

ORIGINAL SCIENTIFIC PAPER

Body Composition of Soccer Players of Montenegro and Bosnia and Herzegovina

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Abstract

The aim of this research was to determine the differences among the soccer players of the soccer club in Montenegro, FC Buducnost and the soccer players of the soccer club in Bosnia and Herzegovina FC Siroki Brijeg, in the anthropometric characteristics and body composition. A sample of 52 subjects was divided into two sub-samples. The first sub-sample of the subjects consisted of 30 soccer players of FC Buducnost of the average age 22.73 ± 4.33 , the champions of the Montenegro Championship in the season 2016/17, while the other sub-sample consisted of 22 players of FC Siroki Brijeg of the average age of 24.00 ± 6.22 , the champions of the Cup of Bosnia and Herzegovina in the season 2016/17. Soccer players were tested immediately after the end of the competition season 2016/17. Anthropometric characteristics in the body composition were evaluated by a battery of 10 variables: body height, body weight, waist circumference, triceps skinfold, biceps skinfold, skinfold of the back, abdominal skinfold, body mass index, fat percentage and muscle mass. The significance of the differences between the soccer players of the top two soccer clubs in the anthropometric characteristics 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 three variables that estimate the triceps skinfold, biceps skinfold and abdominal skinfold, in a favor of FC Siroki Brijeg.

Keywords: soccer, FC Buducnost, FC Siroki Brijeg, Anthropometric Characteristics, Body Composition

Introduction

A soccer game is said to be the most important secondary thing in the world, it gathers huge masses at stadiums and in front of TV's (Gardašević i Vasiljević, 2016; Gardašević, Bjelica, Popović, & Milašinić, 2016). It is a highly dynamic and fast team game which, with its richness of movement, falls under category of polystructural sports games (Gardašević & Bjelica, 2014; Gardasevic, Bjelica, & Vasiljevic, 2017a). Soccer is a sport that is characterized by numerous and various complex and dynamic kinesiological activities which are then characterized by either cyclical (Gardašević, Vasiljević, i Bojanić, 2015; Sermahaj, Popovic, Bjelica, Gardasevic, & Arifi, 2017; Gardasevic, Bjelica, & Vasiljevic, 2017b) or acyclical movement (Gardase-

vic, 2015; Gardašević, Bjelica, i Vasiljević, 2016a; Gardašević, Bjelica, i Vasiljević, 2016b; Gardasevic, Bjelica, Milasinovic, i Vasiljevic, 2016; Gardasevic, Popovic, & Bjelica, 2016). In soccer, top score can be achieved only under conditions of well-programmed training process (Gardasevic, Bjelica, & Vasiljevic, 2020). High quality management of the training process depends on the knowing of the structure of certain anthropological capabilities and player's characteristics, as well as their development (Gardasevic & Bjelica, 2018; Bjelica, Gardasevic, Vasiljevic, & Corluca, 2018). Various researches are to be done in order to establish certain principles and norms for the transformational processes of the anthropological characteristics important for soccer (Gardašević, Bjelica, Georgiev, & Popović, 2012); with anthropomet-

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ric characteristics and body composition among them as expected. Findings regarding anthropometric characteristics and body composition are of crucial importance for complex sports games such as soccer (Gusic, Popovic, Molnar, Masanovic, & Radakovic, 2017). The anthropometric space is defined by the longitudinal dimension of the skeleton, the transversal dimensionality of the skeleton, the mass and volume of the body (Gardasevic, Bjelica, Vasiljevic, & Corluca, 2019; Masanovic, Bavcevic, & Bavcevic, 2019). The purpose of knowing anthropometric characteristics is to improve skills in many sports (Carter & Heath, 1990; Masanovic, Milosevic, & Corluca, 2018). The anthropometric status of top level athletes is relatively homogeneous, depending on the sport, and it can be defined as a model of athletic achievement (Masanovic, Corluca, & Milosevic, 2018; Corluca, Bjelica, Gardasevic, & Vasiljevic, 2019; Masanovic, 2018; Masanovic, 2019; Arifi, Bjelica, & Masanovic, 2019). Research on anthropometric characteristics and body composition among athletes of different sports indicates that athletes of different sports have their own specific characteristics. Muscle mass improves performance in activities that require muscular strength and endurance, but also in those that require enviable aerobic ability (Ramadan & Byrd, 1987; Green, 1992; Rico-Sanz, 1998).

