičkoj aktivnosti" (Čokorilo i Mikalački, 2007), "Povezanost fizičke aktivnosti devojčica i njihovih roditelja sa odnosom roditelja prema fizičkoj aktivnosti" (Čokorilo, N. i Čokorilo, R., 2007), "Od sportskih aktivnosti do sportske delatnosti" (Džeko i Bjelica, 2007), "Short introduction to ethical reasoning in sport" (Hosta, 2007), "Sedeća odbojka kao važno terapijsko sredstvo i značajna sportska aktivnost u obrazovanju i vaspitanju hendikepiranih učenika" (Kabok, 2007), "Razlike učinka između pobjedničkih i poraženih ekipa na Svjetskom nogometnom prvenstvu 2006" (Kapidžić i Mujanović, 2007), "Starosna struktura vrhunskih rvačica" (Kasum i Radović, 2007), "Saznanja o pravilnoj ishrani sportista u Crnoj Gori" (Klarić i Vujačić, 2007), "Odnos sportske aktivnosti i uspeha u učenju" (Lepeš, 2007), "Sportske nauke i strategije unapređenja stila života stanovništva" (Maksimović i Vasić, 2007), "Uslovi i opremljenost osnovnih škola za realizaciju nastave fizičkog vaspitanja, kao i doprinos i uticaj nastavnika u neposrednoj nastavi" (Martinović i Branković, 2007), "Analiza strukture stavova i mišljenja nastavnika razredne nastave prema fizičkom vaspitanju" (E. Međedović i A. Međedović, 2007), "Saradnja nastavnika fizičkog vaspitanja sa organizacijama u fizičkoj kulturi" (E. Međedović i A. Međedović, 2007), "Psihološka i taktička priprema tenisera juniorske kategorije" (Milenković, 2007), "Strah od vode ili umišljeni događaji koji se čine stvarnim" (Milošević, 2007), "Opisno ocjenjivanje u fizičkom vaspitanju" (Milošević, 2007), "Stavovi i interesi radnika Mlina "Muharem Asović" prema sportskoj rekreaciji" (Nikolić, 2007), "Čitanje stručnog sportskog teksta na stranom jeziku" (Pirsl, 2007), "Značaj sporta u evropskim integracijama sa osvrtom na Crnu Goru" (Rašović, 2007) i "Stavovi adolescenata prema nastavi fizičkog vaspitanja" (Višnjić i Marković, 2007).

Fiziologija sporta je integralni dio sportske medicine i bavi se izučavanjem funkcionisanja organskih sistema i organizma u cjelosti prilikom raznovrsnih fizičkih aktivnosti čovjeka. Iz ove oblasti su zastupljeni sljedeći radovi: "Ples kao dopunsko sredstvo u sportu" (Karanov i Protić-Gava, 2007), "Faktori od kojih zavisi zamor kod plivača" (Madić i Okičić, 2007), "Faktorska struktura funkcionalnih sposobnosti bodibildera" (Milenović i Mutavdžić, 2007) i "Intenzifikacija časa fizičkog vaspitanja košarka-vođenje lopte" (Šabotić i Dedeić, 2007).

Sportski trening i metodika treninga kao sastavni dio trenažne tehnologije, omogućavaju transformacione procese pojedinih segmenata antropološkog statusa sportiste i usavršavanje tehničko-taktičkih-elemenata, što u krajnjem vodi ka postizanju vrhunskih sportskih dostignuća. Iz ovog veoma važnog segmenta su prikazani sljedeći radovi: "Efekti koncentrisane nastave plivanja u savladavanju plivačkih tehnika" (Bulatović, 2007), "Struktura tehničko-taktičkih dejstava košarkaških ekipa NBA lige" (Jovanova-Simeva, 2007), "Uticaj različitih modela plivačkog treninga (definisanih u odnosu na anaerobni prag) na promjene varijabli tjelesnog sastava" (Krivokapić, 2007), "Efekti različitih modela plivačkog treninga (definisanih u odnosu na anaerobni prag) na povećanje brzine plivanja" (Krivokapić, 2007), "Razvoj nekih motoričkih sposobnosti studenata nakon desetodnevne nastave smučanja" (Lilić, 2007), "Kondicione pripreme za biciklističke trekking ture" (Martinović i Branković, 2007), "Primijenjena sportska akrobatika u trenažnom procesu rukometa" (Marušić, 2007),

"Izbor vežbi i varijanti u treningu kružnog napadača" (Mavrić, 2007), "Program elemenata parterne gimnastike za individualni rad sa kružnim napadačem" (Mavrić, 2007), "Uticaj trenažnog procesa na brzinsku sposobnost, agilnost i skočnost odbojkašica" (Nejić, 2007), "Pouzdanost nekih testova za procenu izvođenja tehnike u džudou" (Obadov i Kopas, 2007), "Obuka i usavršavanje tehnike tai otoši" (Obadov, 2007), "Most kao dominantna tehnička struktura u rvanju grčko-rimskim i slobodnim stilom" (Radović i Kasum, 2007), "Tenis u Crnoj Gori sa posebnim osvrtom na metodologiju rada na teniskom zidu" (D. Rašović i I. Rašović, 2007), "Osnovne karakteristike i tehnika veslanja u turističkom kanu čamcu" (Savić, 2007), "Planiranje i programiranje trenažnog procesa kod mladih sprintera u pripremnom periodu" (Stefanović i Mekić, 2007), "Model za povećanje izdržljivosti kandidata za prijemni ispit Fakulteta sporta i fizičkog vaspitanja" (Šolaja, 2007), "Homogenost rezultata u zavisnosti od dionica i tehnika plivanja" (Trivun i Vuković, 2007), "Specifičnost pliometrijskog treninga u karateu" (Vujkov, 2007) i "Metodski pristup učenja osnovnih tehničko-taktičkih elemenata u rukometu" (Vujović, 2007).

U oblasti istorija sporta i bibliografija zastupljena su tri rada u kojima je prikazana zanimljiva hronološka retrospektiva bibliografkih jedinica koje su se odnosile na pojedina sportska zbivanja, objašnjen je način sistematizacije bibliografskih fondova i data su glavna obilježja prikupljanja istorijskih podataka. Radi se o sljedećim radovima: "Bibliografija radova dr Duška Bjelice u Jugoslovenskom sportskom listu "Sport": 1984/85 godine" (Krivokapić, 2007), "Predmetna klasifikacija u nauci o sportu" (Protić, 2007) i "Heuristika na primeru istraživanja u sportu i fizičkom vaspitanju" (Savić, 2007).

Turizam, menadžment i marketing u sportu, predstavljaju veoma bitne karike u složenom sistemu društvenih odnosa u sportu. Iz ovih oblasti su sljedeći radovi: "Sport za sve i rekreacija u uslovima tranzicije društva i tržišne ekonomije" (Bijelić, 2007), "Sadašnji opšti uslovi za sport i turizam" (Bjelica, 2007), "Direktni uticaj sponzorstva na razvoj sporta" (Đuranović i Novaković, 2007), "Rijeka Zeta kao potencijal za razvoj sportsko-rekreativnih oblika turizma" (Jovović, 2007), "Ponašanje potrošača u sportu" (Ljubojević i Vetro, 2007), "Organizacija rada ronilačkog centra" (V. Mijajlović i D. Mijajlović, 2007), "Struktura menadžmenta sportske organizacije tranzicionog oblika vlasništva" (Nikolić, 2007), "Finansiranje sporta u međunarodnim takmičenjima" (Stojčinović, 2007), "Sportsko turističke mogućnosti nacionalnog parka i olimpijske planine kao vid organizovanja aktivnosti u prirodi" (Trivun, 2007) i "Modernizacija opreme u sportskim teretanama kao preduslov razvoja body buildinga" (Vukasović, 2007).

Diskusija

U ovom radu izvršena je klasifikacija naučnih članaka iz časopisa Sport Mont, koji su obljavljeni 2007. godine. Metodom analize sadržaja utvrđeno je da su isti iz sljedećih oblasti: biomehanika (5), korektivna gimnastika (5), sportska medicina (6), antropologija sporta (43), psihologija, sociologija i pedagogija sporta (23), fiziologija sporta (4), sportski trening i metodika treninga (20), istorija sporta i bibliografija (3) i turizam, menadžment i marketing u sportu (10). Najveći broj istraživanja je iz antropologije sporta, što i ne čudi obzirom na veliki opseg ove naučne discipline i sami značaj problematike koju tretira. Naime, ovdje je pažnja bila usmjerena na utvrđivanju raznovrsnih uticaja i relacija između pojedinih segmenata antropološkog statusa, kao i njihov prediktivni aspekt na raznovrsne kineziološke manifestacije. Istraživanja iz ove kompleksne oblasti daju nesumnjiv teorijski i praktični doprinos, rasvjetljavajući brojne nedoumice vezane za kompleksno funkcionisanje "sistema čovjek" u najraznovrsnijim kretnim postavkama. Poslije antropologije sporta, najviše radova je bilo iz oblasti psihologije, pedagogije i sociologije sporta. U ovim radovima je primjetna tendencija objašnjavanja položaja sportiste ili učenika u veoma raznovrsnim i složenim društvenim okolnostima i situacijama koje nameću ispoljavanje njihovih kognitivnih i konativnih modela funkcionisanja. Nesumnjivo, radovi skoncentrisani u ovom segmentu su dali značajan doprinos razumijevanju problematike društvenog života, vaspitanja i psiholoških odrednica savremenog čovjeka. Po svojoj zastupljenosti, slijede radovi koji se tiču procesa trenažne tehnologije. U njima je težište stavljeno na utvrđivanju efekata dejstva raznovrsnih trenažnih tretmana na unaprijeđivanje kondicionih potencijala i usavršavanje tehnike izvođenja kretanja u pojedinim sportovima. Suština značaja rezultata dobijenih ovim istraživanjima je u davanju konkretnih smjernica za usavršavanje djelotvornih trenažnih transformacionih procesa, kako bi došlo do postizanja vrhunskog sportskog postignuća. Ovdje je takođe naglašen i broj radova iz turizma, menadžmenta i marketinga u sportu. Ove teme su dale doprinos shvatanju brojnih dešavanja u sportu i turizmu u kontekstu savremenog poimanja socioekonomskih fenomena. Iako su radovi iz biomehanike, sportske medicine i korektivne gimnastike zastupljeni u znatno manjem broju, oni su obzirom na značaj predmeta proučavanja ipak ostavili značajan trag u ovom izdanju časopisa. Ustanovljeno je da su ovi radovi dali brojne činjenične postavke koje su od posebnog značaja za poimanje raznovrsnih kretnih struktura, unaprijeđivanje posturalnog statusa školske djece i omladine, kao i shvatanje brojnih činilaca koji dovode do nastanka sportskih povreda. Sve ovo ima nesumnjiv teorijski i praktičan značaj za nastavu fizičkog vaspitanja i sportsku djelatnost. Sport Mont iz 2007. godine su dopunila i tri istraživanja vezana za istoriju sporta i bibliografiju, što je u konačnom dalo predstavu o njemu kao o jednom izuzetno uspješnom izdanju, koje je zajedno sa ostalim izdanjima trasiralo put ka samom vrhu najčitanijih sportskih časopisa u regionu i šire.

