

## ORIGINAL SCIENTIFIC PAPER

# Differences in Body Composition of Football Players of Two Top Football Clubs

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## Abstract

The aim of this research was to determine the differences among the football players of the football club in Bosnia and Herzegovina, CSC Zrinjski Mostar and the football players of the football club in Montenegro FC Sutjeska Niksic, in the anthropometric characteristics and body composition. A sample of 51 subjects was divided into two sub-samples. The first sub-sample of the subjects consisted of 28 football players of CSC Zrinjski Mostar of the average age  $24.36 \pm 4.14$ , the champions of the Bosnia and Herzegovina in the season 2016/17, while the other sub-sample consisted of 23 players of FC Sutjeska Niksic of the average age of  $21.69 \pm 4.30$ , the winner of the Cup of Montenegro in the season 2016/17. Football 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 football players of the top two football 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 football players of the two mentioned clubs have statistically significant differences by the three variables that estimate the waist circumference, triceps skinfold and skinfold of the back, in a favor of FC Sutjeska Niksic.

**Key words:** Anthropometric Characteristics, Body Composition, Football Players

## Introduction

A football game is said to be the most important secondary thing in the world, it gathers huge masses at stadiums and in front of TVs (Gardašević, 2010; Gardašević, Bjelica, Popović, & Milašinović, 2016). It is a highly dynamic and fast team game which, with its richness of movement, falls under category of polystructural sports games (Bjelica, 2005; Gardašević i Goranović, 2011; Gardašević i Bjelica, 2013; Gardašević & Bjelica, 2014a; Gardasevic i Bjelica, 2014b). Football 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; Bjelica, Popović, & Gardašević, 2016a; Bjelica, Popović i Gardašević, 2016b; Sermaxhaj, Popovic, Bjelica, Gardasevic, & Artifi, 2017; Gardasevic, Bjelica, & Vasiljevic,

2017a; Gardasevic, Bjelica, & Vasiljevic, 2017b) or acyclical movement (Gardasevic, 2015; Gardašević i sar., 2015; Gardašević, Bjelica i Vasiljević, 2016a; Gardašević, Bjelica i Vasiljević, 2016b; Gardasevic, Bjelica, Milasinovic i Vasiljevic, 2016; Gardašević i Vasiljević, 2016; Gardasevic, Popovic, & Bjelica, 2016). In football, top score can be achieved only under conditions of well-programmed training process (Gardašević, Bjelica i Popović, 2015). 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 (Bjelica i Popović, 2012; Bjelica, 2013). Various researches are to be done in order to establish certain principles and norms for the transformational processes of the anthropological characteristics important for football (Gardašević, Bjelica, Georgiev, & Popović, 2012); with

anthropometric 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 football. 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 (Bjelica & Fratrić, 2011). The purpose of knowing anthropometric characteristics is to improve skills in many sports (Carter & Heath, 1990). 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 (Mišigoj-Duraković, Matković, & Medved, 1995). 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, football is certainly the number one sport in the world for its view and popularity (Gardašević, Georgiev, & Bjelica, 2012; Vasiljević, Gardašević, & Bojanić, 2013; Gardasevic, Bjelica, Vasiljevic, Arifi, & Sermaxhaj, 2019), and the same applies to Bosnia and Herzegovina and Montenegro (Bjelica, Gardasevic, Vasiljevic, Arifi, & Sermaxhaj, 2019). The two clubs that are at the top of the Premier League of Bosnia and Herzegovina and of the First Montenegrin Telecom League, in the 2016/17 competitive season, they both have achieved a staggering success, CSC Zrinjski Mostar was the champion of Bosnia and Herzegovina and FC Sutjeska-Niksic was the winner of the Cup of Montenegro. 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 football 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 anthropometric characteristics and body composition of elite football players, players of CSC Zrinjski Mostar who compete in the Telecom Premier League of Bosnia and Herzegovina and players of FC Sutjeska Niksic, who compete in the First Montenegrin Telecom League. After which, compare the variables between these football players and determine the possible differences between them.

