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Water Polo Players of Montenegro and Serbia who participated in the FINA World Junior Water Polo Championship 2019 and Differences in their Body Composition

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Abstract

This research aimed to determine the differences between the junior (U20) water polo players of national teams of Montenegro and Serbia in the anthropometric characteristics and body composition. The first sub-sample of the subjects consisted of 15 water polo players of the Serbian national team, the vice-champions of the FINA World Men's Junior Water Polo Championship in Kuwait 2019, and the second sub-sample consisted of 18 water polo players of the Montenegrin national team, who occupied the sixth position on the championship. The players were tested at the final preparations just before the World Championship in Kuwait in 2019. Anthropometric characteristics and body composition were evaluated using a battery of 11 variables: body height, body weight, triceps skinfold, biceps skinfold, skinfold of the back, abdominal skinfold, upper-leg skinfold, lower leg skinfold, body mass index, fat percentage, and muscle mass. Based on the results, it can be stated that the values of all the variables are highly similar to all of the water polo players of these two countries. The t-test found that the water polo players of the two national teams do not have statistically significant differences in the variables for assessing anthropometric characteristics and body composition. The results obtained in this research can serve as model parameters for the estimated variables for all water polo players (U20) in the World , because the players that have been analysed were the best and the most successful water polo players in their countries, and participants in the World Championship in Kuwait 2019.

Keywords: *Water Polo, Anthropometric Characteristics, Young Athletes, BMI of Athletes*

Introduction

Water polo is a popular sport worldwide. It is a highly dynamic and fast team game that, with its richness of movement, belongs to the category of polystructural sport games. Water polo is a sport characterized by numerous and various complex and dynamic kinesiological activities, which are then characterized by either cyclical or acyclical movement. It is full-contact sport, and rapidly growing sport in the World (Cecchi et al., 2019), characterized by different swimming intensities, duelling, acceleration and deceleration (Gardasevic, Akpinar, Popovic, & Bjelica, 2019a). In water polo, top scores can be achieved only under conditions of a well-programmed training process. High quality management of the training process depends on knowing the structure of certain anthropological capabilities and water polo players' characteristics, as well as their development. Various studies have been done to establish certain principles and norms for the transformational processes

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of the anthropological characteristics necessary for water polo, with anthropometric characteristics and body composition among them, as expected. Findings regarding anthropometric characteristics and body composition are of crucial importance for complex sports, such as water polo. The anthropometric space is defined by the longitudinal dimension of the skeleton, the transversal dimensionality of the skeleton, and the mass and volume of the body. The purpose of knowing anthropometric characteristics is to improve skills in many sports (Masanovic, Corluka, & Milosevic, 2018). The anthropometric status of top-level athletes is relatively homogeneous, depending on the sport, and can be defined as a model of athletic achievement (Gardasevic, Bjelica, Vasiljevic, & Masanovic, 2020a). Research on anthropometric characteristics and body composition among athletes of different sports indicates that athletes of different sports have specific characteristics (Bjelica, Gardasevic, Vasiljevic, Jeleskovic, & Covic, 2019; Popovic, Akpinar, Jaksic, Matic, & Bjelica, 2013), mostly because absolute size contributes a significant percentage of total variance associated with athletic success (Carvajal et al., 2012). Muscle mass improves performance in activities that require muscular strength and endurance, but also in those that require enviable aerobic ability (Rico-Sanz, 1998).

It is well known that water polo in Serbia and Montenegro have a long tradition and the best results in international competitions. Serbians and Montenegrins were the junior world champions several times. Serbia and Montenegro junior national teams are always top-ranked in Europe and the world.

It was expected that the national teams would continue with good results on the FINA World Men's Junior (U20) Water Polo Championship in Kuwait City (Kuwait) 12 - 20 December 2019, where twenty national teams participated. It is clear that these were the best players in Serbia, and Montenegro, at age 20, and that they had many years of quality training in order to qualify to wear a representative cap. It is well known in all sports and, therefore, in water polo that long-term and intensive training is one of the critical factors that enable athletes to reach and remain at the elite representative level (Gardasevic et al., 2019a). It became interesting for researchers to determine the models of anthropometric characteristics and body composition of the water polo players who play for these two national teams to determine the differences among them.