Acknowledgements
There are no acknowledgements.

Conflict of Interest
The authors declare that there are no conflicts of interest.

Received: 1 March 2019 | **Accepted:** 12 March 2019 | **Published:** 19 April 2019

References

Bajramović, Š., & Mekić, M. (2007). Kanoničke relacije bazično-motoričkih sposobnosti i uspješnosti u nogometnoj igri kod juniora premijer lige. *Sport Mont, 5*(12-13-14), 323-30.

Bijelić, B. (2007). Sport za sve i rekreacija u uslovima tranzicije društva i tržišne ekonomije. *Sport Mont, 5*(12-13-14), 151-7.

Bijelić, B. (2007). Korektivno-kompezatorna uloga rekreacije u životu i radu savremenog čovjeka. *Sport Mont, 5*(12-13-14), 303-9.

Bjeković, G. (2007). Metodološko modelno zasnivanje dopunskog profesionalnog usavršavanja profesora fizičkog vaspitanja sa aspekta njihove sociokulturne i pedagoške usmjerenosti. *Sport Mont, 5*(12-13-14), 225-34.

Bjeković, G., & Arnaut, Đ. (2007). Dijagnostika stanja građe stopala kod djece predškolskog uzrasta u ustanovi za predškolsko vaspitanje i obrazovanje "Sokolac" u Sokocu. *Sport Mont, 5*(12-13-14), 374-80.

Bjelica, D. (2007). Sport i kultura mira. *Sport Mont, 5*(12-13-14), 4-9.

Bjelica, D. (2007). Doping i nedozvoljene metode u sportu. *Sport Mont, 5*(12-13-14), 27-34.

Bjelica, D. (2007). Dinamika biomehaničke tehnologije. *Sport Mont, 5*(12-13-14), 532-8.
Bjelica, D. (2007). Kategorizacija sportskih disciplina prema nivou elementarnih biomotornih dimenzija. *Sport Mont, 5*(12-13-14), 814-9.
Bjelica, S., & Džeko, Š. (2007). Sadašnji opšti uslovi za sport i turizam. *Sport Mont, 5*(12-13-14), 527-31.
Bogdanović, Z. (2007). Prisustvo posturalnih poremećaja kod mlađeg školskog uzrasta u zavisnosti od nivoa informisanosti roditelja o lošem držanju tela. *Sport Mont, 5*(12-13-14), 609-15.
Bogdanović, Z. (2007). Uloga nastavnika na formiranju pravilnog držanja tela. *Sport Mont, 5*(12-13-14), 694-702.
Bulatović, D. (2007). Prediktivna vrijednost nekih testova opšte motorike na formiranje ocjene u nastavi fizičkog vaspitanja. *Sport Mont, 5*(12-13-14), 276-84.
Bulatović, D. (2007). Efekti koncentrisane nastave plivanja u savladavanju plivačkih tehnika. *Sport Mont, 5*(12-13-14), 499-505.
Čoh, M. (2007). Biomechanical model of the sprint start. *Sport Mont, 5*(12-13-14), 19-26.
Čokorilo, N., & Mikalački, M. (2007). Povezanost fizičke aktivnosti devojčica i njihovih roditelja sa pozitivnim odnosom devojčica prema fizičkoj aktivnosti. *Sport Mont, 5*(12-13-14), 134-8.
Čokorilo, N., & Čokorilo, R. (2007). Povezanost fizičke aktivnosti devojčica i njihovih roditelja sa odnosom roditelja prema fizičkoj aktivnosti. *Sport Mont, 5*(12-13-14), 445-50.
Doder, D., & Babiak, J. (2007). Povezanost eksplozivne snage sa vrhunskim rezultatima u karateu. *Sport Mont, 5*(12-13-14), 784-91.
Doder, D., & Golik-Perić, D. (2007). Mišićni disbalansi fudbalera ustanovljeni izokinetičkom dijagnostikom. *Sport Mont, 5*(12-13-14), 115-20.
Drapšin, M., & Drid, P. (2007). Razlike u morfološkim i motoričkim pokazateljima grupa vrhunskih rvača i boksera. *Sport Mont, 5*(12-13-14), 732-7.
Drid, P., & Vujkov, S. (2007). Razlike u funkcionalnim i motoričkim pokazateljima grupa vrhunskih karatiskinja i džudiskinja. *Sport Mont, 5*(12-13-14), 47-52.
Džeko, Š., & Bjelica, S. (2007). Od sportskih aktivnosti do sportske delatnosti. *Sport Mont, 5*(12-13-14), 292-6.
Đug, M., & Mikić, B. (2007). Uticaj step aerobika na transformaciju antropometrijskih karakteristika i motoričkih sposobnosti studenata. *Sport Mont, 5*(12-13-14), 129-33.
Đukanović, N., & Ražnatović, A. (2007). Iznenadne smrti kod sportista. *Sport Mont, 5*(12-13-14), 411-5.
Đuranović, D., & Novaković, S. (2007). Direktni uticaj sponzorstva na razvoj sporta. *Sport Mont, 5*(12-13-14), 654-62.
Hadžić, R. (2007). Uticaj motoričkih sposobnosti i konativnih karakteristika na brzinu vođenja lopte i preciznost u košarci. *Sport Mont, 5*(12-13-14), 180-5.
Hadžić, R. (2007). Biomehanika karvinog zavoja u alpskom skijanju. *Sport Mont, 5*(12-13-14), 360-5.
Hosta, M. (2007). Short introduction to ethical reasoning in sport. *Sport Mont, 5*(12-13-14), 345-50.
Janković, I., & Stojiljković, S. (2007). Motoričke sposobnosti dečaka mlađeg školskog uzrasta. *Sport Mont, 5*(12-13-14), 551-6.
Joksimović, M., & Joksimović, V. (2007). Fizička aktivnost djece u gradskoj sredini. *Sport Mont, 5*(12-13-14), 273-5.
Joksimović, V., & Joksimović, M. (2007). Funkcionalno osposobljavanje i fizikalni tretman sportista nakon povrede kolateralnih ligamenata zgloba koljena. *Sport Mont, 5*(12-13-14), 649-53.
Jovanova-Simeva, V. (2007). Struktura tehničko-taktičkih dejstava košarkaških ekipa NBA lige. *Sport Mont, 5*(12-13-14), 285-91.
Jovović, O. (2007). Rijeka Zeta kao potencijal za razvoj sportsko-rekreativnih oblika turizma. *Sport Mont, 5*(12-13-14), 827-40.
Jovović, V. (2007). Neke antropometrijske karakteristike dvanaestogodišnje djece u Nikšiću. *Sport Mont, 5*(12-13-14), 80-6.
Jovović, V. (2007). Transverzalna analiza učestalosti lordotičnih poremećaja kod dvanaestogodišnjih dječaka i djevojčica. *Sport Mont, 5*(12-13-14), 381-6.
Kabok, I. (2007). Sedeća odbojka kao važno terapijsko sredstvo i značajna sportska aktivnost u obrazovanju i vaspitanju hendikepiranih učenika. *Sport Mont, 5*(12-13-14), 249-53.
Karanov, B., & Protić-Gava, B. (2007). Ples kao dopunsko sredstvo u sportu. *Sport Mont, 5*(12-13-14), 588-93.
Kapidžić, A., & Mujanović, E. (2007). Razlike učinka između pobjedničkih i poraženih ekipa na Svjetskom nogometnom prvenstvu 2006. *Sport Mont, 5*(12-13-14), 297-302.
Kasum, G., & Radović, M. (2007). Starosna struktura vrhunskih rvačica. *Sport Mont, 5*(12-13-14), 351-9.
Klarić, D., & Vujačić, V. (2007). Saznanja o pravilnoj ishrani sportista u Crnoj Gori. *Sport Mont, 5*(12-13-14), 261-6.
Kljajević, V. (2007). Uticaj različitih programa nastave fizičkog vaspitanja na antropometrijske karakteristike ispitanika. *Sport Mont, 5*(12-13-14), 387-95.
Koropanovski, N., & Janković, R. (2007). Razlike motoričkih sposobnosti studenata kriminalističko-policijske akademije iz Beograda i dobro treniranih osoba. *Sport Mont, 5*(12-13-14), 738-43.
Krivokapić, D. (2007). Uticaj različitih modela plivačkog treninga (definisanih u odnosu na anaerobni prag) na promjene varijabli tjelesnog sastava. *Sport Mont, 5*(12-13-14), 158-66.
Krivokapić, D. (2007). Efekti različitih modela plivačkog treninga (definisanih u odnosu na anaerobni prag) na provećanje brzine plivanja. *Sport Mont, 5*(12-13-14), 310-8.
Krivokapić, P. (2007). Bibliografija radova dr Duška Bjelice u Jugoslovenskom sportskom listu „Sport": 1984/85. godine. *Sport Mont, 5*(12-13-14), 841-69.
Lepeš, J. (2007). Odnos sportske aktivnosti i uspeha u učenju. *Sport Mont, 5*(12-13-14), 63-71.
Lilić, Lj. (2007). Neke morfološke karakteristike fudbalera. *Sport Mont, 5*(12-13-14), 632-7.
Lilić, Lj. (2007). Razvoj nekih motoričkih sposobnosti kod studenata nakon desetodnevne nastave smučanja. *Sport Mont, 5*(12-13-14), 721-4.
Ljubojević, Č., & Vetro, L. (2007). Ponašanje potrošača u sportu. *Sport Mont, 5*(12-13-14), 459-67.
Madić, D., & Okičić, T. (2007). Faktori od kojih zavisi zamor kod plivača. *Sport Mont, 5*(12-13-14), 602-8.
Maksimović, N., & Vasić, G. (2007). Sportske nauke i strategije unapređenja stila života stanovništva. *Sport Mont, 5*(12-13-14), 95-101.
Marković, Ž., & Višnjić, D. (2007). Doprinos fakultativnih aktivnosti-rukometa u transformaciji motoričkog statusa učenica prvog razreda srednje škole. *Sport Mont, 5*(12-13-14), 53-62.
Martinović, D., & Branković, D. (2007). Kondicione pripreme za biciklističke treking ture. *Sport Mont, 5*(12-13-14), 337-44.
Martinović, D., & Branković, D. (2007). Uslovi i opremljenost osnovnih škola za realizaciju nastave fizičkog vaspitanja, kao i doprinos i uticaj nastavnika u neposrednoj nastavi. *Sport Mont, 5*(12-13-14), 616-22.
Marušić, R. (2007). Selekcija u rukometu. *Sport Mont, 5*(12-13-14), 805-13.
Marušić, R. (2007). Primijenjena sportska akrobatika u trenažnom procesu rukometa. *Sport Mont, 5*(12-13-14), 820-6.
Mavrić, F. (2007). Program elemenata parterne gimnastike za individualni rad sa kružnim napadačem. *Sport Mont, 5*(12-13-14), 780-3.
Mavrić, F. (2007). Izbor vežbi i varijanti u treningu kružnog napadača. *Sport Mont, 5*(12-13-14), 797-804.
Međedović, E., & Međedović, A. (2007). Analiza strukture stavova i mišljenja nastavnika razredne nastave prema fizičkom vaspitanju. *Sport Mont, 5*(12-13-14), 451-8.
Međedović, E., & Međedović, A. (2007). Saradnja nastavnika fizičkog vaspitanja sa organizacijama u fizičkoj kulturi. *Sport Mont, 5*(12-13-14), 668-76.
Mekić, M., & Bajramović, Š. (2007). Regresiona analiza testova za procjenu bazično-motoričkih i situaciono-motoričkih sposobnosti nogometaša-juniora Premijer lige u prostoru konativnih karakteristika. *Sport Mont, 5*(12-13-14), 35-46.
Mijajlović, V., & Mijajlović, D. (2007). Organizacija rada ronilačkog centra. *Sport Mont, 5*(12-13-14), 725-31.
Mikić, B., & Ahmeti, V. (2007). Uticaj motoričkih sposobnosti na uspješnost izvođenja specifičnih motoričkih testova u rvanju. *Sport Mont, 5*(12-13-14), 396-402.
Milenković, S. (2007). Psihološka i taktička priprema tenisera juniorske kategorije. *Sport Mont, 5*(12-13-14), 594-601.
Milenković, S., & Nejić, D. (2007). Prisutnost skoliotično lošeg držanja i razlike u morfološkim karakteristikama odbojkašica i rukometašica. *Sport Mont, 5*(12-13-14), 638-48.
Milenović, P., & Mutavdžić, V. (2007). Faktorska struktura funkcionalnih sposobnosti bodibildera. *Sport Mont, 5*(12-13-14), 267-72.
Milošević, D. (2007). Strah od vode ili umišljeni događaji koji se čine stvarnim. *Sport Mont, 5*(12-13-14), 110-5.
Milošević, D. (2007). Opisno ocjenjivanje u fizičkom vaspitanju. *Sport Mont, 5*(12-13-14), 519-26.
Mujanović, E., & Nožinović, F. (2007). Prediktivna vrijednost nekih testova motoričkih sposobnosti za predviđanje uspjeha u brzini prelaska preko konopca. *Sport Mont, 5*(12-13-14), 139-44.
Mutavdžić, V., & Milenović, P. (2007). Struktura morfoloških karakteristika bodibildera. *Sport Mont, 5*(12-13-14), 544-50.
Nejić, D. (2007). Uticaj trenažnog procesa na brzinsku sposobnost, agilnost i skočnost odbojkašica. *Sport Mont, 5*(12-13-14), 681-8.
Nikolić, B. (2007). Relacije između motoričkih sposobnosti i preciznosti dodavanja lopte kod košarkaša pionirskog uzrasta. *Sport Mont, 5*(12-13-14), 199-203.
Nikolić, B. (2007). Relacije između morfoloških karakteristika i preciznosti

