

ORIGINAL SCIENTIFIC PAPER

Body Composition Variation among U-19 Futsal National Team Players from Bosnia and Herzegovina According to Playing Position

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Abstract

Elite futsal players in addition to other characteristics, must have suitable anthropometric and body composition according to their playing position. The research aimed to determine body composition of Bosnia and Herzegovina U-19 national futsal team players and also determine differences in anthropometric and body composition of players according to their playing position. The sample of respondents consisted of Bosnia and Herzegovina U-19 National Futsal Team players (n=14, average age 18.07±0.48 yrs, body height 181.40±5.72 cm, and body weight 77.66±10.60 kg). Anthropometric characteristics and body composition were evaluated by a battery of 11 variables: body height (BH), body mass (BM), triceps skinfold (TS), biceps skinfold (BiS), back skinfold (BS), abdominal skinfold (AS), upper leg skinfold (UIS), lower leg skinfold (LIS), body mass index (BMI), fat percentage (FP), and muscle mass percentages (MP). Futsal players were divided according to their positions in the team into goalkeepers, defenders, wingers and pivots. Based on ANOVA and post-hoc tests, the findings showed that there were significant differences between groups in 8 out of 11 anthropometric parameters. So, in relation to this, the main findings of the study indicate that: i) goalkeepers and pivots have significantly higher body mass and percentage of fat compared to defenders and wingers; ii) goalkeepers have a higher BMI than all other players, while pivots have higher BMI values than defenders and wingers; iii) muscle mass favors goalkeepers and pivots over wingers; iv) goalkeepers had significantly higher values in triceps and biceps skinfold measurements compared to other players, as well as in lower leg skinfold compared to defenders and wingers, and in back skinfold compared to wingers. Although this study is significant, because it examines the morphology of elite futsal players and indicates certain differences in the anthropometric characteristics of futsal players according to the positions in the team. However, we must interpret these results cautiously due to the limited sample size of participants.

Keywords: *playing position differences, professional futsal players, morphological characteristics, body fat percentages*

Introduction

Futsal is a variant of football played on a hard surface, smaller than a regular football field, and mostly indoors. Futsal is played between two teams of five players each, one of whom is a goalkeeper (Stojmenović, Stanković, Katanic, & Ilić, 2019). An important aspect of futsal development is that FIFA (Fédération Internationale de Football Association) has stan-

dardized this sport in the '5-a-side' version (Moore, Bullough, Goldsmith, & Edmondson, 2014). Thus, a futsal team consists of five players, namely a goalkeeper, a defender, two wingers (left and right), and a pivot. The basic characteristics of futsal include playing with significant intensity on a smaller field (20x40 m) and within a shorter time frame (2x20 min) (Queiroga et al., 2019).



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Recent authors have been striving to determine the demands of futsal. According to various authors, the total distance covered during a futsal match averages 3,133 m (Bueno et al., 2014), 3,749 m (Ribeiro et al., 2020), 4,277 m (Dogramaci, Watsford, & Murphy, 2011), and 4,313 m (Barbero-Alvarez, Soto, Barbero-Alvarez, & Granda-Vera, 2008). Milioni et al. (2016) confirmed that the total distance covered in halves was 1,986±74.4 m in the first half and 1,856±129.7 m in the second half. When considering average distances according to intensity zones, futsal players cover 9.0% and 39.9% of the total average distance in low-intensity walking and running, respectively. The average distance covered in moderate-intensity activity was 28.5%, high-intensity 13.7%, and sprinting 8.9% of the total match (Bueno et al., 2014). Dogramaci et al. (2011) highlight that elite teams cover a 42% greater total distance than sub-elite teams (4,277±1,030 versus 3,011±999 m). Additionally, elite players cover 58% more distance in running than sub-elite players. Regarding the physiological demands of the game, the average heart rate (HR) values during a futsal match were 174±7 b·min⁻¹ (range: 164–181), representing 90±2% of maximum heart rate (HR_{max}; range: 86–93%). As HR is classified based on the percentage of time spent in different zones, players spent 0.3%, 16%, and 83% of the time at intensities ≤65%, 65–85%, and ≥85% of HR_{max}, respectively (Barbero-Alvarez et al., 2008). However, it should be noted that data from official matches showed slightly lower average HR values (86.4±3.8% HR_{max}; Rodrigues et al., 2011). It has also been found that professional futsal players have significantly higher values of maximum oxygen consumption (VO_{2max}) than sub-elite players (62.8 versus 55.2 ml·kg⁻¹·min⁻¹). Spyrou, Freitas, Marin-Cascales, and Alcaraz (2020) add that during a match, HR rarely drops below 150 b·min⁻¹, which may be due to short and incomplete rest periods. These parameters indicate the high physiological demands placed on futsal players, thus futsal players should possess optimal physical performance accordingly.