This research aimed to determine the anthropometric characteristics and body composition of junior (U20) water polo players of national teams of Serbia and Montenegro, who participated on the FINA World Men's Water Polo Championship 2019 in Kuwait City (Kuwait). The variables between these water polo players were compared, and the possible differences between them were determined.

Methods

Participants

A sample of the subjects consists of a total of 33 water polo players, divided into two sub-samples. The first sub-sample of the subjects consisted of 15 water polo players of the national team of Serbia of an average age of 18.40±1.12, the vice-champions on the FINA World Men's Junior Water Polo Championship in Kuwait 2019. The other sub-sample consisted of 18 water polo players of the national team of Montenegro of an average age of 18.44±0.98, who occupied the sixth position on the championship in Kuwait 2019 (Table 1).

Table 1. Final rankings (12 December 2019) at the FINA World Men's Junior Water Polo Championship in Kuwait 2019

National teams	Place
Greece	1
Serbia	**2**
Italy	3
Croatia	4
Spain	5
Montenegro	**6**
USA	7
Japan	8
Hungary	9
Canada	10
Australia	11
New Zealand	12
Russia	13
South Africa	14
Egypt	15
China	16
Brazil	17
Uzbekistan	18
Iran	19
Kuwait	20

Procedure

Players of the Montenegrin national team were tested at the final preparations in Niksic (Montenegro), one week before the World Championship in Kuwait. Players of the Serbian national team were tested at the final preparations in Kragujevac (Serbia), two days before departure for the World Championship in Kuwait. All participants signed the consent form approved by the Institutional Review Board of the University of Montene-

gro, which was in accordance with the Declaration of Helsinki as amended by the World Medical Association Declaration of Helsinki (World Medical Association, 2013). Anthropometric research has been carried out with respect to the basic rules and principles related to the selection of measuring instruments and measurement techniques, standardized in accordance with the International Biological Program guidelines. For this study, eight anthropometric measures have been taken: body height, body weight, triceps skinfold, biceps skinfold, skinfold of the back, abdominal skinfold, upper leg skinfold and lower leg skinfold, and three body composition assessment variables: body mass index, fat percentage and muscle mass. An anthropometer, calliper, and measuring tape were used for anthropometric measurements. To evaluate the body composition, a Tanita body fat scale (model BC-418MA) was used. The scale is based on the principle of the indirect measurement of the body composition; a safe electrical signal is transmitted through the body via electrodes located in the standalone unit. The Tanita Scale enables athletes to closely monitor their body weight, health condition and form with all relevant parameters.

Statistical analysis

The data obtained through the research were processed using descriptive and comparative statistical procedures. For each variable, central and dispersion parameters have been processed. The significance of the differences between the water polo players of the two national teams in the anthropometric characteristics and variables for assessing body composition was determined by t-tests, with statistical significance of $p<0.05$.

Results

The variables for assessing anthropometric characteristics and body composition of water polo players of Serbian and Montenegrin national teams are shown in Table 2.

Table 2. Descriptive data and differences between Serbian (N=15) and Montenegrin water polo players (N=18)