dodavanja lopte kod košarkaša pionirskog uzrasta. *Sport Mont, 5*(12-13-14), 484-8.
Nikolić, I. (2007). Struktura menadžmenta sportske organizacije tranzicionog oblika vlasništva. *Sport Mont, 5*(12-13-14), 319-22.
Nikolić, M. (2007). Stavovi i interesi radnika Mlina „Muharem Asović" prema sportskoj rekreaciji. *Sport Mont, 5*(12-13-14), 429-34.
Nožinović, A., & Nožinović, Z. (2007). Povezanost morfoloških karakteristika studenata sa uspjehom u izvođenju narodnih igara. *Sport Mont, 5*(12-13-14), 145-50.
Obadov, S., & Kopas, J. (2007). Pouzdanost nekih testova za procenu tehnike u džudou. *Sport Mont, 5*(12-13-14), 744-9.
Obadov, S. (2007). Obuka i usavršavanje tehnike tai otoši. *Sport Mont, 5*(12-13-14), 755-61.
Obradović, B., & Srdić, B. (2007). Da li su dečaci mlađeg školskog uzrasta gojazni? *Sport Mont, 5*(12-13-14), 574-8.
Obradović, B., & Srdić, B. (2007). Da li su devojčice mlađeg školskog uzrasta gojazne? *Sport Mont, 5*(12-13-14), 762-6.
Obradović, Z., & Rajković, Ž. (2007). Hijerarhijski pristup dijagnostičkom materijalu B.I.A. parametara. *Sport Mont, 5*(12-13-14), 715-20.
Opavsky, P. (2007). Biomehanička analiza slobodnog zamaha. *Sport Mont, 5*(12-13-14), 10-8.
Pavlović, R. (2007). Odnos morfoloških dimenzija mehanizma energetske regulacije. *Sport Mont, 5*(12-13-14), 513-8.
Petković, J. (2007). Povezanost motoričkih sposobnosti učenika IV razreda srednje škole sa uspješnošću u realizaciji programskih sadržaja sportske gimnastike. *Sport Mont, 5*(12-13-14), 254-60.
Petković, J. (2007). Razlike u povezanosti motoričkih sposobnosti sa uspješnošću u realizaciji programskih sadržaja sportske gimnastike u odnosu na uzrast ispitanika. *Sport Mont, 5*(12-13-14), 489-98.
Pirsl, D. (2007). Čitanje stručnog-sportskog teksta na stranom jeziku. *Sport Mont, 5*(12-13-14), 468-76.
Protić, P. (2007). Predmetna klasifikacija u nauci o sportu. *Sport Mont, 5*(12-13-14), 566-73.
Purenović, T. (2007). Komparativna analiza kraniofacijalne antropometrije učenica i učenika V razreda osnovnih škola u Nišu. *Sport Mont, 5*(12-13-14), 623-31.
Purenović, T. (2007). Indeks telesne mase i dijametar glave učenika V razreda osnovnih škola u Nišu. *Sport Mont, 5*(12-13-14), 703-14.
Radović, M., & Kasum, G. (2007). Most kao dominantna tehnička struktura u rvanju grčko-rimskim i slobodnim stilom. *Sport Mont, 5*(12-13-14), 243-8.
Rajković, Ž., & Obradović, Z. (2007). Morfofunkcionalni status taekwon-do sportista reprezentacije Srbije. *Sport Mont, 5*(12-13-14), 750-4.
Rakočević, T. (2007). Uticaj repetitivne snage na razvoj specifične koordinacije i uspješnost savladavanja tehnike fudbalera-početnika. *Sport Mont, 5*(12-13-14), 192-8.
Rakočević, T. (2007). Razlike u morfološkim karakteristikama sportista u sportskim igrama. *Sport Mont, 5*(12-13-14), 477-83.
Rašović, D., & Rašović, I. (2007). Tenis u Crnoj Gori s posebnim osvrtom na metodologiju rada na teniskom zidu. *Sport Mont, 5*(12-13-14), 366-73.
Rašović, I. (2007). Značaj sporta u evropskim integracijama sa osvrtom na Crnu Goru. *Sport Mont, 5*(12-13-14), 677-80.
Savić, Z. (2007). Heuristika na primeru istraživanja u sportu i fizičkom vaspitanju. *Sport Mont, 5*(12-13-14), 579-87.
Savić, Z. (2007). Osnovne karakteristike i tehnika veslanja u turističkom kanu čamcu. *Sport Mont, 5*(12-13-14), 767-74.
Smajić, M., & Molnar, S. (2007). Relacije bazično motoričkih sposobnosti i specifične preciznosti fudbalera uzrasta 10-12 godina. *Sport Mont, 5*(12-13-14), 87-94.
Stefanović, R., & Mekić, B. (2007). Planiranje i programiranje trenažnog procesa kod mladih sprintera u pripremnom periodu. *Sport Mont, 5*(12-13-14), 173-9.
Stefanović, R., & Milenković, V. (2007). Neka od atletskih kretanja kao osnova za motoričku sposobnost vrhunskih fudbalera. *Sport Mont, 5*(12-13-14), 539-43.
Stijepić, R., & Nićin, Đ. (2007). Istraživanje senzitivnih perioda preciznosti kod učenika osnovne škole. *Sport Mont, 5*(12-13-14), 204-15.
Stoiljković, S., & Janković, I. (2007). Razlike u morfološkom prostoru između ičenika sportista i ostalih učenika srednjeg školskog uzrasta. *Sport Mont, 5*(12-13-14), 792-6.
Stojčinović, M. (2007). Finansiranje sporta u međunarodnim takmičenjima. *Sport Mont, 5*(12-13-14), 662-7.
Šabotić, B., & Drobnjak, D. (2007). Relacije bazično-motoričkih sposobnosti sa situaciono-motoričkim sposobnostima u fudbalu. *Sport Mont, 5*(12-13-14), 167-72.
Šabotić, B., & Dedeić, N. (2007). Intenzifikacija časa fizičkog vaspitanja košarka-vođenje lopte. *Sport Mont, 5*(12-13-14), 331-6.
Šolaja, M. (2007). Model za povećanje izdržljivosti kandidata za prijemni ispit Fakulteta sporta i fizičkog vaspitanja. *Sport Mont, 5*(12-13-14), 689-93.
Šolaja, M. (2007). Selekcija mladih za sprint. *Sport Mont, 5*(12-13-14), 775-9.
Trivun, M. (2007). Sportsko turističke mogućnosti nacionalnog parka i olimpijske planine kao vid organizovanja aktivnosti u prirodi. *Sport Mont, 5*(12-13-14), 422-8.
Trivun, M., & Vuković, S. (2007). Homogenost rezultata u zavisnosti od dionica i tehnika plivanja. *Sport Mont, 5*(12-13-14), 216-24.
Vasić, G., & Jakonić, D. (2007). Najčešće korišćeni steroidi kod sportista. *Sport Mont, 5*(12-13-14), 102-9.
Višnjić, D., & Marković, Ž. (2007). Stavovi adolescenata prema nastavi fizičkog vaspitanja. *Sport Mont, 5*(12-13-14), 435-44.
Vučković, G., & Dopsaj, M. (2007). Uticaj osnovne obuke u gađanju kod policajaca u funkciji pola. *Sport Mont, 5*(12-13-14), 557-65.
Vučković, G., & Koropanovski, N. (2007). Razlike između motoričkih sposobnosti studenata kriminalističko-policijske akademije iz Beograda i kategorisanih sportista-karatisti. *Sport Mont, 5*(12-13-14), 235-42.
Vujkov, S. (2007). Specifičnost pliometrijskog treninga u karateu. *Sport Mont, 5*(12-13-14), 72-9.
Vujović, D. (2007). Biotipska determinisanost modela mladih rukometaša uzrasta 16-18 godina. *Sport Mont, 5*(12-13-14), 186-91.
Vujović, D. (2007). Metodski pristup učenja osnovnih tehničko-taktičkih elemenata u rukometu. *Sport Mont, 5*(12-13-14), 506-12.
Vukasović, D. (2007). Modernizacija opreme u sportskim teretanama kao preduslov razvoja body buildinga. *Sport Mont, 5*(12-13-14), 416-21.
Zrnzević, N. (2007). Motoričke sposobnosti učenica prvog, drugog i trećeg razreda osnovne škole. *Sport Mont, 5*(12-13-14), 121-8.
Zrnzević, N. (2007). Morfološke karakteristike učenika prvog, drugog i trećeg razreda osnovne škole. *Sport Mont, 5*(12-13-14), 403-10.

