*Int. J. Morphol.,*
*41(6)*:1758-1763, 2023.

# Tokyo 2021 Olympic Water Polo Champions and Their Anthropometric Characteristics and Body Composition Compared to Other Players

## Campeones Olímpicos de Waterpolo de Tokio 2021 y sus Características Antropométricas y Composición Corporal en Comparación con Otros Jugadores

**Ivan Vasiljevic & Jovan Gardasevic**

**VASILJEVIC, I. & GARDASEVIC, J**. Tokyo 2021 Olympic water polo champions and their anthropometric characteristics and body composition compared to other players. *Int. J. Morphol., 41(6)*:1758-1763, 2023.

**SUMMARY:** The Olympic Games always offer great interest when it comes to water polo. Currently, many selections have an approximate quality and details determine who will win. Prior to the tournament the authors wanted to verify body composition and anthropometric characteristics of players of the three national teams, Serbia, the United States of America (USA) and Montenegro. The purpose of this research was to determine the differences in body composition and anthropometric characteristics between the water polo players of the national team of Serbia and Olympic champion in Tokyo 2021, the national team of USA which took sixth place and the national team of Montenegro, which took the eighth place. Body mass index, fat percentage and muscle mass (body composition variables) were evaluated by Bioelectric Impedance type MC-980 and body height, body weight, triceps skinfold, biceps skinfold, skinfold of the back, abdominal skinfold, upper leg skinfold, lower leg skinfold (other anthropometric characteristics) were evaluated by an anthropometer and a calliper. ANOVA showed that there was a statistically significant difference in fat percentage. The LSD post hoc test showed statistically significant differences between the water polo players of the Montenegrin national team (13.33 %) compared to the water polo players of the USA national team (16.67 %). It can be stated that water polo players from Montenegro had a statistically significantly lower fat percentage than water polo players from the USA and a lower level of fat than water polo players from Serbia, though this was not statistically significant. Although the fat percentage is a disruptive factor with athletes, it had no effect on the result at the Olympic Games in Tokyo, because Serbia eventually won the gold medal, the USA obtained sixth place, and Montenegro eighth place. It means that some other abilities influenced the results at the Tokyo Olympics in water polo, for example tactical, physical, psychological, technical... which is to be shown by some other research.

**KEY WORDS: Water polo players; Body composition; Anthropometric characteristics; Olympic Games.**

## 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 (Gardasevic *et al*., 2019). Water polo is a sport characterized by numerous and various complex and dynamic physical activities, which are then characterized by either cyclical or acyclical movement. It is full-contact sport, and rapidly growing sport in the World, characterized by different swimming intensities, duelling, acceleration and deceleration (Ferragut *et al*., 2011; Kondric *et al*., 2012). In water polo, top scores can be achieved only under conditions of a well-programmed training process (Botonis *et al*., 2016). 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 (Lupo *et al*., 2016). Various studies have been carried out to establish certain principles and norms for the transformational processes of the anthropological characteristics necessary for water polo, with anthropometric characteristics and body composition among some (Milanovic & Vuleta, 2013; Gardasevic *et al*., 2020). Findings regarding anthropometric characteristics and body composition are of crucial importance for complex sports, such as water polo (Gardasevic *et al*., 2020). The anthropometric space is defined by the longitudinal dimension of the skeleton, the transversal dimensionality of

Faculty for Sport and Physical Education, University of Montenegro, Niksic, Montenegro.