## Method

The data obtained in the study of anthropometric characteristics and body composition are checked and prepared for processing according to the set goal. Data bases are arranged according to the features and prepared for planned statistical processing. The results obtained by statistical analysis are presented in the tables and analyzed by the corresponding logical units. In general, the results of the research, through gradualness in the explanation of individual relationships, allow seeing differences in the observed anthropometric measures and body composition in accordance with the aim of the research, that is, they contribute to a clearer application of the obtained results in practice. In terms of time constraint, the research is of transversal character, and it consists of a

one-off measurement of the corresponding anthropometric characteristics and body composition of top-level senior football players.

### Sample of subjects

A sample of the subjects consists of a total of 51 top-level senior football players who performed in the Premier League of Bosnia and Herzegovina and the First Montenegrin Telecom League, divided into two sub-samples. The first one consists of 28 football players of CSC Zrinjski Mostar, the average age of  $24.36 \pm 4.14$ , Bosnia and Herzegovina's Championship winner in season 2016/17, and the second one that consists of 23 football players of FC Sutjeska Niksic of the average age  $21.69 \pm 4.30$ , the winner of the Cup of Montenegro in the season 2016/17. The football 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: body mass index (BMI), 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 composition of the body of the football 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 football 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 football players of CSC Zrinjski Mostar (Table 1).

**Table 1.** Central and dispersion parameters of variables for assessment of anthropometric characteristics and body composition of football players of CSC Zrinjski Mostar (N=28)

Variables	Min	Max	Mean±S.D.	Variance	Skewness	Kurtosis
Body height	170.8	193.0	182.59±4.82	23.27	-.07	.25
Body weight	70.0	90.5	78.85±5.80	33.68	.13	-.92
Waist circumference	77.0	98.0	86.39±4.35	18.91	.34	.95
Triceps skinfold	4.6	13.0	7.59±2.09	4.39	.88	.63
Biceps skinfold	3.3	6.2	4.33±.74	.55	1.07	.59
Skinfold of the back	3.7	13.8	9.23±2.18	4.74	.31	.92
Abdominal skinfold	4.0	15.0	8.02±2.77	7.66	.89	.36
BMI-body mass index	21.4	26.1	23.63±1.14	1.30	.16	-.47
Fat percentage	3.9	14.6	8.79±3.18	10.14	-.05	-.88
Muscle mass	35.5	46.9	40.67±2.67	7.12	.05	-.03

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 football players; that there is a normal distribution in all variables and that the results that prevail are superior to the arithmetic mean, which

is not statistically significant because it is to be expected that regarding football players of a professional football club, there is no too large a span between the results of analyzed variables. Table 2 showed the central and dispersion parameters of the variables were analyzed to evaluate the anthropometric characteristics and body composition of the football players of FC Sutjeska Niksic.

**Table 2.** Central and dispersion parameters of variables for assessment of anthropometric characteristics and body composition of football players of FC Sutjeska Niksic (N=23)

Variables	Min	Max	Mean±Std.D.	Variance	Skewness	Kurtosis
Body height	166.0	195.0	182.99±6.77	45.83	-.55	.61
Body weight	68.0	91.7	78.33±7.71	59.43	.48	-1.16
Waist circumference	76.0	90.0	83.00±3.82	14.64	.28	-.54
Triceps skinfold	3.4	9.8	6.46±1.66	2.77	.26	-.22
Biceps skinfold	3.1	7.7	4.52±1.22	1.49	1.12	.94
Skinfold of the back	6.4	11.8	8.13±1.42	2.01	1.10	1.15
Abdominal skinfold	5.4	14.0	8.25±2.38	5.65	.85	.03
BMI-body mass index	21.7	25.8	23.36±1.41	1.99	.43	-1.33
Fat percentage	2.6	13.6	8.66±2.92	8.53	-.38	-.51
Muscle mass	34.1	46.8	40.56±3.81	14.51	-.03	-1.19

Based on the central and dispersion parameters, the values of skewness and kurtosis of the football players of FC Sutjeska-Niksic, 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 football players of CSC Zrinjski Mostar. It can also be stated that the football players of FC Sutjeska-Niksic are younger on average. It can also be concluded that almost all variables of quantitative value are better with football players of FC Sutjeska-Niksic. However, a compara-

tive 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 variables of the biceps skinfold and skinfold of the back, 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 football players of these two clubs, the statistical procedure t-test (Table 3) was applied.