Guidelines for Authors

Revised October 2017

*** Please use the bookmark function to navigate within the guidelines. ***

When preparing the final version of the manuscripts, either NEW or REVISED authors should strictly follow the guidelines. Manuscripts departing substantially from the guidelines will be returned to the authors for revision or, rejected.

1. UNIFORM REQUIREMENTS

1.1. Overview

The *Journal of Anthropology of Sport and Physical Education* (JASPE) applies the Creative Commons Attribution (CC BY) license to articles and other works it publishes.

There is no charge for submissions and no page charge for accepted manuscripts. However, if the manuscript contains graphics in color, note that printing in color is charged.

JASPE adopts a double-blind approach for peer reviewing in which the reviewer's name is always concealed from the submitting authors as well as the author(s)'s name from the selected reviewers.

JASPE honors six-weeks for an initial decision of manuscript submission.

Authors should submit the manuscripts as one Microsoft Word (.doc) file.

Manuscripts must be provided either in standard UK or US English or Montenegrin language. Chosen language standards should be consistent throughout the manuscripts.

Format the manuscript in A4 paper size; margins are 1 inch or 2.5 cm all around.

Type the whole manuscript double-spaced, justified alignment.

Use Times New Roman font, size eleven (11) point.

Number (Arabic numerals) the pages consecutively (centering at the bottom of each page), beginning with the title page as page 1 and ending with the Figure legend page.

Include line numbers (continuous) for the convenience of the reviewers.

Apart from chapter headings and sub-headings avoid any kind of formatting in the main text of the manuscripts.

1.2. Type & Length

JASPE publishes following types of papers:

Original scientific papers are the results of empirically- or theoretically-based scientific research, which employ scientific methods, and which report experimental or observational aspects of anthropology of sport and physical education from five major fields of anthropology: cultural, global, biological, linguistic and medical. Descriptive analyses or data inferences should include rigorous methodological structure as well as sound theory. Your manuscript should include the following sections: Introduction, Methods, Results, and Discussion.

☑Open Submissions ☑Indexed ☑Peer Reviewed

Original scientific papers should be:

- Up to 3000 words (excluding title, abstract, tables/figures, figure legends, Acknowledgements, Conflict of Interest, and References);
- A structured abstract of less than 250 words;
- Maximum number of references is 30;
- Maximum combined total of 6 Tables/Figures.

Review papers should provide concise in-depth reviews of both established and new areas, based on a critical examination of the literature, analyzing the various approaches to a specific topic in all aspects of anthropology of sport and physical education from five major fields of anthropology: cultural, global, biological, linguistic and medical.

☑Open Submissions ☑Indexed ☑Peer Reviewed

Review papers should be:
- Up to 6000 words (excluding title, abstract, tables/figures, figure legends, Acknowledgements, Conflict of Interest, and References);
- A structured abstract of less than 250 words;
- Maximum number of references is 100.

Editorials are written or commissioned by the editors, but suggestions for possible topics and authors are welcome. It could be peer reviewed by two reviewers who may be external or by the Editorial Board.

☐Open Submissions ☑Indexed ☑Peer Reviewed

Editorials should be:
- Up to 1000 words (excluding title, abstract, tables/figures, figure legends, Acknowledgements, Conflict of Interest, and References);
- A structured abstract of less than 250 words;
- Maximum number of references is 10.

Short reports of experimental work, new methods, or a preliminary report can be accepted as two page papers. Your manuscript should include the following sections: Introduction, Methods, Results, and Discussion.

☑Open Submissions ☑Indexed ☑Peer Reviewed

Short reports should be:
- Up to 1500 words (excluding title, abstract, tables/figures, figure legends, Acknowledgements, Conflict of Interest, and References);
- A structured abstract of less than 250 words;
- Maximum number of references is 15.

Peer review - fair review provides authors who feel their paper has been unfairly rejected (at any journal) the opportunity to share reviewer comments, explain their concerns, and have their paper reviewed for possible publication in JASPE.

☑Open Submissions ☑Indexed ☐Peer Reviewed

Peer review - fair review should be:
- Up to 1500 words (excluding title, abstract, tables/figures, figure legends, Acknowledgements, Conflict of Interest, and References);
- A structured abstract of less than 250 words;
- Maximum number of references is 15.

Invited papers and award papers include invited papers from authors with outstanding scientific credentials. Nomination of invited authors is at the discretion of the JASPE editorial board. JASPE also publishes award papers selected by the scientific committee of the publisher's conferences.

☐Open Submissions ☑Indexed ☐Peer Reviewed

Invited papers and award papers should be:
- Up to 3000 words (excluding title, abstract, tables/figures, figure legends, Acknowledgements, Conflict of Interest, and References);
- A structured abstract of less than 250 words;
- Maximum number of references is 30;
- Maximum combined total of 6 Tables/Figures.

1.3. Submission

JASPE only accepts electronic submission to the e-mail of the Journal Office: **jaspe@ac.me**.

Submitted material includes:

- A manuscript prepared according to the Guidelines for the Authors;
- A signed form that states the study was not previously published, nor has been submitted simultaneously for consideration of publication elsewhere, that states that all of the authors are in agreement with submission of the manuscript to JASPE, and that, for studies that use animal or human individuals, authors must include information regarding their institution's ethics committee, and which identifies the official approval number;
- A signed form that there is no conflict of interest.

Name the files according to the family name of the first author. Authors submitting revised versions of the manuscript can use the identification number of their manuscript as provided by the Journal Office. *See* example:

- ✓ FAMILY NAME-manuscript.doc – (main manuscript file)
- ✓ FAMILY NAME-statement.PDF – (authorship statement)
- ✓ FAMILY NAME-declaration.PDF – (declaration of potential conflict of interest)
- ✓ FAMILY NAME-fig1.tiff – (Figure 1)

1.4. Peer Review Process

A manuscript submitted for publication will be submitted to the review process as long as it fits the following criteria:

- The study was not previously published, nor has been submitted simultaneously for consideration of publication elsewhere;
- All persons listed as authors approved its submission to JASPE;
- Any person cited as a source of personal communication has approved the quote;
- The opinions expressed by the authors are their exclusive responsibility;
- The author signs a formal statement that the submitted manuscript complies with the directions and guidelines of JASPE.

The editors-in-chief and associate editors will make a preliminary analysis regarding the appropriateness, quality, originality and written style/grammar of the submitted manuscript. The editors reserve the right to request additional information, corrections, and guideline compliance before they submit the manuscript to the ad-hoc review process.

JASPE uses ad-hoc reviewers, who volunteer to analyze the merit of the study. Typically, one or two expert reviewers are consulted in a double-blind process. Authors are notified by e-mail when their submission has been accepted (or rejected). Minor changes in the text may be made at the discretion of the editors-in-chief and/or associate editors. Changes can include spelling and grammar in the chosen language, written style, journal citations, and reference guidelines. The author is notified of changes via email. The final version is available to the author for his or her approval before it is published.