Received: 2023-09-03 Accepted: 2023-10-15

the skeleton, and the mass and volume of the body. The purpose of knowing anthropometric characteristics is to improve skills in many sports (Masanovic *et al*., 2018). The resulting morphological status of an athlete is impacted by the genetic heritage and the adaptation changes caused by training or nutrition (Barr *et al*., 1994). The anthropometric status of top-level athletes is relatively homogeneous, depending on the sport, and can be defined as a model of athletic achievement. Research on anthropometric characteristics and body composition among athletes of different sports indicates that athletes of different sports have specific characteristics (Popovic *et al*., 2013), mostly because absolute size contributes a significant percentage of total variance associated with athletic success (Carvajal *et al*., 2012). Achievement in water polo, among other things, depends on the anthropometric characteristics of athletes, namely height and body mass (Hraste, 2023). Morphological characteristics that may be significantly influenced by training are muscle tissue volume and the quantity of subcutaneous adipose tissue (Hraste, 2023). 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, the United States and in Montenegro has a long tradition and the best results in international competitions, especially Serbia and Montenegro. Serbia has been Olympic, world and European champion several times. This national team won the gold medal at the last two summer Olympic Games. The USA was once the Olympic champion. Montenegro, as a part of the former Yugoslavia, of which Serbia was also a part, won gold medals in world competitions. Since 2006, Montenegro has been an independent country and in 2008 was the European champion. Those are the three national teams that are top-ranked in water polo in the world.

It was expected that these national teams would continue with good results on the summer Olympic Games in Tokyo (Japan) 23 July to 8 August 2021. Originally scheduled to take place from 24 July to 9 August 2020, the Olympic Games were postponed to 2021 due to the global COVID-19 pandemic, the first such instance in the history of the Olympic Games. It is the most important competition in water polo and the best players of these national teams were present. It is a well-known fact in all sports and 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 (Tan *et al*., 2009; McCluskey *et al*., 2010; Alcaraz *et al*., 2012). It was interesting for researchers to determine the models of anthropometric characteristics and body composition of the water polo players who played for these three national teams at the Olympic Games, to determine statistically significant differences and whether this affected their final placement in that competition.

This research aimed to determine the anthropometric characteristics and body composition of the water polo players of the national teams that participated in the 2021 Summer Olympic Games in Tokyo, Serbia (gold medal) the United States of America (sixth place) and Montenegro (eighth place). The variables between these water polo players were compared and possible differences between them were determined.

## MATERIAL AND METHOD

**Sample of subjects.** A sample of the subjects consisted from a total of 48 water polo players was divided into three sub-samples. The first sub-sample of the subjects consisted of 13 water polo players of the national team of Serbia, average age of 23.38±3.84, which won the gold medal at the Olympic Games in Tokyo 2021. The other sub-sample consisted of 16 water polo players of the national team of the United States of America, average age of 24.56±4.13, who occupied the sixth position at the Olympic Games in Tokyo 2021. The last sub-sample of the examinees consisted of 19 water polo players of the national team of Montenegro, average age of 24.16±5.69, who occupied the eighth position on same Olympic Games (Table I).

Table I. Final rankings (08/08/2021) at the men's water polo tournament in Olympic Games in Tokyo 2021.

| National teams | Place |
|---|---|
| Serbia | 1 (gold medal) |
| Greece | 2 (silver medal) |
| Hungary | 3 (bronze medal) |
| Spain | 4 |
| Croatia | 5 |
| USA | 6 |
| Italy | 7 |
| Montenegro | 8 |
| Australia | 9 |
| Japan | 10 |
| Kazakhstan | 11 |
| South Africa | 12 |

Players of the Serbian, USA and Montenegrin national teams were tested at the final preparation tournament in Podgorica (Montenegro), before the Olympic Games in Tokyo. All participants signed the consent form approved by the Institutional Review Board of the University of Montenegro, which was in accordance with the Declaration of Helsinki (World Medical Association, 2013).

**Sample of measures.** 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 analyzed: body height, body weight, triceps skinfold, biceps skinfold, skinfold of the back, abdominal skinfold, upper leg skinfold and lower leg skinfold. An anthropometer, calliper, and measuring tape were used for anthropometric measurements. To evaluate the body composition a Bioelectric Impedance type MC-980 model BC-418MA was used. For this study, three variables assessed body composition: body mass index, fat percentage and muscle mass. Bioelectric Impedance 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 Bioelectric Impedance enables athletes to closely monitor their body weight, health condition and form with all relevant parameters.