Today, soccer is certainly the number one sport in the world for its view and popularity (Gardašević, Georgiev, & Bjelica, 2012; Gardasevic, Bjelica, Vasiljevic, Arifi, & Sermahhaj, 2019), and the same applies to Montenegro and Bosnia and Herzegovina (Bjelica, Gardasevic, Vasiljevic, Arifi, & Sermahhaj, 2019). The two clubs that are at the top of the First Montenegrin Telecom League and Premier League of Bosnia and Herzegovina, in the 2016/17 competitive season, they both have achieved a staggering success, FC Buducnost was the champion of Montenegro and FC Siroki Brijeg was the winner of the Cup of Bosnia and Herzegovina. Based on these two trophies that they have won at the end of the competition season, both clubs have acquired the right to play on the international soccer scene within the framework of UEFA's Champions League qualification and UEFA's Europa League qualification. It became as interesting for researchers to determine the models of anthropometric characteristics and body composition of the players who play for these clubs as to determine the differences among them.

The aim of this research was to determine body composition and anthropometric characteristics of elite soccer players, players of FC Buducnost who compete in the First Montenegrin Telecom League and players of FC Siroki Brijeg who compete in the Telecom Premier League of Bosnia and Herzegovina. Afterwhich, compare the variables between these soccer players and determine the possible differences between them.

Method

Sample of subjects

A sample of the subjects consists of a total of 52 top-level senior

soccer players who performed in the First Montenegrin Telecom League and the Premier League of Bosnia and Herzegovina, divided into two sub-samples. The first one consists of 30 soccer players of FC Buducnost of the average age 22.73±4.33, the champions of the Montenegro Championship in the season 2016/17, and the second one that consists of 22 players of FC Siroki Brijeg of the average age of 24.00±6.22, the winner of the Cup of Bosnia and Herzegovina in the season 2016/17. The soccer players were tested immediately after the 2016/17 season ended.

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 the purpose of this study, 7 anthropometric measures have been taken: body height, body weight, waist circumference, triceps skinfold, biceps skinfold, skinfold of the back and abdominal skinfold, and 3 body composition assessment variables: BMI-body mass index, fat percentage and muscle mass. Anthropometer, caliper, and measuring tape were used for anthropometric measurements. To evaluate the body composition, Tanita body fat scale - model BC-418MA, was used. The principle of this scale is based on indirect measurement of the body composition; a safe electrical signal is transmitted through the body via electrodes located in the standalone unit. The Tanita Scale, thanks to its athletics mode, enables athletes to closely monitor their body weight, health condition and form with all relevant parameters.

Method of data processing

The data obtained through the research are processed by descriptive and comparative statistical procedures. For each variable, central and dispersion parameters, as well as asymmetry and flattening measures are processed. Differences in anthropometric characteristics and the body composition of the soccer players of these two clubs were determined by using a discriminatory parametric procedure with t-test for small independent samples, with statistical significance of p<0.05.

Results

In Tables 1 and 2, basic descriptive statistical parameters of anthropometric variables and body composition of the soccer players of the two clubs, where the values of central measurements and dispersion tendencies are calculated, are shown: Arithmetic mean (Mean), Standard deviation (S.D.), Variance, Minimal (Min) i Maximal (Max) values, coefficient of Curvature (Skewness) and Elongation (Kurtosis). First, the central and dispersion parameters of the variables were analyzed to evaluate the anthropometric characteristics and body composition of the soccer players of FC Buducnost (Table 1).