1.5. Open Access License and Publisher Copyright Policies

JASPE applies the Creative Commons Attribution (CC BY) license to articles and other works it publishes. If author(s) submit its paper for publication by JASPE, they agree to have the CC BY license applied to their work. Under this Open Access license, the author(s) agree that anyone can reuse their article in whole or part for any purpose, for free, even for commercial purposes. Anyone may copy, distribute, or reuse the content as long as the author(s) and original source are properly cited. This facilitates freedom in re-use and also ensures that JASPE content can be mined without barriers for the needs of research. On the other hand, the author(s) may use content owned by someone else in their article if they have written permission to do so. If the manuscript contains content such as photos, images, figures, tables, audio files, videos, et cetera, that the author(s) do not own, JASPE will require them to provide it with proof that the owner of that content has given them written permission to use it, and has approved of the CC BY license being applied to their content. Otherwise, JASPE will ask the author(s) to remove that content and/or replace it with other content that you own or have such permission to use. JASPE provides a form the author(s) can use to ask for and obtain permission from the owner.

In addition, the author(s) may freely use the content they previously published in a paper through another publisher and they own the rights to that content; however, that's not necessarily the case and it depends on the license that covers the other paper. Some publishers allow free and unrestricted reuse of article content they own, such as under the CC BY

license. Other publishers use licenses that allow reuse only if the same license is applied by the person or publisher reusing the content. If the article was published under a CC BY license or another license that allows free and unrestricted use, the author(s) may use the content in the submitted manuscript provided that the author(s) give proper attribution, as explained above. If the content was published under a more restrictive license, the author(s) must ascertain what rights they have under that license. JASPE advices the author(s) not to include any content in the submitted manuscript which they do not have rights to use, and always give proper attribution.

The editors of JASPE consider plagiarism to be a serious breach of academic ethics. Any author who practices plagiarism (in part or totality) will be suspended for six years from submitting new submissions to JASPE. If such a manuscript is approved and published, public exposure of the article with a printed mark ("plagiarized" or "retracted") on each page of the published file, as well as suspension for future publication for at least six years, or a period determined by the editorial board. Third party plagiarized authors or institutions will be notified, informing them about the faulty authors. Plagiarism will result in immediate rejection of the manuscript.

JASPE only publishes studies that have been approved by an institutional ethics committee (when a study involves humans or animals). Fail to provide such information prevent its publication. To ensure these requirements, it is essential that submission documentation is complete. If you have not completed this step yet, go to JASPE website and fill out the two required documents: Declaration of Potential Conflict of Interest and Authorship Statement. Whether or not your study uses humans or animals, these documents must be completed and signed by all authors and attached as supplementary files in the originally submitted manuscript.

1.6. After Acceptance

After the manuscript has been accepted, authors will receive a PDF version of the manuscripts for authorization, as it should look in printed version of JASPE. Authors should carefully check for omissions. Reporting errors after this point will not be possible and the Editorial Board will not be eligible for them.

Should there be any errors, authors should report them to the Office e-mail address **jaspe@ac.me**. If there are not any errors authors should also write a short e-mail stating that they agree with the received version.

1.7. Code of Conduct Ethics Committee of Publications

JASPE is hosting the Code of Conduct Ethics Committee of Publications of the **COPE** (the Committee on Publication Ethics), which provides a forum for publishers and Editors of scientific journals to discuss issues relating to the integrity of the work submitted to or published in their journals.

2. MANUSCRIPT STRUCTURE

2.1. Title Page

The first page of the manuscripts should be the title page, containing: title, type of publication, running head, authors, affiliations, corresponding author, and manuscript information. *See* example:

Analysis of Dietary Intake and Body Composition of Female Athletes over a Competitive Season

Original Scientific Paper

Diet and Body Composition of Female Athletes

Svetlana Nepocatych[1], Gytis Balilionis[1], Eric K. O'Neal[2]

[1]Elon University, Department of Exercise Science1, Elon, NC 27215
[2]University of North Alabama, Department of Health, Physical Education and Recreation, Florence, AL 35632

Corresponding author:

S. Nepocatych

Elon University

Department of Exercise Science

100 Campus Dr.

2525 CB

Elon, NC 27244

United States

E-mail: snepocatych@elon.edu

Word count: 2,946

Word count: 4259

Abstract word count: 211

Number of Tables: 3

2.1.1. Title

Title should be short and informative and the recommended length is no more than 20 words. The title should be in Title Case, written in uppercase and lowercase letters (initial uppercase for all words except articles, conjunctions, short prepositions no longer than four letters etc.) so that first letters of the words in the title are capitalized. Exceptions are words like: "and", "or", "between" etc. The word following a colon (:) or a hyphen (-) in the title is always capitalized.

2.1.2. Type of publication

Authors should suggest the type of their submission.

2.1.3. Running head

Short running title should not exceed 50 characters including spaces.

2.1.4. Authors

The form of an author's name is first name, middle initial(s), and last name. In one line list all authors with full names separated by a comma (and space). Avoid any abbreviations of academic or professional titles. If authors belong to different institutions, following a family name of the author there should be a number in superscript designating affiliation.

2.1.5. Affiliations

Affiliation consists of the name of an institution, department, city, country/territory (in this order) to which the author(s) belong and to which the presented / submitted work should be attributed. List all affiliations (each in a separate line) in the order corresponding to the list of authors. Affiliations must be written in English, so carefully check the official English translation of the names of institutions and departments.

Only if there is more than one affiliation, should a number be given to each affiliation in order of appearance. This number should be written in superscript at the beginning of the line, separated from corresponding affiliation with a space. This number should also be put after corresponding name of the author, in superscript with no space in between.

If an author belongs to more than one institution, all corresponding superscript digits, separated with a comma with no space in between, should be present behind the family name of this author.

In case all authors belong to the same institution affiliation numbering is not needed.

Whenever possible expand your authors' affiliations with departments, or some other, specific and lower levels of organization.

2.1.6. Corresponding author

Corresponding author's name with full postal address in English and e-mail address should appear, after the affiliations. It is preferred that submitted address is institutional and not private. Corresponding author's name should include only initials of the first and middle names separated by a full stop (and a space) and the last name. Postal address should be written in the following line in sentence case. Parts of the address should be separated by a comma instead of a line break. E-mail (if possible) should be placed in the line following the postal address. Author should clearly state whether or not the e-mail should be published.

2.1.7. Manuscript information

All authors are required to provide word count (excluding title page, abstract, tables/figures, figure legends, Acknowledgements, Conflict of Interest, and References), the Abstract word count, the number of Tables, and the number of Figures.

2.2. Abstract

The second page of the manuscripts should be the abstract and key words. It should be placed on second page of the manuscripts after the standard title written in upper and lower case letters, bold.

Since abstract is independent part of your paper, all abbreviations used in the abstract should also be explained in it. If an abbreviation is used, the term should always be first written in full with the abbreviation in parentheses immediately after it. Abstract should not have any special headings (e.g., Aim, Results…).

Authors should provide up to six key words that capture the main topics of the article. Terms from the Medical Subject Headings (MeSH) list of Index Medicus are recommended to be used.

Key words should be placed on the second page of the manuscript right below the abstract, written in italic. Separate each key word by a comma (and a space). Do not put a full stop after the last key word. *See* example:

Abstract

Results of the analysis of

Key words: *spatial memory, blind, transfer of learning, feedback*

2.3. Main Chapters

Starting from the third page of the manuscripts, it should be the main chapters. Depending on the type of publication main manuscript chapters may vary. The general outline is: Introduction, Methods, Results, Discussion, Acknowledgements (optional), Conflict of Interest (optional), and Title, Author's Affiliations, Abstract and Key words must be in English (for both each chosen language of full paper). However, this scheme may not be suitable for reviews or publications from some areas and authors should then adjust their chapters accordingly but use the general outline as much as possible.

2.3.1. Headings

Main chapter headings: written in bold and in Title Case. *See* example:

- ✓ **Methods**

Sub-headings: written in italic and in normal sentence case. Do not put a full stop or any other sign at the end of the title. Do not create more than one level of sub-heading. *See* example:

- ✓ *Table position of the research football team*

2.3.2 Ethics

When reporting experiments on human subjects, there must be a declaration of Ethics compliance. Inclusion of a statement such as follow in Methods section will be understood by the Editor as authors' affirmation of compliance: "This study was approved in advance by [name of committee and/or its institutional sponsor]. Each participant voluntarily provided written informed consent before participating." Authors that fail to submit an Ethics statement will be asked to resubmit the manuscripts, which may delay publication.

2.3.3 Statistics reporting

JASPE encourages authors to report precise p-values. When possible, quantify findings and present them with appropriate indicators of measurement error or uncertainty (such as confidence intervals). Use normal text (i.e., non-capitalized, non-italic) for statistical term "p".

2.3.4. 'Acknowledgements' and 'Conflict of Interest' (optional)

All contributors who do not meet the criteria for authorship should be listed in the 'Acknowledgements' section. If applicable, in 'Conflict of Interest' section, authors must clearly disclose any grants, financial or material supports, or any sort of technical assistances from an institution, organization, group or an individual that might be perceived as leading to a conflict of interest.

2.4. References

References should be placed on a new page after the standard title written in upper and lower case letters, bold.

All information needed for each type of must be present as specified in guidelines. Authors are solely responsible for accuracy of each reference. Use authoritative source for information such as Web of Science, Medline, or PubMed to check the validity of citations.

2.4.1. References style

JASPE adheres to the American Psychological Association 6th Edition reference style. Check "American Psychological Association. (2009). Concise rules of APA style. American Psychological Association." to ensure the manuscripts conform to this reference style. Authors using EndNote® to organize the references must convert the citations and bibliography to plain text before submission.