It is well known that the anthropometric status of athletes is crucial, as morphological characteristics are directly linked to success in sports (López-Plaza, Alacid, Muyor, & López-Miñarro, 2017; Slimani & Nikolaidis, 2019; Banjević et al., 2022; Katanic, Bjelica, Rezić, Selimi, & Osmani, 2022). It has been established that athletes must possess an optimal level of morphological characteristics according to the demands of a specific sport (Popović, Akpınar, Jakšić, Matic & Bjelica, 2013; Slimani & Nikolaidis, 2019; Katanic, Bjelica, & Covic, 2022; Katanic et al., 2023). Although significant diversity in morphological status among football players is evident (Dowson, Cronin, & Presland, 1999; Reilly, Bangsbo, & Franks, 2000), it should be emphasized that body structure represents a crucial characteristic, as subcutaneous fat behaves as unnecessary weight during locomotion (Katanic, Ugrinić, & Ilić, 2020). When analyzing body composition, particular attention is paid to the percentage of body fat, which ranges from 7 to 12% in professional footballers (Shephard, 1999). Comparing with less successful teams, better teams have significantly lower percentages of body fat (Arnason et al., 2004). It is important to consider that an athlete's body composition can influence all measures of physical performance (Castillo et al., 2022). However, despite futsal being an indoor form of the world's most popular sport, there is little research on the morphological structure of futsal players.

On the other hand, research on the anthropometric characteristics of futsal players has been rarely conducted (Galy et al.,

2015; Nikolaidis et al., 2019), and especially there are no studies that have examined body composition according to playing position in futsal. However, since differences in body composition between playing positions have been found in footballers (Silvestre, West, Maresh, & Kraemer, 2006), it is assumed that there will also be certain differences between positions in futsal. In this regard, the aim of this study was to determine the body composition of representative-level futsal players and to establish differences in body composition according to playing position. This research can provide reference values for parameters of body composition for a specific position in futsal, which can assist conditioning coaches in gaining deeper insight into the body composition parameters of elite futsal players and in creating an appropriate training program accordingly.

Method

Participants

The sample of respondents consisted of players from the Bosnia and Herzegovina U-19 National Futsal Team (n=14, average age 18.07±0.48 years, body height 181.40±5.72 cm, and body weight 77.66±10.60 kg). The participants were categorized according to their playing positions as goalkeepers, defenders, wingers, and pivots. The inclusion criteria for participants were that they were representatives of Bosnia and Herzegovina, they were healthy, and they had not suffered any injuries in the last 6 months at the time of the study. Participation in the study was voluntary, and futsal players were informed about the study and provided written consent. The study was conducted in accordance with the Helsinki Declaration (World Medical Association, 2011) and approved by the Ethics Committee of the University.

Anthropometric characteristics

Anthropometric assessments were conducted following the guidelines of the International Biological Program (Eston & Reilly, 2009). Anthropometric characteristics and body composition were evaluated using a battery of 11 variables: body height (BH), body mass (BM), triceps skinfold (TS), biceps skinfold (BiS), back skinfold (BS), abdominal skinfold (AS), upper leg skinfold (ULS), lower leg skinfold (LIS), body mass index (BMI), fat percentage (FP), and muscle mass (MP). Anthropometers, calipers, and measuring tape were employed for the morphological measurements. A Tanita body fat scale (model BC-418MA) was utilized to assess body composition, specifically the parameters of fat percentage (FP) and muscle mass percentages (MP).

Statistics

The descriptive statistics were presented as mean, standard deviation, minimum, and maximum for each variable. Differences in anthropometric characteristics and body composition among the four groups of futsal players according to playing position were assessed using a discriminatory parametric procedure with ANOVA and post-hoc tests, with a level of statistical significance set at p<0.05. The data obtained in the research were analyzed using SPSS 26.0 software (Statistical Package for Social Sciences, v26.0, SPSS Inc., Chicago, IL, USA).

Results

Based on the descriptive statistics (Table 1), it is noticeable that the futsal players of the Bosnia and Herzegovina national

team had a body height of 181.40±5.72 cm, it should be noted that the shortest player measured 169.5 cm, while the tallest player measured 191.5 cm. The average body mass of the futsal players was 77.66±10.60 kg, with significant differences between the minimum (62.1 kg) and maximum values (94.4

kg). Looking at the average values of body fat percentage, they were 11.63±5.50%, also with considerable variation, where the lowest values recorded for one futsal player were 4.1%, while the highest values reached up to 20.4% body fat. On the other hand, the average values of muscle mass were 38.60±3.40 kg.