Table 1. Central and dispersion parameters of variables for assessment of anthropometric characteristics and body composition of soccer players of FC Buducnost (N=30)

Variables	Min	Max	Mean±SD	Variance	Skewness	Kurtosis
Body height	171.1	196.0	181.96±5.89	34.75	.34	-.26
Body weight	64.7	96.9	78.03±8.52	72.63	.70	-.31
Waist circumference	74.0	95.0	83.43±5.23	27.36	.45	-.26
Triceps skinfold	4.0	13.6	7.79±2.45	6.01	.48	-.27
Biceps skinfold	3.2	8.2	5.28±1.29	1.69	.54	-.56
Skinfold of the back	3.6	18.6	9.81±2.89	8.39	.83	2.14
Abdominal skinfold	6.4	18.2	10.22±2.90	8.43	1.04	.94
Body mass index	21.1	27.1	23.49±1.45	2.11	.87	.76
Fat percentage	5.2	16.0	9.98±2.76	7.63	.16	-.47
Muscle mass	34.7	46.9	39.54±3.69	13.63	.41	-1.13

Note: Min – minimal value; Max – maximal value; Mean – average value; SD – standard deviation

Based on the central and dispersion parameters, the values of the skewness and the kurtosis, it can be noted that all the variables are placed within the normal distribution boundaries. Generally, according to all statistical parameters, it can be concluded that here we have some top soccer players and that there is a normal distribution in all variables. By the value of the skewness, it can be noticed

that in the variable of the abdominal skinfold, there was a slight inclination on the side of the lower results, which is good because subcutaneous fat is a disrupting factor for professional athletes. Table 2 showed the central and dispersion parameters of the variables were analyzed to evaluate the anthropometric characteristics and body composition of the soccer players of FC Siroki Brijeg.

Table 2. Central and dispersion parameters of variables for assessment of anthropometric characteristics and body composition of soccer players of FC Siroki Brijeg (N=22)

Variables	Min	Max	Mean±SD	Variance	Skewness	Kurtosis
Body height	167.2	195.5	183.29±6.75	45.59	-.59	.34
Body weight	64.6	87.9	77.60±6.57	43.12	-.46	-.52
Waist circumference	78.0	92.0	83.77±3.84	14.75	.59	.14
Triceps skinfold	4.0	9.2	5.88±1.17	1.37	1.06	1.81
Biceps skinfold	3.6	6.6	4.58±.75	.57	1.00	1.01
Skinfold of the back	6.6	13.6	8.96±1.75	3.05	.92	1.14
Abdominal skinfold	4.8	13.6	8.51±2.49	6.19	.45	-.69
Body mass index	20.7	26.8	22.99±1.51	2.28	.37	.34
Fat percentage	4.2	14.5	9.84±2.69	7.22	-.38	-.18
Muscle mass	33.1	46.1	39.57±3.26	10.61	-.17	.23

Based on the central and dispersion parameters, the values of skewness and kurtosis of the soccer players of FC Siroki Brijeg, it can be stated that all the variables are within the normal distribution boundaries and that the values are very similar to those of the soccer players of FC Buducnost. It can also be stated that the soccer players of FC Buducnost are younger on average. It can also be concluded that almost all variables of quantitative value are better with soccer players of FC Siroki Brijeg. However, a com-

parative statistical procedure, t-test (Table 3), will show whether it is statistically significant. By the value of the skewness, it can be noticed that in the all variables of the skinfolds there was a slight inclination on the side of the lower results, which is good because subcutaneous fat is a disrupting factor for professional athletes. In order to determine whether there are statistically significant differences in the analyzed variables in the top soccer players of these two clubs, the statistical procedure t-test (Table 3) was applied.