Variables	National teams	Mean±SD	Mean Difference	t	Sig.
Body height	Serbia	192.12±5.49	2.52	1.14	0.260
	Montenegro	189.60±6.89			
Body weight	Serbia	90.29±8.52	1.60	0.44	0.660
	Montenegro	88.69±11.72			
Triceps skinfold	Serbia	6.54±2.24	-1.31	-1.62	0.120
	Montenegro	7.85±2.38			
Biceps skinfold	Serbia	5.45±1.32	-0.90	-1.57	0.130
	Montenegro	6.35±1.86			
Skinfold of the back	Serbia	11.90±4.16	-0.21	-0.16	0.870
	Montenegro	12.11±3.31			
Abdominal skinfold	Serbia	13.87±6.47	-2.14	-0.87	0.390
	Montenegro	16.01±7.45			
Upper leg skinfold	Serbia	13.03±3.74	-0.18	-0.13	0.900
	Montenegro	13.21±4.25			
Lower leg skinfold	Serbia	10.96±4.15	1.00	0.75	0.460
	Montenegro	9.96±3.54			
Body mass index	Serbia	24.50±2.54	-0.09	-0.11	0.910
	Montenegro	24.59±2.20			
Fat percentage	Serbia	12.69±3.89	-0.43	-0.30	0.770
	Montenegro	13.13±4.39			
Muscle mass	Serbia	44.51±3.23	1.04	0.72	0.48

Note: Mean - Arithmetic mean; SD - Standard deviation; t - values of t test; Sig. - significant difference

Based on the central and dispersion parameters of the water polo players of Serbia and Montenegro (Table 2), it can be stated that the values of all the variables are very similar to all water polo players of this two countries. There were no significant differences in variables among the water polo players of the two national teams.

Discussion

This study aimed to determine the difference in the anthropometric characteristics and body composition of the junior (U20) water polo players of the Serbian national team, who won a silver medal at the FINA World Water Polo Championship in Kuwait City (Kuwait) 12-20 December 2019, and the water polo players of the Montenegrin national team, who occupied the sixth position at the World Championship. The results were obtained using a battery of 11 tests in the area of anthropometric characteristics and body composition. By examining the basic descriptive statistical parameters, it can be concluded that we have analysed the best selected junior age water polo players from these two countries. Similar results in their research were obtained by Kondric, Uljevic, Gabrilo, Kontić, & Sekulić (2012). It can be observed that the water polo players of two national teams are of the approximately similar mean values of the all variables analysed, which is not surprising because these are the two national teams of the same age, in countries where water polo is popular and in where water polo coaches are highly skilled. U20 water polo players have years of training experience and spend many hours in the pool each week. The results of t-test showed that the water polo players of two national teams do not differ significantly in the ana-

lysed variables, which is not surprising compared to the results achieved at the World U20 Water Polo Championship in Kuwait 2019. For all variables, some values are better for water polo players of the Serbian national team, some for those of the Montenegrin national team, although, insignificantly for statistics. All of the above mentioned indicates that water polo players of the Serbian and Montenegrin national teams have similar anthropometric parameters and body compositions. All of these players have long-term training before a greatest competitions and they are all top water polo players at the world level, so it is no surprise that there are no differences in anthropometric characteristics and body composition between them. Due to their lifestyle (constant training and sports nutrition), all top athletes take care of body composition, this is confirmed in research Melchiorri et al. (2018) where did not get differences in body weight and body composition in 13 water polo players after a three-month training program for the Olympic Games. Use by system of bioelectrical impedance for high-level athletes involved in long and intense training periods helps to evaluate the effects of training and to prevent any decrease in the performance level of body composition (Melchiorri et al., 2018).

Given that the concentration of the best water polo players U20 is at World Championship in Kuwait 2019, the assumption is that the mean values of the analysed variables of two national teams' water polo players should be the model values for all such clubs in the world (Table 3).

Table 3. Descriptive data of all 33 water polo players

Variables	Mean±SD
Age	18.42±1.03
Body height (cm)	190.74±6.33
Body weight (kg)	89.41±10.26
Triceps skinfold (mm)	7.25±2.37
Biceps skinfold (mm)	5.94±1.67
Skinfold of the back (mm)	12.02±3.66
Abdominal skinfold (mm)	15.04±6.99
Upper leg skinfold (mm)	13.12±3.96
Lower leg skinfold (mm)	10.41±3.79
Body mass index (kg/m^2)	24.55±2.32
Fat percentage (%)	12.93±4.11
Muscle mass (kg)	43.94±4.10