**Method of data processing.** 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 three national teams in the anthropometric characteristics and variables for assessing body composition was determined by ANOVA and LSD Post Hoc tests, with statistical significance of $p<.05$.

## RESULTS

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

Based on the central and dispersion parameters of the water polo players of Serbia, USA, and Montenegro (Table II), it can be stated that values of all variables are very similar in water polo players of these three countries. The analysis of Table II shows that according to the values of the body mass index (BMI), all water polo players of all three national teams are at the borderline value of over nutrition. However, if we look at the value of muscle mass, it is clear that these are elite athletes and that muscle mass raises the total body weight, and thus the BMI value.

There were significant differences only in one variable among the water polo players of the three national teams. ANOVA test found significant difference for fate percentage ($F=3.425$; $p<.05$). The LSD Post Hoc test showed that there is a statistically significant difference in this variable between the water polo players of the USA and the water polo players of Montenegro, while the water polo players of these two national teams did not have statistically significant differences with the water polo players of Serbia (Fig. 1).

The LSD Post Hoc test showed that fat percentage of water polo players of the two national teams, USA and Montenegro, is significantly different. The water polo players of Montenegro had the lowest fat percentage (13.33), while the water polo players of USA had the highest fat percentage (16.67) and it was statistically significant. The water polo players of Serbia had a higher fat percentage (14.68) than water polo players of Montenegro, and less than water polo

Table II. Descriptive data and ANOVA of 46 water polo players, members of the three national teams.

| Variables | Serbia | USA | Montenegro | ANOVA | |
|---|---|---|---|---|---|
| | Mean±Standard Deviation | | | F | Sig. |
| body height | 191.02±4.95 | 191.49±5.93 | 191.79±4.76 | .084 | .920 |
| body weight | 92.21±8.26 | 95.95±10.74 | 92.59±8.73 | .763 | .472 |
| triceps skinfold | 5.65±2.01 | 6.26±1.33 | 5.81±2.24 | .415 | .663 |
| biceps skinfold | 5.06±1.41 | 5.56±1.26 | 5.17±1.40 | .579 | .564 |
| skinfold of the back | 11.91±3.57 | 11.53±3.35 | 11.73±4.42 | .034 | .966 |
| abdominal skinfold | 17.09±7.24 | 13.96±7.58 | 14.29±7.05 | .788 | .461 |
| upper leg skinfold | 13.35±4.14 | 12.98±4.11 | 12.39±3.66 | .241 | .787 |
| lower leg skinfold | 9.31±2.75 | 8.52±2.66 | 9.02±3.63 | .245 | .784 |
| body mass index | 25.32±2.68 | 26.16±2.48 | 25.24±1.88 | .781 | .464 |
| fat percentage | 14.68±3.92 | 16.67±3.83 | 13.33±3.61 | 3.425 | .041* |
| muscle mass | 42.95±3.24 | 43.61±3.49 | 43.04±2.79 | .195 | .823 |

players of USA, but these differences were not statistically significant.