2.4.2. Examples for Reference citations

One work by one author
- ✓ In one study (Reilly, 1997), soccer players
- ✓ In the study by Reilly (1997), soccer players
- ✓ In 1997, Reilly's study of soccer players

Works by two authors
- ✓ Duffield and Marino (2007) studied
- ✓ In one study (Duffield & Marino, 2007), soccer players
- ✓ In 2007, Duffield and Marino's study of soccer players

Works by three to five authors: cite all the author names the first time the reference occurs and then subsequently include only the first author followed by et al.
- ✓ First citation: Bangsbo, Iaia, and Krustrup (2008) stated that
- ✓ Subséquent citation: Bangsbo et al. (2008) stated that

Works by six or more authors: cite only the name of the first author followed by et al. and the year
- ✓ Krustrup et al. (2003) studied
- ✓ In one study (Krustrup et al., 2003), soccer players

Two or more works in the same parenthetical citation: Citation of two or more works in the same parentheses should be listed in the order they appear in the reference list (i.e., alphabetically, then chronologically)
- ✓ Several studies (Bangsbo et al., 2008; Duffield & Marino, 2007; Reilly, 1997) suggest that

2.4.3. Examples for Reference list

Journal article (print):

Nepocatych, S., Balilionis, G., & O'Neal, E. K. (2017). Analysis of dietary intake and body composition of female athletes over a competitive season. *Montenegrin Journal of Sports Science and Medicine, 6*(2), 57-65. doi: 10.26773/mjssm.2017.09.008

Duffield, R., & Marino, F. E. (2007). Effects of pre-cooling procedures on intermittent-sprint exercise performance in warm conditions. *European Journal of Applied Physiology, 100*(6), 727-735. doi: 10.1007/s00421-007-0468-x

Krustrup, P., Mohr, M., Amstrup, T., Rysgaard, T., Johansen, J., Steensberg, A., Bangsbo, J. (2003). The yo-yo intermittent recovery test: physiological response, reliability, and validity. *Medicine and Science in Sports and Exercise, 35*(4), 697-705. doi: 10.1249/01.MSS.0000058441.94520.32

Journal article (online; electronic version of print source):

Williams, R. (2016). Krishna's Neglected Responsibilities: Religious devotion and social critique in eighteenth-century North India [Electronic version]. *Modern Asian Studies, 50*(5), 1403-1440. doi:10.1017/S0026749X14000444

Journal article (online; electronic only):

Chantavanich, S. (2003, October). Recent research on human trafficking. *Kyoto Review of Southeast Asia, 4*. Retrieved November 15, 2005, from http://kyotoreview.cseas.kyoto-u.ac.jp/issue/issue3/index.html

Conference paper:

Pasadilla, G. O., & Milo, M. (2005, June 27). *Effect of liberalization on banking competition*. Paper presented at the conference on Policies to Strengthen Productivity in the Philippines, Manila, Philippines. Retrieved August 23, 2006, from http://siteresources.worldbank.org/INTPHILIPPINES/Resources/Pasadilla.pdf

Encyclopedia entry (print, with author):

Pittau, J. (1983). Meiji constitution. In *Kodansha encyclopedia of Japan* (Vol. 2, pp. 1-3). Tokyo: Kodansha.

Encyclopedia entry (online, no author):

Ethnology. (2005, July). In *The Columbia encyclopedia* (6th ed.). New York: Columbia University Press. Retrieved November 21, 2005, from http://www.bartleby.com/65/et/ethnolog.html

Thesis and dissertation:

Pyun, D. Y. (2006). *The proposed model of attitude toward advertising through sport.* Unpublished Doctoral Dissertation. Tallahassee, FL: The Florida State University.

Book:
Borg, G. (1998). *Borg's perceived exertion and pain scales*: Human kinetics.

Chapter of a book:
Kellmann, M. (2012). Chapter 31-Overtraining and recovery: Chapter taken from Routledge Handbook of Applied Sport Psychology ISBN: 978-0-203-85104-3 *Routledge Online Studies on the Olympic and Paralympic Games* (Vol. 1, pp. 292-302).

Reference to an internet source:
Agency. (2007). Water for Health: Hydration Best Practice Toolkit for Hospitals and Healthcare. Retrieved 10/29, 2013, from www.rcn.org.uk/newsevents/hydration

2.5. Tables

All tables should be included in the main manuscript file, each on a separate page right after the Reference section.

Tables should be presented as standard MS Word tables.

Number (Arabic) tables consecutively in the order of their first citation in the text.

Tables and table headings should be completely intelligible without reference to the text. Give each column a short or abbreviated heading. Authors should place explanatory matter in footnotes, not in the heading. All abbreviations appearing in a table and not considered standard must be explained in a footnote of that table. Avoid any shading or coloring in your tables and be sure that each table is cited in the text.

If you use data from another published or unpublished source, it is the authors' responsibility to obtain permission and acknowledge them fully.

2.5.1. Table heading

Table heading should be written above the table, in Title Case, and without a full stop at the end of the heading. Do not use suffix letters (e.g., Table 1a, 1b, 1c); instead, combine the related tables. *See* example:

- ✓ **Table 1.** Repeated Sprint Time Following Ingestion of Carbohydrate-Electrolyte Beverage

2.5.2. Table sub-heading

All text appearing in tables should be written beginning only with first letter of the first word in all capitals, i.e., all words for variable names, column headings etc. in tables should start with the first letter in all capitals. Avoid any formatting (e.g., bold, italic, underline) in tables.

2.5.3. Table footnotes

Table footnotes should be written below the table.

General notes explain, qualify or provide information about the table as a whole. Put explanations of abbreviations, symbols, etc. here. General notes are designated by the word *Note* (italicized) followed by a period.

- ✓ *Note.* CI: confidence interval; Con: control group; CE: carbohydrate-electrolyte group.

Specific notes explain, qualify or provide information about a particular column, row, or individual entry. To indicate specific notes, use superscript lowercase letters (e.g. $^{a, b, c}$), and order the superscripts from left to right, top to bottom. Each table's first footnote must be the superscript ^{a}.

- ✓ ^{a}One participant was diagnosed with heat illness and n = 19.^{b}n =20.

Probability notes provide the reader with the results of the texts for statistical significance. Probability notes must be indicated with consecutive use of the following symbols: * † ‡ § ¶ || etc.

- ✓ *P<0.05,†p<0.01.

2.5.4. Table citation

In the text, tables should be cited as full words. *See* example:

- ✓ Table 1 (first letter in all capitals and no full stop)
- ✓ ...as shown in Tables 1 and 3. (citing more tables at once)
- ✓ ...result has shown (Tables 1-3) that... (citing more tables at once)
- ✓ ....in our results (Tables 1, 2 and 5)... (citing more tables at once)

2.6. Figures

On the last separate page of the main manuscript file, authors should place the legends of all the figures submitted separately.

All graphic materials should be of sufficient quality for print with a minimum resolution of 600 dpi. JASPE prefers TIFF, EPS and PNG formats.

If a figure has been published previously, acknowledge the original source and submit a written permission from the copyright holder to reproduce the material. Permission is required irrespective of authorship or publisher except for documents in the public domain. If photographs of people are used, either the subjects must not be identifiable or their pictures must be accompanied by written permission to use the photograph whenever possible permission for publication should be obtained.

Figures and figure legends should be completely intelligible without reference to the text.

The price of printing in color is 50 EUR per page as printed in an issue of JASPE.

2.6.1. Figure legends

Figures should not contain footnotes. All information, including explanations of abbreviations must be present in figure legends. Figure legends should be written bellow the figure, in sentence case. *See* example:

- ✓ **Figure 1.** Changes in accuracy of instep football kick measured before and after fatigued. SR – resting state, SF – state of fatigue, *p>0.01, †p>0.05.

2.6.2. Figure citation

All graphic materials should be referred to as Figures in the text. Figures are cited in the text as full words. *See* example:

- ✓ Figure 1
  - × figure 1
  - × Figure 1.
  - ✓ ….exhibit greater variance than the year before (Figure 2). Therefore…
  - ✓ ….as shown in Figures 1 and 3. (citing more figures at once)
  - ✓ ….result has shown (Figures 1-3) that... (citing more figures at once)
  - ✓ ….in our results (Figures 1, 2 and 5)... (citing more figures at once)

2.6.3. Sub-figures

If there is a figure divided in several sub-figures, each sub-figure should be marked with a small letter, starting with a, b, c etc. The letter should be marked for each subfigure in a logical and consistent way. *See* example:

- ✓ Figure 1a
- ✓ …in Figures 1a and b we can…
- ✓ …data represent (Figures 1a-d)…

2.7. Scientific Terminology

All units of measures should conform to the International System of Units (SI).

Measurements of length, height, weight, and volume should be reported in metric units (meter, kilogram, or liter) or their decimal multiples.

Decimal places in English language are separated with a full stop and not with a comma. Thousands are separated with a comma.

Percentage	Degrees	All other units of measure	Ratios	Decimal numbers
✓ 10%	✓ 10º	✓ 10 kg	✓ 12:2	✓ 0.056
× 10 %	× 10 º	× 10kg	× 12 : 2	× .056

Signs should be placed immediately preceding the relevant number.		
✓ 45±3.4	✓ p<0.01	✓ males >30 years of age
× 45 ± 3.4	× p < 0.01	× males > 30 years of age

2.8. Latin Names

Latin names of species, families etc. should be written in italics (even in titles). If you mention Latin names in your abstract they should be written in non-italic since the rest of the text in abstract is in italic. The first time the name of a species appears in the text both genus and species must be present; later on in the text it is possible to use genus abbreviations. *See* example:

- ✓ First time appearing: *musculus biceps brachii*

Abbreviated: *m. biceps brachii*

ISSN 1451-7485 eISSN 2337-0351
SportMont
www.sportmont.ucg.ac.me

ISSN 1451-7485

Journal Sport Mont (SM) is a print (ISSN 1451-7485) and electronic scientific journal (eISSN 2337-0351) aims to present easy access to the scientific knowledge for sport-conscious individuals using contemporary methods. The purpose is to minimize the problems like the delays in publishing process of the articles or to acquire previous issues by drawing advantage from electronic medium. Hence, it provides:

- Open-access and freely accessible online;
- Fast publication time;
- Peer review by expert, practicing researchers;
- Post-publication tools to indicate quality and impact;
- Community-based dialogue on articles;
- Worldwide media coverage.

Journal SM is published three times a year, in February, June and October of each year. Journal SM publishes original scientific papers, review papers, editorials, short reports, peer review - fair review, as well as invited papers and award papers in the fields of Sports Science and Medicine, as well as it can function as an open discussion forum on significant issues of current interest.