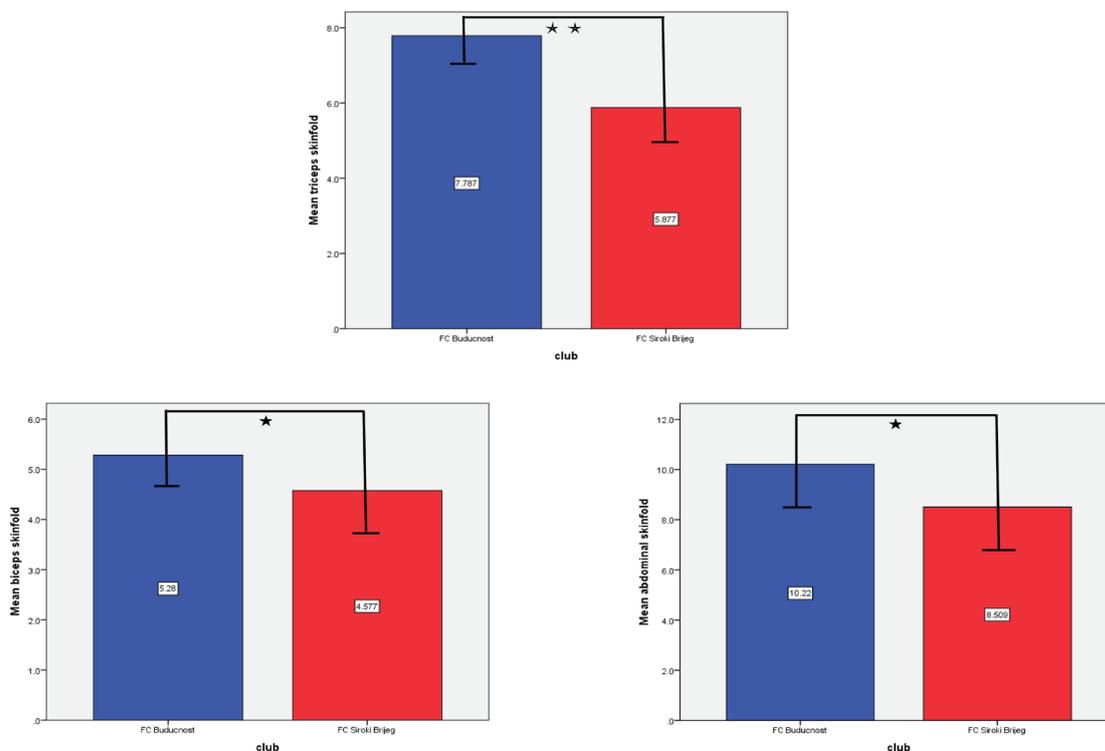
Table 3. Differences between the arithmetic mean of variables for the evaluation of anthropometric characteristics and body composition of soccer players of FC Buducnost (N=30) and FC Siroki Brijeg (N=22)

Variables	Club	Mean±SD	MD	t-test	Sig
Body height	FC Buducnost	181.96±5.89	-1.33	-.754	.455
	FC Siroki Brijeg	183.29±6.75			
Body weight	FC Buducnost	78.03±8.52	0.43	.196	.846
	FC Siroki Brijeg	77.60±6.57			
Waist circumference	FC Buducnost	83.43±5.23	-0.34	-.257	.798
	FC Siroki Brijeg	83.77±3.84			
Triceps skinfold	FC Buducnost	7.79±2.45	1.91	3.376	.001
	FC Siroki Brijeg	5.88±1.17			
Biceps skinfold	FC Buducnost	5.28±1.29	0.70	2.269	.028
	FC Siroki Brijeg	4.58±.75			
Skinfold of the back	FC Buducnost	9.81±2.89	0.85	1.218	.229
	FC Siroki Brijeg	8.96±1.75			
Abdominal skinfold	FC Buducnost	10.22±2.90	1.71	2.227	.030
	FC Siroki Brijeg	8.51±2.49			
Body mass index	FC Buducnost	23.49±1.45	0.50	1.195	.238
	FC Siroki Brijeg	22.99±1.51			
Fat percentage	FC Buducnost	9.98±2.76	0.14	.186	.853
	FC Siroki Brijeg	9.84±2.69			
Muscle mass	FC Buducnost	39.54±3.69	-0.03	-.030	.976
	FC Siroki Brijeg	39.57±3.26			

Note: Mean – average value; SD – standard deviation; MD - mean difference; Sig – significant difference

Based on the obtained values of t-test results, it can be noted that there are statistically significant differences in three variables; in one variable at $p < 0.01$ (triceps skinfold), and in two variables at $p < 0.05$ (biceps skinfold and abdominal skinfold). It can be stated that the

soccer players of FC Buducnost have statistically significant higher triceps skinfold, biceps skinfold and abdominal skinfold than the soccer players of FC Siroki Brijeg (Figure 1). In all other variables the differences are negligible and not statistically significant.