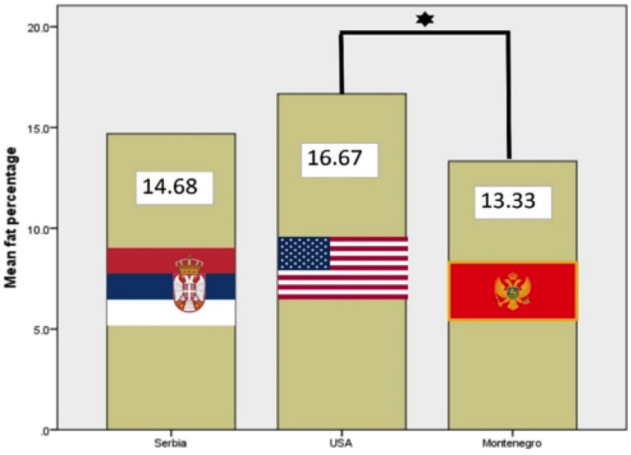


Fig. 1. LSD Post Hoc test for the fat percentage *- p<.05

## DISCUSSION

This study aimed to determine the difference in the anthropometric characteristics and body composition of the water polo players of the Serbian national team, who won a gold medal at the Olympic Games in Tokyo (Japan) 2021, the water polo players of the USA national team, occupied the sixth position, while water polo players of the Montenegro national team occupied the eight position in Tokyo. The results were obtained using a battery of eleven tests in the area of anthropometric characteristics and body composition. In relation to the ranking at the end of the Olympic Tournament of these national teams, which all played in the quarter-finals, where the Serbian national team won the gold medal, it can be concluded that we have analyzed the best selected water polo players in the world at this moment. It can be observed that the water polo players of three national teams have approximately similar mean values of all variables analyzed, which is not surprising since these are the three national teams in countries where water polo is popular and water polo coaches are highly skilled. Water polo players in these countries have years of training experience and spend many hours in the pool each week. The ANOVA results showed that water polo players of three national teams differ significantly in only one variable compared to the results achieved at the Olympic Games in Tokyo 2021. When the national teams reach the quarter-finals of the Olympic tournament, only nuances decide which team goes to compete for a medal, and which competes for placement from fourth to eighth place. Only in fat percentage, did the water polo players of these representatives show a statistically significant difference. Players of the Montenegrin national team have a statistically significantly lower percentage of fat than USA national team players, and lower than Serbian national team players, but not statistically significantly. Considering that Montenegro took the weakest position of these three national teams at the Olympic Games, it can be concluded that the lowest percentage of fat did not significantly affect the final ranking at the Olympic tournament, compared to the other two national teams. For other variables, some values are better for water polo players of the Serbian national team, some for those of the USA national team and some for those of the Montenegrin national team, although, insignificant for statistics. All of the abovementioned indicates that water polo players of the Serbian, USA, and Montenegrin national teams have similar anthropometric parameters and body compositions.

According to the results of (Mazza *et al*., 1994; Lozovina & Pavicic, 2004; Vila *et al*., 2010) the mean value of body height and body mass in elite water polo players were ranging between 184.2 and 189.5 cm and 85.9 and 89.2 kg, respectively. This study showed that the trend of recent years in water polo is higher body height and body weight of elite water polo players, because the water polo players of these three national teams are on average 191.02 cm to 192.79 cm tall, and have an average body weight of 92.21 kg to 95.95 kg.

Based on the obtained results in this research, before the start of the Olympic Games in Tokyo, it could not be assumed which national team would achieve a better placement. The national team of Serbia is always the favourite for the highest ranking, confirming the forecasts by winning the gold medal, so it can be concluded that body composition and anthropometric characteristics did not decide the final ranking, but some other parameters probably did, which may be a better technical and tactical preparation, or physical and mental preparation... The Olympic Games showed that of the eight best national teams in the tournament, nuances decided the final ranking confirming that these are the best water polo players in the world.

Results showed that water polo players of the three national teams have different levels of subcutaneous adipose tissue, which is known to be a disruptive factor for athletes (Pavlovic *et al*., 2021). Also, in previous studies of water polo players, 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 *et al*., 2000; Gil *et al*., 2007).

In addition, all the water polo players of these three national teams had similar muscle mass values; water polo is a strenuous sport that takes place in water and requires significant muscle mass (Botonis *et al*., 2018). Body height is important for swimming, and long arms are important for kicks and defense (De Jesus *et al*., 2012); however, there were no statistically significant differences between the water polo players of the three national teams, which is perhaps surprising, considering that the Serbian national team won the gold medal at the Olympic Games in Tokyo 2021, and the Montenegrin and USA national teams lost 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, physical preparation, and functional and psychological preparation between water polo players of the three teams. Many teams have video analysts who analyse the opponent in detail and present it to their players. Based on that, a strategy is made for that opponent, which may also be a reason for the different ranking. It is possible that the Serbian national team was the best prepared in that area compared to other national teams. Physical preparation in such hard competitions is essential because the games were played almost every day, and this was not analyzed. Experience of water polo players at this level of competition can be the reason for different placement. Based on our findings, the Serbian water polo team has the most experience.