Note: Mean - Arithmetic mean; SD - Standard deviation

Based on the obtained results in this research, before the start of the World Championship in Kuwait, it could not be assumed which national team would achieve a better placement. The Kuwait Championships showed that they were the national teams in which the nuances decided the final standings. For example, the Serbian national team beat the Montenegrin national team in the quarterfinals with one goal difference in the last minute of the game, thus going into the medal fight. In the finals, the Serbian national team lost to the Greek national team by a small result and thus won a silver medal. After the defeat of the Serbian national team, the Montenegrin national team fought for 5th to 8th place (winning sixth place). All this confirms that these are the best water polo players in the world under the age of 20, many of whom already play for the senior national teams.

All water polo players of the two national teams had similar levels of subcutaneous adipose tissue. Different authors state the importance of body fat as a positive fact in water polo (Platanou, 2005; Peric, Zenic, Mandic, Sekulic, & Sajber, 2012), however in other studies it is not confirmed (Vila, Manchado, Abraldes, & Ferragut, 2018), and many researches showed that it is disruptive factor for athletes (Gardasevic, Bjelica, & Vasiljevic, 2020b; Masanovic, 2019; Gardasevic, Bjelica, & Vasiljevic, 2019b). Also, in previous studies of water polo players of this age, subcutaneous adipose tissue has been shown to be a disruptive factor in defence (Milanovic & Vuleta, 2013). It is well known that a low fat percentage is desirable for high physical performance in all sports. Although not every body composition characteristic is expected to play a role in optimal performance in professional sport, lower levels of body fat (that are specific to each player) are desirable for optimal performance, as body mass must be moved against gravity (Rienzi, Drust, Reilly, Carter, & Martin, 2000; S.M. Gil, J. Gil, Ruiz, A. Irazusta, & J. Irazusta, 2007).

In addition, all the water polo players of the two national teams had similar muscle mass values; water polo is a strenuous sport that takes place in water and requires significant muscle mass. Body height is important for swimming, and long arms are important for kicks and defence; however, there were no statistically significant differences between the water polo players of the two national teams, which is perhaps surprising, considering that the Serbian national team played the final of the World U20 Championship, and the Montenegrin national team dropped out in the quarter-final of the competition. The reason for the different placement may be found in the different levels of technical and tactical preparation, and functional and psychological preparation between water polo players of the two teams. Physical preparation at such championships is essential because it is done every day, and we have not analysed it. Experience in playing deciding matches at this level of competition can be the reason for different placement. The Serbian team has the most experience, and the Montenegrin team has less experience.

The national water polo associations of Serbia and Montenegro should turn to other research studies and check the functional-motoric status, psychological preparation as well as tactical training of their players, and analyse if there are differences at water polo players that influenced the result at this world championship, and whether there is room for improvement. The values obtained in this research can be useful for coaches of these national teams for making a comparison of their players with others and prepare their training in a way that enables the reduction of adverse parameters, and raise the beneficial ones to a higher lev-

el. That will surely make their water polo players even better and more successful. The results obtained in this research can serve as model parameters for the estimated variables for water polo players (U20) of all clubs in Serbia and Montenegro, because the players that have been analysed were the best and the most successful water polo players in their countries, and participants in the World Championship in Kuwait 2019.

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Conflict of Interest
The authors declare that there is no conflict of interest.

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References

Bjelica, D., Gardasevic, J., Vasiljevic, I., Jeleskovic, E., & Covic, N. (2019). Body Composition and Morphological Characteristics of Soccer Players in Bosnia and Herzegovina. *Kinesiologia Slovenica*, *25*, 5–13.

Carvajal, W., Betancourt, H., León, S., Deturnel, Y., Martínez, M., Echevarría, I., Castillo, M.E., & Serviat, N. (2012). Kinanthropometric Profile of Cuban Women Olympic Volleyball Champions. *MEDICC Review, 14*, 16-22.