Note: ** - significant difference at level $p < 0.01$; * - significant difference at level $p < 0.05$

Figure 1. Statistically significant differences between soccer players of FC Buducnost and soccer players of FC Siroki Brijeg in three variables

Discussion

The aim of this study was to determine the difference in the anthropometric characteristics and body composition of the top soccer players of the champions' in Montenegro FC Buducnost and the top soccer players of the winners' Cup in Bosnia and Herzegovina FC Siroki Brijeg. A sample of 52 respondents was divided into two sub-samples. The first one consists of 30 soccer players of FC Buducnost of the average age 22.73 ± 4.33 , who were a statistically younger than the 22 soccer players of FC Siroki Brijeg, who made the second sub-sample of 24.00 ± 6.22 age on average. The results were obtained by using a battery of 10 tests in the area of anthropometric characteristics and body composition. By looking into the basic descriptive statistical parameters, it can be concluded that we have examined professional sportsmen indeed. It can be noticed that the soccer players of both clubs are of the approximately similar mean values of the variables analyzed, which is not surprising because these are the top two soccer clubs in Montenegro and Bosnia and Herzegovina, a state where there is also a great concentration of good soccer players. The t-test results showed that the soccer players of the two mentioned clubs have statistically significant differences by the three variables that estimate the triceps skinfold, biceps skinfold and abdominal skinfold, in a favor of FC Siroki Brijeg. The variable in which a statistically significant difference has been found is a variable that estimates abdominal skinfold, where the soccer players of FC Buducnost have a statistically higher value than the soccer players of FC Siroki Brijeg. Also, at the variables of triceps skinfold and biceps

skinfold, soccer players of FC Siroki Brijeg have shown statistically better values because a smaller number means a better result when the disrupting factor of subcutaneous fat on playing soccer is taken into account. Very similar characteristics of soccer players were obtained in the region, which shows that soccer players have similar the anthropometric characteristics and body composition in the whole region (Gardasevic, Bjelica, Popovic, Vasiljevic, & Milosevic, 2018; Bjelica, Gardasevic, & Vasiljevic, 2018; Corluca & Vasiljevic, 2018; Bjelica & Gardasevic, 2019; Gardasevic, Bjelica, & Vasiljevic, 2019a; Gardasevic, Bjelica, & Vasiljevic, 2019b; Gardasevic & Bjelica, 2020; Bjelica, Gardasevic, Vasiljevic, Jeleuskovic, & Covic, 2019).

For other variables, all values are better for soccer players of FC Siroki Brijeg, although, insignificantly for statistics, which indicates that these soccer players have very similar anthropometric parameters and body composition, which is again, not surprising, considering that these two soccer clubs are the best in their countries in the 2016/17 competitive season. The values obtained in this research can be useful for coaches of these soccer clubs for making a comparison of their soccer players with others and formulate their work in a way that enables reduction of those parameters that are not good, and raise those that are good to a higher level. That will surely make their soccer players even better and more successful. Also, both clubs should turn to other researches and check the functional-motoric status, psychological preparation as well as tactical training of their soccer players and analyze whether there is room for their improvement. The

results obtained in this research can serve as model parameters for the estimated variables for soccer players of all other soccer clubs in Montenegro and Bosnia and Herzegovina, because the soccer players that have been analyzed here, were among the best and the most successful soccer players in those two countries at the end of the competitive season 2016/17.

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Conflict of Interest

The authors declare that there is no conflict of interest.

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