Given that the concentration of the best water polo players was at Olympic Games in Tokyo 2021, the assumption is that the mean values of the analyzed variables of three national teams' water polo players could be the model values for all water polo players in the world (Table III).

**This study also has certain limitations.** The average values of all players were analyzed, but more precise results would have been obtained if the players were analyzed by their position in the pool, considering that it is known that different playing positions in team sports require different anthropometric types of players and body composition. Another limitation is the number of national teams analyzed, however, the authors were only able to reach those national teams who performed at the joint pre-Olympic tournament in Montenegro.

The recommendation for follow-up research is that in addition to anthropometric measurements and determination of body composition of water polo players, other tests must be added such as determination of the technical-tactical level of preparedness, physical level, functional level and psychological profile.

Table III. Descriptive data of all 48 water polo players.

| Variables | Mean±Std. Dev. |
|---|---|
| age | 24.08±4.67 |
| body height (cm) | 191.48±5.13 |
| body weight (kg) | 93.61±9.29 |
| triceps skinfold (mm) | 5.92±1.89 |
| biceps skinfold (mm) | 5.27±1.34 |
| skinfold of the back (mm) | 11.71±3.79 |
| abdominal skinfold (mm) | 14.94±7.25 |
| upper leg skinfold (mm) | 12.85±3.88 |
| lower leg skinfold (mm) | 8.93±3.06 |
| body mass index (kg/m$^2$) | 25.57±2.31 |
| fat percentage (%) | 14.81±3.96 |
| muscle mass (kg) | 43.21±3.10 |

## CONCLUSIONS

Out of the eleven variables analysed between the Olympic water polo champion and the two national teams that played in the quarterfinals of the Olympic tournament, there were no statistically significant differences except for one, the body fat percentage. The lowest-ranked national team at the Olympic Games in Tokyo out of the three analyzed, Montenegro, had the lowest percentage of body fat in its players. However, this variable did not significantly affect the final ranking. The values obtained in this research may be useful for all water polo coaches in the world for making a comparison of anthropometric characteristics and body composition and prepare their training process in a way that enables the reduction of adverse parameters, and raise benefits to a higher level. The results obtained in this research can serve as model parameters for the estimated variables for water polo players of all clubs in Serbia, USA, and Montenegro, because the players analyzed were the best and most successful participants in the Olympic Games in Tokyo (Japan) 2021.

**ACKNOWLEDGMENTS**. The authors wish to thank the members of the Water Polo Association of Serbia, USA and Montenegro for their cooperation.

**VASILJEVIC, I. & GARDASEVIC, J.** Campeones olímpicos de waterpolo de Tokio 2021 y sus características antropométricas y composición corporal en comparación con otros jugadores. *Int. J. Morphol., 41(6)*:1758-1763, 2023.

**RESUMEN:** Los Juegos Olímpicos siempre ofrecen un gran interés en lo que respecta al waterpolo. Actualmente, muchas selecciones tienen una calidad aproximada y los detalles determinan quién ganará. Antes del torneo, los autores deseaban comprobar la composición corporal y las características antropométricas de los jugadores de las tres selecciones nacionales: Serbia, Estados Unidos

