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Elite Football Players from Bosnia and Herzegovina and Kosovo and their Body Composition

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Abstract

The aim of this research was to determine the differences among the top football players of the club in Bosnia and Herzegovina, CSC Zrinjski Mostar and the top football players of the club in Kosovo FC Trepca '89, the champions in their countries, in the morphological characteristics and body composition. A sample of 43 subjects was divided into two sub-samples. The first sub-sample of the subjects consisted of 28 players of CSC Zrinjski Mostar of the average age 24.36 ± 4.14 , the champions of the Bosnia and Herzegovina in the season 2016/17, while the other sub-sample consisted of 15 players of FC Trepca '89 of the average age 21.80 ± 3.57 , the champions of the Kosovo Championship in the season 2016/17. Football players were tested immediately after the end of the competition season 2016/17. Morphological 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 standard central and dispersion parameters of all variables were calculated. The significance of the differences between the players of the top two football clubs in the morphological 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 don't have statistically significant differences by the variables.

Key words: soccer, morphological characteristics, football players, Bosnia and Herzegovina, Kosovo

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, & Arifi, 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 cha-



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characteristics important for football (Gardašević, Bjelica, Georgiev, & Popović, 2012); with morphological characteristics and body composition among them as expected. Findings regarding morphological characteristics and body composition are of crucial importance for complex sports games such as football. The morphological 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 morphological characteristics is to improve skills in many sports (Carter & Heath, 1990). The morphological 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 morphological 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, & Sermahaj, 2019), and the same applies to Bosnia and Herzegovina and Kosovo (Bjelica, Gardasevic, Vasiljevic, Arifi, & Sermahaj, 2019). The two clubs that are at the top of the Premier League of Bosnia and Herzegovina and of the Super League of Kosovo, 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 Trepca '89 was the champion of Kosovo. 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. 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 morphological characteristics and body composition of elite soccer players, players of CSC Zrinjski Mostar who compete in the Telecom Premier League of Bosnia and Herzegovina and players of FC Trepca '89, who compete in the Super League of Kosovo. After which, compare the variables between these players and determine the possible differences between them.

Method

The data obtained in the study of morphological 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 morphological 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 morphological characteristics and body composition of top-level senior players.

Sample of subjects

A sample of the subjects consists of a total of 43 top-level senior players who performed in the Premier League of Bosnia and Herzegovina and Suoer League of Kosovo, divided into two sub-samples. The first one consists of 28 players of CSC Zrinjski Mostar, the average age of 24.36 ± 4.14 , Bosnia and Herzegovina's Championship winner in season 2016/17, and the second one that consists of 15 players of FC Trepca '89 of the average age 21.80 ± 3.57 , the champions of the Kosovo Championship 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 morphological measures have been taken: body height (ABH), body weight (ABW), waist circumference (AWC), triceps skinfold (ATS), biceps skinfold (ABS), skinfold of the back (ASB) and abdominal skinfold (AAS), and 3 body composition assessment variables: body mass index (BMI), fat percentage (AFP) and muscle mass (AMM). Anthropometer, caliper, and measuring tape were used for morphological 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 morphological characteristics and the composition of the body of the 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 players of the two clubs, where the values of central measurements and dispersion tendencies are calculated, are shown: Arithmetic mean (Mean), Standard deviation (Std. Dev.), Variance (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 morphological characteristics and body composition of the players of CSC Zrinjski Mostar (Table 1).

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

Variables	Min	Max	Mean \pm S.D.	Variance	Skewness	Kurtosis
ABH	170.8	193.0	182.59 \pm 4.82	23.27	-.07	.25
ABW	70.0	90.5	78.85 \pm 5.80	33.68	.13	-.92
AWC	77.0	98.0	86.39 \pm 4.35	18.91	.34	.95
ATS	4.6	13.0	7.59 \pm 2.09	4.39	.88	.63
ABS	3.3	6.2	4.33 \pm .74	.55	1.07	.59
ASB	3.7	13.8	9.23 \pm 2.18	4.74	.31	.92
AAS	4.0	15.0	8.02 \pm 2.77	7.66	.89	.36
BMI	21.4	26.1	23.63 \pm 1.14	1.30	.16	-.47
AFP	3.9	14.6	8.79 \pm 3.18	10.14	-.05	-.88
AMM	35.5	46.9	40.67 \pm 2.67	7.12	.05	-.03

Legend: ABH-body height, ABW-body weight, AWC-waist circumference, ATS-triceps skinfold, ABS-biceps skinfold, ASB-skinfold of the back, AAS-abdominal skinfold, BMI-body mass index, AFP-fat percentage; AMM-muscle mass

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 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 morphological characteristics and body composition of the players of FC Trepca '89.