Cecchi, N.J., Monroe, D.C., Fote, G.M., Small, S.L., & Hicks, J.W. (2019). Head impacts sustained by male collegiate water polo athletes. *PLoS ONE*, *14*, e0216369. doi: 10.1371/journal.pone.0216369

Gardasevic, J., Akpinar, S., Popovic, S., & Bjelica, D. (2019a). Increased Perceptual and Motor Performance of the Arms of Elite Water Polo Players. *Applied Bionics and Biomechanics*, 6763470. doi: 10.1155/2019/6763470

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

Gardasevic, J., Bjelica, D., Vasiljevic, I., & Masanovic, B. (2020a). Differences in body composition between young soccer players (U19) members of the best soccer clubs in Serbia, Bosnia and Herzegovina, and North Macedonia. *Pedagogy of Physical Culture and Sports*, *24*(4), 175-180. doi: 10.15561/26649837.2020.0404

Gardasevic, J., Bjelica, D., & Vasiljevic, I. (2020b). Differences in anthropometric characteristics between young soccer players (U19) members of the best soccer clubs in Montenegro, Bosnia and Herzegovina, and Kosovo. *Pedagogy of Physical Culture and Sports*, *24*(1), 21-25. doi: 10.15561/26649837.2020.0103

Gil, S.M., Gil, J., Ruiz, F., Irazusta, A., & Irazusta, J. (2007). Physiological and anthropometric characteristics of young football players according to their playing position: relevance for the selection process. *Journal of Strength and Conditioning Research*, *21*, 438-445.

Kondric, M., Uljevic, O., Gabrilo, G., Kontić, D., & Sekulić, D. (2012). General anthropometric and specific physical fitness profile of high-level junior water polo players. *Journal of Human Kinetics*, *32*, 157–165. doi: 10.2478/v10078-012-0032-6

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*, 37-46.

Masanovic, B. (2019). Comparative study of morphological characteristics and body composition between different team players from Serbian junior national league: soccer, handball, basketball and volleyball. *International Journal of Morphology*, *37*, 612-619.

Melchiorri, G., Viero, V., Sorge, R., Triossi, T., Campagna, A., Volpe, S.L., Lecis, D., Tancredi, V., & Andreoli, A. (2018). Body composition analysis to study long-term training effects in elite male water polo athletes. *The Journal of Sports Medicine and Physical Fitness*, *58*(9), 1269-1274. doi: 10.23736/S0022-4707.17.07208-5

Milanovic, D., & Vuleta, D. (2013). Association between morphological dimensions of water polo players and play performance indicators. *Sport Mont*, *11*(37-38-39), 447-453.

Peric, M., Zenic, N., Mandic, G. F., Sekulic, D., & Sajber, D. (2012). The reliability, validity and applicability of two sport-specific power tests in synchronized swimming. *Journal of Human Kinetics*, *32*, 135-145.

Platanou, T. (2005). On-water and dryland vertical jump in water polo players. *Journal of Sports Medicine and Physical Fitness*, *45*(1), 26-31.

Popovic, S., Akpinar, S., Jaksic, D., Matic, R., & Bjelica, D. (2013). Comparative Study of Anthropometric Measurement and Body Composition between Elite Football and Basketball Players. *International Journal of Morphology*, *31*(2), 461-467.

Rienzi, E., Drust, B., Reilly, T., Carter, J. E. L., & Martin, A. (2000). Investigation of anthropometric and work-rate profiles of elite South American international football players. *Journal of Sports Medicine and Physical Fitness*, *40*, 162-169.

Rico-Sanz, J. (1998). Body composition and nutritional assessments in soccer. *International Journal of Sport Nutrition*, *8*, 113-123.

Vila, M.H., Manchado, C., Abraldes, J.A., & Ferragut, C. (2018). Predicting playing status in professional water polo players: analysis by gender. *The Journal of Sports Medicine and Physical Fitness*, *58*(9), 1234-1239.

World Medical Association (2013). World Medical Association Declaration of Helsinki: Ethical Principles for Medical Research Involving Human Subjects. *The Journal of the American Medical Association*, *310*, 2191–2194