(EE.UU.) y Montenegro, que siempre tienen las mayores ambiciones en las grandes competiciones. El propósito de esta investigación fue determinar las diferencias en composición corporal y características antropométricas entre los jugadores de waterpolo de la selección nacional de Serbia, que fue campeona olímpica en Tokio 2021, la selección nacional de Estados Unidos que ocupó el sexto lugar y la selección nacional de Montenegro, que acabó octavo. El índice de masa corporal, el porcentaje de grasa y la masa muscular (variables de composición corporal) se evaluaron mediante Impedancia Bioeléctrica tipo MC-980 y la altura corporal, el peso corporal, el pliegue del tríceps, el pliegue del bíceps, el pliegue de la espalda, el pliegue abdominal, el pliegue de la parte superior de la pierna y la parte inferior de la pierna. Los pliegues cutáneos (otras características antropométricas) fueron evaluados mediante un antropómetro y un calibrador. ANOVA mostró que había una diferencia estadísticamente significativa en el porcentaje de grasa. La prueba post hoc de LSD mostró diferencias estadísticamente significativas entre los jugadores de waterpolo de la selección nacional de Montenegro (13,33 %) en comparación con los jugadores de waterpolo de la selección de Estados Unidos (16,67 %). Se puede afirmar que los jugadores de waterpolo de Montenegro tenían un porcentaje de grasa estadísticamente significativamente menor que los jugadores de waterpolo de EE. UU. y un nivel de grasa más bajo que los jugadores de waterpolo de Serbia, lo que no es estadísticamente significativo. Aunque el porcentaje de grasa es un factor perturbador para los atletas, no tuvo ningún efecto en el resultado de los Juegos Olímpicos de Tokio, ya que al final Serbia ganó la medalla de oro, Estados Unidos quedó en sexto lugar y Montenegro en el octavo lugar. Esto significa que en los resultados de los Juegos Olímpicos de Tokio en el waterpolo influyeron otras habilidades, por ejemplo tácticas, físicas, psicológicas y técnicas, tal como lo demostrarán investigaciones a futuro.

**PALABRAS CLAVE: Jugadores de waterpolo; Composición corporal; Características antropométricas; Juegos olímpicos**

## REFERENCES

Alcaraz, P. E.; Abraldes, J. A.; Ferragut, C.; Vila H., Rodriguez, N. & Argudo, F. M. Relationship between characteristics of water polo players and efficacy indices. *J. Strength Cond. Res., 26(7)*:1852-7, 2012.

Barr, S. I.; Mccargar, L. J. & Crawford, S. M. Practical use of body-composition analysis in sport. *Sports Med., 17(5)*:277-82, 1994.

Botonis, P. G.; Toubekis, A. G. & Platanou, T. I. Concurrent strength and interval endurance training in elite water polo players. *J. Strength Cond. Res., 30(1)*:126-33, 2016.

Botonis, P. G.; Toubekis, A. G. & Platanou, T. I. Evaluation of physical fitness in water polo players according to playing level and positional role. *Sports (Basel), 6(4)*:157, 2018.

Carvajal, W.; Betancourt, H.; León, S.; Deturnel, Y.; Martínez, M.; Echevarría, I.; Castillo, M. E. & Serviat, N. Kinanthropometric profile of Cuban women olympic volleyball champions. *MEDICC Rev., 14(2)*:16-22, 2012.

De Jesus, K.; Figueiredo, P.; De Jesus, K.; Pereira, F.; Vilas-Boas, J. P.; Machado, L. & Fernandes, R. J. Kinematic analysis of three water polo front crawl styles. *J. Sports Sci., 30(7)*:715-23, 2012.

Ferragut, C.; Abraldes, J. A.; Vila, H.; Rodríguez, N.; Argudo, F. M. & Fernandes, R. J. Anthropometry and throwing velocity in elite water polo by specific playing positions. *J. Hum. Kinet., 27*:31-44, 2011.

Gardasevic, J.; Akpinar, S.; Popovic, S. & Bjelica, D. Increased perceptual and motor performance of the arms of elite water polo players. *Appl. Bion. Biomech., 2019*:6763470, 2019.