Table 1. Descriptive statistics of anthropometric characteristics in national futsal team players

	Mean	SD	Min	Max
Age	18.07	0.48	17.0	19.0
Body height	181.40	5.72	169.5	191.5
Body weight	77.66	10.60	62.1	94.4
Triceps skinfold	10.74	5.01	5.2	21.6
Skinfold of the back	11.42	4.49	6.0	20.4
Biceps skinfold	6.61	3.54	3.8	13.6
Abdominal skinfold	15.41	8.55	6.0	29.9
Lower leg skinfold	8.44	3.59	4.0	15.6
Upper leg skinfold	14.74	4.01	8.5	21.7
Body mass index	23.61	3.15	20.2	30.4
Fat percentage	11.63	5.50	4.1	20.4
Muscle mass	38.60	3.40	32.9	42.5

Note Mean - Arithmetic mean; SD - Standard deviation; Min – Minimum; Max - Maximum

Comparing anthropometric parameters according to playing position using ANOVA and post hoc tests, differences were found in the majority of parameters, specifically in 8 out of 11 variables (Table 2). It was found that goalkeepers and pivots had significantly higher body mass than defenders and wingers, and goalkeepers had a higher BMI than all other players, while pivots had higher BMI values than defenders and wingers. Regarding body composition, goalkeepers and pivots also had significantly

higher values than defenders and wingers, and muscle mass favored goalkeepers and pivots over wingers. In terms of skinfold parameters, goalkeepers had significantly higher values in triceps and biceps skinfold than other players, in lower leg skinfold than defenders and wingers, and in skinfold of the back than wingers. There was no significant difference among the groups of futsal players in other anthropometric parameters (body height, abdominal skinfold, and upper leg skinfold).

Table 2. Descriptive data and ANOVA with post-hoc test of national futsal players by different playing position

	Goalkeepers Mean±SD	Defenders Mean±SD	Wingers Mean±SD	Pivots Mean±SD	Sig.	Post-hoc
Body height	179.25±6.01	184.73±5.94	178.97±6.29	184.37±2.87	.399	/
Body weight	93.70±0.99	73.23±4.17	69.67±5.65	87.40±3.48	.000*	G>D, G>W, P>D, P>W
Triceps skinfold	20.25±1.91	7.00±2.78	8.60±1.25	12.43±4.48	.001*	G>D, G>W, G>P
Skinfold of the back	17.95±1.34	10.07±3.23	8.90±2.13	13.47±6.12	.044*	G>W
Biceps skinfold	13.15±0.64	4.97±1.69	4.73±0.59	7.67±4.27	.004*	G>D, G>W, G>P
Abdominal skinfold	28.20±2.40	14.60±11.32	11.17±4.54	16.17±8.55	.091	/
Lower leg skinfold	14.25±1.91	5.93±1.30	7.42±2.43	9.10±4.29	.035*	G>D, G>W
Upper leg skinfold	17.15±2.90	12.93±7.59	14.15±2.31	16.10±3.83	.666	/
Body mass index	29.25±1.63	21.50±1.84	21.75±1.25	25.70±0.53	.000*	G>D, G>W, G>P, P>D, P>W
Fat percentage	20.25±0.21	5.93±1.80	9.30±2.58	16.23±2.37	.000*	G>D, G>W, P>D, P>W
Muscle mass	42.30±0.28	39.00±2.08	35.75±2.78	41.43±1.08	.009*	G>W, P>W

Note G – Goalkeepers; D – Defenders; W – Wingers; P – Pivots; Mean - Arithmetic mean; SD - Standard deviation; * - significant difference

Discussion

This study aimed to determine the body composition of representative-level futsal players and to establish differences in body composition according to playing position. It was found that there were differences between playing positions in the majority of futsal players’ body composition parameters, specifically in 8 out of 11 variables. Therefore, the main find-

ings of the study indicate that: i) goalkeepers and pivots have significantly higher body mass and percentage of body fat than defenders and wingers; ii) goalkeepers have a higher BMI than all other players, while pivots have higher BMI values than defenders and wingers; iii) muscle mass favors goalkeepers and pivots over wingers; iv) goalkeepers had significantly higher values in triceps and biceps skinfold than other players, as well

as in lower leg skinfold than defenders and wingers, and in skinfold of the back than wingers.