Journal SM covers all aspects of sports science and medicine; all clinical aspects of exercise, health, and sport; exercise physiology and biophysical investigation of sports performance; sport biomechanics; sports nutrition; rehabilitation, physiotherapy; sports psychology; sport pedagogy, sport history, sport philosophy, sport sociology, sport management; and all aspects of scientific support of the sports coaches from the natural, social and humanistic side.

Prospective authors should submit manuscripts for consideration in Microsoft Word-compatible format. For more complete descriptions and submission instructions, please access the Guidelines for Authors pages at the journal SM website: http://www.sportmont.ucg.ac.me/?sekcija=page&p=51. Contributors are urged to read journal SM's guidelines for the authors carefully before submitting manuscripts. Manuscripts submissions should be sent in electronic format to sportmont@ucg.ac.me or contact following Editors:

Dusko BJELICA, *Editor-in Chief – dbjelica@ucg.ac.me*
Zoran MILOSEVIC, *Editor-in Chief – zoranais@eunet.rs*
Jovan GARDASEVIC, *Managing Editor – jovan@ucg.ac.me*

Publication date: Winter issue – February 2019
Summer issue – June 2019
Autumn issue – October 2019

University of Montenegro

Cetinjska br.2
81 000 Podgorica
Montenegro

E-mail:
rektor@ac.me
rektorat@ac.me

Phone: + 382 20 414 255
Fax: + 382 20 414 230

Web:
www.ucg.ac.me

The University of Montenegro is the leading higher education and research institution in Montenegro. It is a public institution, established by the state, operating as a unique legal entity represented by the Rector. It is an integrated university organized on the model of the most European universities. Organizational units are competent for provision of study programmes, scientific-research and artistic work, use of allocated funds and membership in professional associations.

Since its foundation, the University of Montenegro has continuously been conducting reforms in the area of education and research, while since 2003 in line with the trends in EHEA. After adoption of the Bologna Declaration, University of Montenegro organized systematic preparation of documents aligned with it. Already in 2003, the experimental teaching programme started and today, all studies are organised in line with the Bologna principles. During the last two years systematic reforms of the University`s study programes have been conducted in order to harmonize domestic higher education system with European standards and market needs to highest extent.

The University of Montenegro has unique academic, business and development objectives. It comprises 19 faculties and two research institutes. The seat of the UoM is in Podgorica, the capital city, while university units are located in eight Montenegrin towns. The University support services and centers (advisory services, accounting department, international cooperation, career orientation) are located in the Rectorate.

Academic community of University of Montenegro is aware of the importance of its functioning for further development of the state and wider region. It has been so far, and will be in the future, the leader in processes of social and cultural changes, along with the economic development.

In the aspect of attaining its mission, University of Montenegro is oriented towards the priority social needs of the time in which it accomplishes its mission; open for all the students and staff exclusively based on their knowledge and abilities; dedicated to preservation of multicultural and multi-ethnic society in Montenegro; entrepreneurial in stimulating social and economic application of supreme achievements within the scope of its activities.

In 2015/16 there were a total of 1.192 employees at UoM, 845 of which were engaged in teaching. In the same year there were 20.236 students registered at all three cycles of studies.

Internationalization is high on the agenda of UoM priorities, thus it has participated in a number of international projects – over 50 projects funded under the Tempus programme, over 15 Erasmus Mundus Action 2 projects for student mobility, a number of projects under FP7 funding scheme or IPA supported projects, Erasmus + capacity building and International credit mobility projects and other.

For more information about University of Montenegro, please visit our website www.ucg.ac.me or send e-mail to pr.centar@ac.me.

USEFUL CONTACTS

Editorial enquiries and journal proposals:
Dusko Bjelica
Stevo Popovic
Editors-in-Chief
Email: **office@mjssm.me**

Selcuk Akpinar
Executive Editor
Email: **office@mjssm.me**

Marketing enquiries:
Jovan Gardasevic
Marketing Manager
Email: **administration@mjssm.me**

Sports Science and Medicine Journals

from Montenegrin Sports Academy

We have expanded the quality of our journals considerably over the past years and can now claim to be the market leader in terms of breadth of coverage.

As we continue to increase the quality of our publications across the field, we hope that you will continue to regard MSA journals as authoritative and stimulating sources for your research. We would be delighted to receive your comments and suggestions, mostly due to the reason your proposals are always welcome.

Look Inside!

Journal Sport Mont

Editors-in-Chief: **Dusko Bjelica**, Montenegro; **Zoran Milosevic**, Serbia
Managing Editor: **Jovan Gardasevic**, Montenegro

Volume 17, 2019, 3 issues per year; Print ISSN: 1451-7485, Online ISSN: 2337-0351

Journal Sport Mont is a scientific journal that provides: Open-access and freely accessible online; Fast publication time; Peer review by expert, practicing researchers; Post-publication tools to indicate quality and impact; Community-based dialogue on articles; Worldwide media coverage. Journal SM is published three times a year, in February, June and October of each year. Journal SM publishes original scientific papers, review papers, editorials, short reports, peer review - fair review, as well as invited papers and award papers in the fields of Sports Science and Medicine, as well as it can function as an open discussion forum on significant issues of current interest.

www.sportmont.ucg.ac.me

Montenegrin Journal of Sports Science and Medicine

Editors-in-Chief: **Dusko Bjelica**, Montenegro; **Stevo Popovic**, Montenegro
Executive Editor: **Selcuk Akpınar**, Turkey
Associate Editors: **Mehmet Uygur**, USA; **Catalina Casaru**, USA; and **Predrag Bozic**, Serbia

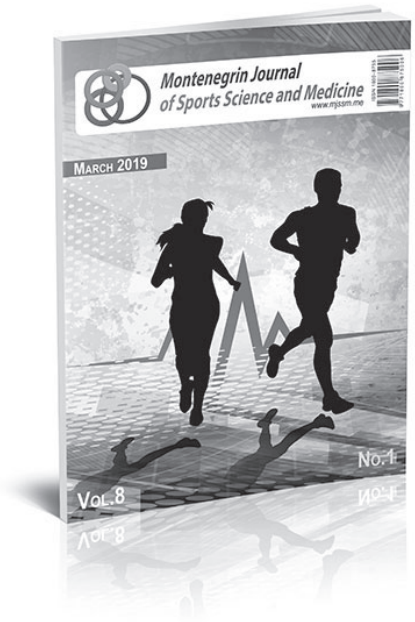
Volume 8, 2019, 2 issues per year; Print ISSN: 1800-8755, Online ISSN: 1800-8763

Montenegrin Journal of Sports Science and Medicine (MJSSM) is published biannually, in September and March of each year. MJSSM publishes original scientific papers, review papers, editorials, short reports, peer review - fair review, as well as invited papers and award papers in the fields of Sports Science and Medicine, as well as it can function as an open discussion forum on significant issues of current interest. MJSSM covers all aspects of sports science and medicine; all clinical aspects of exercise, health, and sport; exercise physiology and biophysical investigation of sports performance; sport biomechanics; sports nutrition; rehabilitation, physiotherapy; sports psychology; sport pedagogy, sport history, sport philosophy, sport sociology, sport management; and all aspects of scientific support of the sports coaches from the natural, social and humanistic side.

www.mjssm.me

Montenegrin Journal of Sports Science and Medicine

MONTENEGRIN JOURNAL OF SPORTS SCIENCE AND MEDICINE



ISSN 1800-8755

CALL FOR CONTRIBUTIONS

Montenegrin Journal of Sports Science and Medicine (MJSSM) is a print (ISSN 1800-8755) and electronic scientific journal (eISSN 1800-8763) aims to present easy access to the scientific knowledge for sport-conscious individuals using contemporary methods. The purpose is to minimize the problems like the delays in publishing process of the articles or to acquire previous issues by drawing advantage from electronic medium. Hence, it provides:

- Open-access and freely accessible online;
- Fast publication time;
- Peer review by expert, practicing researchers;
- Post-publication tools to indicate quality and impact;
- Community-based dialogue on articles;
- Worldwide media coverage.

MJSSM is published biannually, in September and March of each year. MJSSM publishes original scientific papers, review papers, editorials, short reports, peer review - fair review, as well as invited papers and award papers in the fields of Sports Science and Medicine, as well as it can function as an open discussion forum on significant issues of current interest.