Gardasevic, J.; Bjelica, D. & Vasiljevic, I. Differences in body composition between water polo players of national teams of Montenegro and Croatia participating in the European U15 Championship 2019. *Int. J. Morphol., 38(3)*:720-5, 2020.

Gil, S. M.; Gil, J.; Ruiz, F.; Irazusta, A. & Irazusta, J. Physiological and anthropometric characteristics of young football players according to their playing position: relevance for the selection process. *J. Strength Cond. Res., 21(2)*:438-45, 2007.

Hraste, M. Anthropometric, morphological and somatotype characteristics of water polo players: A meta-analysis. *Int. J. Morphol., 41(3)*:686-9, 2023.

Kondric, M.; Uljevic, O.; Gabrilo, G.; Kontic, D. & Sekulic, D. General anthropometric and specific physical fitness profile of high-level junior water polo players. *J. Hum. Kinet., 32*:157-165, 2012.

Lozovina, V. & Pavicic, L. Anthropometric changes in elite male water polo players: survey in 1980 and 1995. *Croat. Med. J., 45(2)*:202-5, 2004.

Lupo, C.; Capranica, L.; Cugliari, G.; Gomez, M. A. & Tessitore, A. Tactical swimming activity and heart rate aspects of youth water polo game. *J. Sports Med. Phys. Fit., 56(9)*:997-1006, 2016.

Masanovic, B.; Corluka, M. & Milosevic, Z. Comparative study of anthropometric measurement and body composition of junior soccer and handball players from the Serbian National League. *Kinesiol. Slov., 24(3)*:37-46, 2018.

Mazza, J.; Ackland, T.; Bach, T. & Cosolito, P. *Absolute Body Size*. In: Carter, J. E. L. & Ackland, T. R. (Eds.). Kinanthropometry in Aquatic Sport: A Study of World Class Athletes. Champaign, Human Kinetics Books, 1994. pp.5-54.

McCluskey, L.; Lynskey, S.; Leung, C. K.; Woodhouse, D.; Briffa, K. & Hopper, D. Throwing velocity and jump height in female water polo players: performance predictors. *J. Sci. Med. Sport., 13(2)*:236-240, 2010.

Milanovic, D. & Vuleta, D. Association between morphological dimensions of water polo players and play performance indicators. *Sport Mont., 11(37-38-39)*:447-53, 2013.

Pavlovic, R.; Savic, V. & Radulovic, N. Percentage of subcutaneous fatty tissue as an indicator of the physical status of volleyball players. *Slovak J. Sport Sci., 7(1)*:64-75, 2021.

Popovic, S.; Akpinar, S.; Jaksic, D.; Matic, R. & Bjelica, D. Comparative study of anthropometric measurement and body composition between elite soccer and basketball players. *Int. J. Morphol., 31(2)*:461-7, 2013.

Rico-Sanz, J. Body composition and nutritional assessments in soccer. *Int. J. Sport Nutr., 8(2)*:113-23, 1998.

Rienzi, E.; Drust, B.; Reilly, T.; Carter, J. E. L. & Martin, A. Investigation of anthropometric and work-rate profiles of elite South American international football players. *J. Sports Med. Phys. Fit., 40(2)*:162-9, 2000.

Tan, F.; Polglaze, T. & Dawson, B. Activity profiles and physical demands of elite women's water polo match play. *J. Sports Sci., 27(10)*:1095-104, 2009.

Vila, H.; Ferragut, C.; Abraldes, J. A.; Rodríguez, N. & Argudo, M. Caracterización antropométrica en jugadores de elite de waterpolo. *Rev. Int. Med. Cienc., 10(40)*:652-63, 2010.

World Medical Association. World Medical Association Declaration of Helsinki: ethical principles for medical research involving human subjects. *JAMA, 310(20)*:2191-4, 2013.

Corresponding author:
Jovan Gardasevic, PhD
University of Montenegro
Faculty for Sport and Physical Education
Narodne omladine bb
81400 Niksic
MONTENEGRO

E-mail: jovan@ucg.ac.me