When looking at the average values of the Bosnia and Herzegovina national team futsal players, it is noticeable that the body height was 181.40 ± 5.72 cm, and the average body weight was 77.66 ± 10.60 kg. The average values of total body mass and total body fat percentage of elite futsal players from Bosnia and Herzegovina were higher compared to the average values for futsal players from Brazil (171 cm and 67.4 kg; de Moura et al., 2013), Spain (175 cm and 69.8 kg; Barbero-Alvarez et al., 2009), Turkey (175.5 cm and 71.7 kg; Göral, 2014), and Croatia (176 cm and 70.4 kg; Milanović, Sporiš, Trajković, & Fredi Fiorentina, 2011). This difference between our study and previous results may be a result of selection since our study involved representatives of one country, representing an elite sample. Regarding the average values of body fat percentage, they were $11.63 \pm 5.50\%$, which were in line with the results of other studies (10.2-13.2%; de Moura et al., 2013). Muscle mass in kg of our players was 38.6 kg, which was slightly lower than the groups of Spanish futsal players.

When analyzed by playing positions, the average values of body height ranged from 179 cm for wingers and goalkeepers to 184 cm for defenders and pivots. The average values of body mass ranged from 69.7 kg for wingers to 93.7 kg for goalkeepers. A remarkably low percentage of body fat was measured in wingers (5.9%), while goalkeepers had 20.3% body fat. Defenders had 9.3% body fat, and pivots had 16.2% body fat, indicating a significant heterogeneity among groups regarding body composition. It was found that the differences in height between groups are not significant, while goalkeepers and pivots have significantly higher body mass and percentage of body fat than defenders and wingers. BMI values were also highest in goalkeepers (29.3), followed by pivots (25.7), while wingers and defenders had BMI values of 21.5 and 21.7, respectively. Based on the post-hoc test, it was determined that goalkeepers have a higher BMI than all other players, while pivots have higher BMI values than defenders and wingers. In line with the percentage of body fat, the distribution of subcutaneous fat tissue measured by skinfolds from specific sites showed a similar distribution among the groups. Goalkeepers, also had significantly higher values in triceps and biceps skinfold than other players, as well as in lower leg skinfold than defenders and wingers, and in skinfold of the back than wingers.

Research by de Moura et al. (2013) revealed that goalkeepers were slightly taller and heavier compared to defenders, pivots, and especially wingers, while the percentage of body fat was sim-

ilar. Ramos Campo et al. (2014) obtained different results, where defenders were the tallest, followed by goalkeepers, pivots, and wingers, while goalkeepers and pivots had the highest body mass, followed by defenders and wingers. The highest percentage of total body fat was observed in pivots, followed by goalkeepers and wingers, while defenders had the lowest percentage. Comparing these results with our findings, differences among studies are noticeable. Specifically, in various studies, morphological and body composition parameters are differently distributed among groups according to playing position. This supports studies that have indicated significant diversity in the morphological status of football players (Dowson, Cronin, & Presland, 1999; Reilly, Bangsbo, & Franks, 2000). The reasons for these findings could be that players in the same position may differ in playing style, as well as in different tactical tasks. Therefore, it is not easy to establish reference values for specific anthropometric parameters for a given playing position of futsal players.

However, it should be emphasized that our study identified differences among playing positions in most parameters of futsal players' body composition, which is consistent with studies on football players (Silvestre et al., 2006; Katanic, Bjelica, & Milosevic, 2023). This knowledge can aid conditioning coaches in gaining a deeper understanding of the parameters of elite futsal players' body composition and, accordingly, in creating an optimal training program for improving body composition and physical performance, which requires specific periodization (Sermahaj et al., 2024).

This study is significant because it is one of the few that examines the morphology of elite futsal players, and to our knowledge, the first one to identify differences in anthropometric and body composition according to playing position in futsal. As a pioneering study, it can provide certain guidelines and encourage future researchers to further investigate the morphological and body composition of futsal players in more detail. Additionally, it should be noted that this study has yielded important findings by indicating certain differences in the morphology of futsal players according to team positions. However, these results must be interpreted with caution due to the small sample size, especially the subgroup of respondents, which represents one of the main limitations of this study. Therefore, a suggestion for future studies would be to include a larger sample size, and for a more comprehensive picture of body composition, bioelectrical impedance analysis with a greater number of parameters should be conducted (Đorđević et al., 2024), which would provide a deeper analysis of body composition parameters, both overall and segmental.

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Conflict of Interest

The author declares that there is no conflict of interest.

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