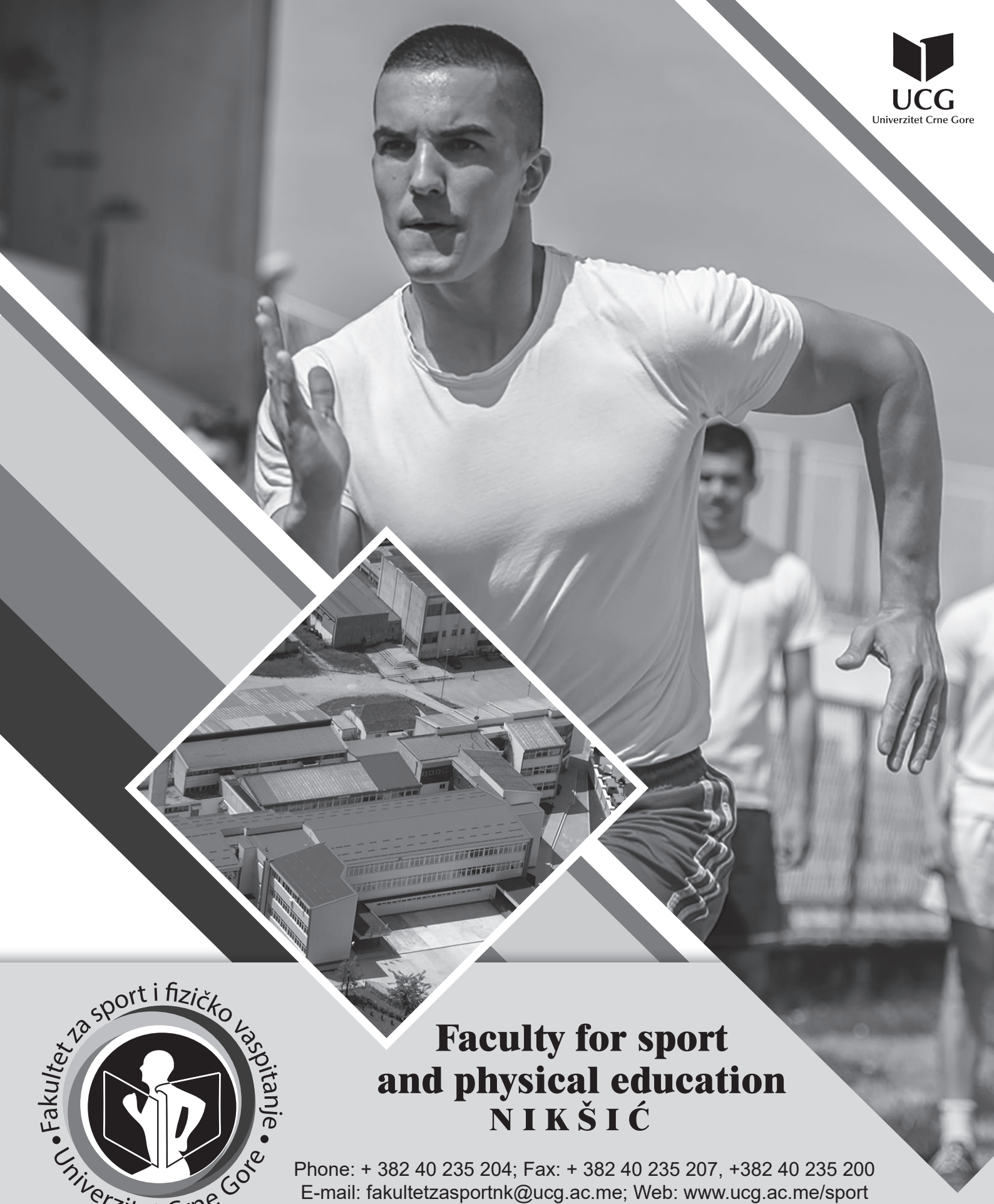
MJSSM covers all aspects of sports science and medicine; all clinical aspects of exercise, health, and sport; exercise physiology and biophysical investigation of sports performance; sport biomechanics; sports nutrition; rehabilitation, physiotherapy; sports psychology; sport pedagogy, sport history, sport philosophy, sport sociology, sport management; and all aspects of scientific support of the sports coaches from the natural, social and humanistic side.

Prospective authors should submit manuscripts for consideration in Microsoft Word-compatible format. For more complete descriptions and submission instructions, please access the Guidelines for Authors pages at the MJSSM website: http://www.mjssm.me/?sekcija=page&p=51. Contributors are urged to read MJSSM's guidelines for the authors carefully before submitting manuscripts. Manuscripts submissions should be sent in electronic format to office@mjssm.me or contact following Editors:

Dusko BJELICA, Editor-in Chief – dbjelica@ucg.ac.me
Stevo POPOVIC, Editor-in Chief – stevop@ucg.ac.me
Selçuk AKPINAR, Executive Editor – sakpinar@nevsehir.edu.tr

Publication date: Spring issue – March 2019
Autumn issue – September 2019

UCG
Univerzitet Crne Gore



Fakultet za sport i fizičko vaspitanje
Univerzitet Crne Gore

Faculty for sport and physical education

N I K Š I Ć

Phone: + 382 40 235 204; Fax: + 382 40 235 207, +382 40 235 200
E-mail: fakultetzasportnk@ucg.ac.me; Web: www.ucg.ac.me/sport

Znanje i zdravlje!

UCG
Univerzitet Crne Gore

UNIVERZITET CRNE GORE
PRAVNI FAKULTET – PODGORICA

UNIVERZITET CRNE GORE
PRAVNI FAKULTET PODGORICA

Faculty of Law was founded on October 27th, 1972 in Podgorica as a scientific and artistic educational institution, in which educational and research work was organized in the area of law and similar social studies. While making into law the establishment of this institution, Assembly of Socialistic Republic of Montenegro highlighted that "The establishment of this institution of high education is necessary for meeting overall demands of the society of the Republic". Faculty of Law is one of the founding fathers of the University of Montenegro.

During the forty-five years of its existence Faculty of Law grew to a modern, contemporary, scientific and artistic educational institution. Forty-five generations studied at the faculty. About 17.000 students enrolled at the faculty and 4285 students graduated from the faculty. About 15 percent of the students studied abroad. Part of the best students continued postgraduate and doctoral studies at prominent university centers. Most of the former students stayed in Montenegro due to family ties. 88 professors and associates worked at the faculty, out of whom there were 26 guest professors. Today most of the professors and cadre at the faculty are former students.

Faculty organizes graduate and postgraduate studies. There are teaching and cadre resources for organizing specialist and doctoral studies in all the areas of law.

As a university branch Faculty of Law realizes a big number of its planned aims and tasks and finds soulutions for many important questions of cadre organization, technical and material problems. With the help of the University of Montenegro, faculty largely develops the international coorporation net.

Faculty follows world trends and achievements in the area of high education with the aim to coordinate its work with European and world demands. This year faculty made the first steps in realization of Bologna declaration. There is enough cadre for all the necessary teaching at the faculty.

The faculty was founnded because of expression of need to reach the neccessary standard for socio-economic, political, cultural and social development of Montenegro. During its overall existence faculty shared the fate with Montenegrin society. It will continue to do so by making steps towards implementing new practises and creating new relations, with the help of implementatation of modern European trends .

The faculty is a complex organization and managing institution nowadays.

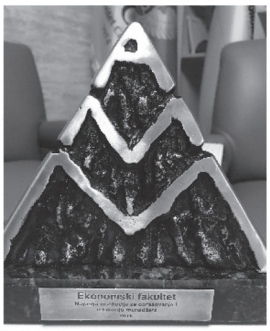
University of Montenegro
FACULTY of ECONOMICS PODGORICA

UCG
University of Montenegro

Faculty of Economics
University of Montenegro

The Faculty of Economics celebrated its 57th anniversary this year, and it is the oldest higher education institution in the country. Since its establishment, 8,630 students graduated at our Faculty.

Today, Faculty of Economics is a largely interdisciplinary institution, characterized by expressed dynamism in its work. Employees at the Faculty are dedicated to constant improvements and enhancements, all in accordance with the needs brought by the changes.



We provide our students with the best theoretical and practical knowledge, enabling them to develop critical spirit in approaching economic phenomena and solving concrete problems in daily work. From September 2017, at the Faculty, the new generation will start a 3 + 2 + 3 study, which will improve the quality of studying.

Development of Faculty of Economics in the coming period will follow the vision of development of the University of Montenegro, pursuing full achievement of its mission

Comprehensive literature, contemporary authors and works have always been imperative in creation of new academic directions at Faculty of Economics, which will form the basis of our future.

Faculty and its employees are dedicated to developing interest in strengthening the entrepreneurial initiative, creative and interdisciplinary approach among young people, using modern teaching and research methods. In this regard, the Faculty has modern textbooks and adequate IT technology, which supports the objectives set.

Jovana Tomaševića 37
81000 Podgorica, Montenegro

www.ekonomija.ac.me
ekonomija@ac.me

Phone: + 382 20 241 138
Fax: + 382 20 244 588

UNIVERSITY OF MONTENEGRO
FACULTY OF MECHANICAL ENGINEERING
Podgorica

www. ucg.ac.me/mf

Mechanical engineering studies in Montenegro started during the school year 1970/71. On April 15th, within the Technical Faculty, the Department of Mechanical Engineering was formed. The Department of Mechanical Engineering of the Technical Faculty was transformed in 1978 into the Faculty of Mechanical Engineering, within the University "Veljko Vlahović". Since 1992 the Faculty of Mechanical Engineering is an autonomous University unit of the University of Montenegro. It is situated in Podgorica.

The University of Montenegro is the only state university in the country, and the Faculty of Mechanical Engineering is the only faculty in Montenegro from the field of mechanical engineering.

Activities of the Faculty of Mechanical Engineering can be divided into three fields: teaching, scientific-research work and profes- sional work.

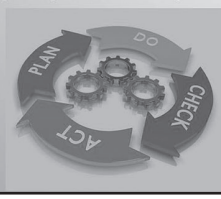
Two study programmes were accredited within the Faculty of Mechanical Engineering:

- Academic study programme MECHANICAL ENGINEERING
- Academic study programme ROAD TRAFFIC

The study programmes are realised according to the Bologna system of studies in accordance to the formula 3+2+3.

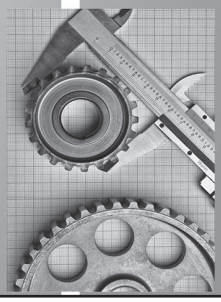
On the study program Mechanical Engineering it is possible to study next modules:

- Mechanical Engineering – Production
- Applied Mechanics and Construction
- Energetics
- Energy Efficiency
- Mechatronics
- Quality



At the Faculty of Mechanical Engineering, as organisational units, there are centres and laboratories through which scientific-re- search and professional work is done:

- Centre for Energetics
- Centre for Vehicles
- Centre for Quality
- Centre for Construction Mechanics
- Centre for Traffic and Mechanical Engi- neering Expertise
- Centre for transport machines and metal constructions
- 3D Centre
- Didactic Centre – Centre for Automation and Mechanomics training
- European Information and Innovation Centre
- Cooperation Training Centre
- Laboratory for Metal Testing
- Laboratory for Turbulent Flow Studies
- Laboratory for Vehicle Testing
- Laboratory for Attesting of Devices on the Technical Examination Line



CRNOGORSKI OLIMPIJSKI KOMITET
MONTENEGRIN OLYMPIC COMMITTEE

CIP – Каталогизација у публикацији
Национална библиотека Црне Горе, Цетиње

ISSN 2536-569X
COBISS.CG-ID 33826832

MSA Conference 2019

16th Annual Scientific Conference of Montenegrin Sports Academy "Sport, Physical Activity and Health: Contemporary Perspectives"

http://www.csakademija.me/conference/

CRNOGORSKA SPORTSKA AKADEMIJA
MONTENEGRIN SPORTS ACADEMY

4th - 7th April 2019,
Dubrovnik - Croatia