**Table 3.** T-test values between the arithmetic mean of variables for the evaluation of anthropometric characteristics and body composition of football players of CSC Zrinjski Mostar (N=28) and FC Sutjeska Niksic (N=23)

Variables	Club	Mean±S. D.	Mean Difference	t-test	Sig.
Body Height	CSC Zrinjski	182.59±4.82	-.3984	-.245	.807
	FC Sutjeska	182.99±6.77			
Body Weight	CSC Zrinjski	78.85±5.80	.5239	.277	.783
	FC Sutjeska	78.33±7.71			
Waist Circumference	CSC Zrinjski	86.39±4.35	3.3929	2.925	.005
	FC Sutjeska	83.00±3.82			
Triceps Skinfold	CSC Zrinjski	7.59±2.09	1.1241	2.087	.042
	FC Sutjeska	6.46±1.66			

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Variables	Club	Mean±S. D.	Mean Difference	t-test	Sig.
Biceps Skinfold	CSC Zrinjski	4.33±.74	-.1932	-.695	.490
	FC Sutjeska	4.52±1.22			
Skinfold of the Back	CSC Zrinjski	9.23±2.18	1.1017	2.088	.042
	FC Sutjeska	8.13±1.42			
Abdominal Skinfold	CSC Zrinjski	8.02±2.77	-.2300	-.314	.755
	FC Sutjeska	8.25±2.38			
BMI-Body Mass Index	CSC Zrinjski	23.63±1.14	.2677	.749	.458
	FC Sutjeska	23.36±1.41			
Fat Percentage	CSC Zrinjski	8.79±3.18	.1292	.150	.882
	FC Sutjeska	8.66±2.92			
Muscle Mass	CSC Zrinjski	40.67±2.67	.1026	.113	.911
	FC Sutjeska	40.56±3.81			

Based on the obtained values of t-test results, it was found that the football players of the two mentioned clubs have statistically significant differences by the three variables that estimate the the waist circumference, triceps skinfold and skinfold of the back, in a favor of FC Sutjeska-Niksic.

## Discussion

The aim of this study was to determine the difference in the anthropometric characteristics and body composition of the top football players of the champions' football club in Bosnia and Herzegovina, CSC Zrinjski Mostar and the top football players of the winner football club in Montenegro FC Sutjeska Niksic. A sample of 51 respondents was divided into two sub-samples. The first sub-sample consisted of the 28 football players of CSC Zrinjski Mostar of  $24.36 \pm 4.14$  age on average, who were a statistically significant older than the 23 football players of FC Sutjeska Niksic, who made the second sub-sample of  $21.69 \pm 4.30$  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 football 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 football clubs in Bosnia and Herzegovina and Montenegro, a state where there are also a great concentration of good football players. The t-test results showed that the football players of the two mentioned clubs have statistically significant differences by the three variables that estimate the waist circumference, triceps skinfold and skinfold of the back, in a favor of FC Sutjeska Niksic. The first variable in which a statistically significant difference has been found is a variable that estimates waist circumference, where the football players of CSC Zrinjski Mostar also have a statistically higher value than the football players of FC Sutjeska Niksic. Also, at the variables of triceps skinfold and skinfold of the back, football players of CSC Zrinjski Mostar have shown statistically better values because a smaller number means a better result when the disrupting factor of subcutaneous fat on playing football is taken into account. Very similar characteristics of football players were obtained in the region, which shows that football players have similar the anthropometric characteristics and body composition in the whole region (Gardasevic, Bjelica, Popovic, Vasiljevic, & Milosevic, 2018; Bjelica, Gardasevic, & Vasiljevic, 2018; Corluka & Vasiljevic, 2018; Bjelica, & Gar-

dasevic, 2019; Gardasevic, Bjelica, & Vasiljevic, 2019; Bjelica, Gardasevic, Vasiljevic, Jeleskovic, & Covic, 2019).

For other variables, some values are better for football players of CSC Zrinjski Mostar and some for football players of FC Sutjeska Niksic, although, insignificantly for statistics, which indicates that these football players have very similar anthropometric parameters and body composition, which is again, not surprising, considering that these two football 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 football clubs for making a comparison of their football 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 football 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 football 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 football players of all other football clubs in Bosnia and Herzegovina and Montenegro, because the football players that have been analyzed here, were among the best and the most successful football 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 are no conflicts of interest.

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