Table 2. Central and dispersion parameters of variables for assessment of morphological characteristics and body composition of players of FC Trepca '89 (N=15)

Variables	Min	Max	Mean \pm S.D.	Variance	Skewness	Kurtosis
ABH	174.3	188.0	181.95 \pm 4.41	19.424	-.502	-.941
ABW	66.3	86.1	76.61 \pm 6.75	45.576	-.066	-1.565
AWC	79.0	91.0	84.20 \pm 3.76	14.171	.182	-.619
ATS	3.6	10.5	7.11 \pm 1.86	3.454	-.114	.094
ABS	2.6	8.2	4.57 \pm 1.49	2.209	1.015	.957
ASB	6.8	13.4	9.04 \pm 2.07	4.303	1.192	.333
AAS	4.6	16.8	8.33 \pm 3.84	14.746	1.391	.702
BMI	20.0	25.5	23.00 \pm 1.65	2.729	-.252	-.762
AFP	3.8	14.4	9.81 \pm 2.96	8.752	-.426	-.121
AMM	34.9	43.0	39.02 \pm 2.53	6.389	-.276	-1.124

Based on the central and dispersion parameters, the values of skewness and kurtosis of the players of FC Trepca '89, 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 players of CSC Zrinjski Mostar. It can also be stated that the players of FC Trepca '89 are younger on average, have less body weight than the players of CSC Zrinjski Mostar, and have a higher fat percentage, though insignificantly. However, a comparative 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 (ABS), skinfold of the back (ASB) and abdominal skinfold (AAS), 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 morphological characteristics and body composition of players of CSC Zrinjski Mostar (N=28) and FC Trepca '89 (N=15)

Variables	Club	Mean \pm S.D.	Mean Difference	t-test	Sig.
ABH	ZRI	182.59 \pm 4.8235	.6395	.427	.672
	TRE	181.95 \pm 4.4073			
ABW	ZRI	78.85 \pm 5.8036	2.2433	1.141	.260
	TRE	76.61 \pm 6.7510			
AWC	ZRI	86.39 \pm 4.3490	2.1929	1.648	.107
	TRE	84.20 \pm 3.7645			

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Variables	Club	Mean ± S.D.	Mean Difference	t-test	Sig.
ATS	ZRI	7.59±2.0959	.4760	.737	.465
	TRE	7.11±1.8585			
ABS	ZRI	4.33±.7418	-.2448	-.724	.473
	TRE	4.57±1.4864			
ASB	ZRI	9.23±2.1768	.1921	.280	.781
	TRE	9.04±2.0743			
AAS	ZRI	8.02±2.7686	-.3088	-.304	.763
	TRE	8.33±3.8401			
BMI	ZRI	23.63±1.1421	.6219	1.452	.154
	TRE	23.01±1.6520			
AFP	ZRI	8.79±3.1849	-1.0210	-1.026	.311
	TRE	9.81±2.9584			
AMM	ZRI	40.67±2.6689	1.6479	1.965	.056
	TRE	39.02±2.5276			

Based on the obtained values of t-test results, it was found that the soccer players of the two mentioned clubs don't have statistically significant differences by the variables. In all variables the differences are negligible and not statistically significant.

Discussion

The aim of this study was to determine the difference in the morphological characteristics and body composition of the top football players of the club in Bosnia and Herzegovina, CSC Zrinjski Mostar and the top football players of the club in Kosovo FC Trepca '89, the champions in their countries in the 2016/17 season. A sample of 43 respondents was divided into two sub-samples. The first sub-sample consisted of the 28 players of CSC Zrinjski Mostar of 24.36 ± 4.14 age on average, who were a statistically significant older than the 15 players of FC Trepca '89, who made the second sub-sample of 21.80 ± 3.57 age on average. The results were obtained by using a battery of 10 tests in the area of morphological 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 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 clubs in Bosnia and Herzegovina and Kosovo, a states where there are also a great concentration of good players. The t-test results showed that the soccer players of the two mentioned clubs don't have statistically significant differences by the variables. 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, & Gardasevic, 2019; Gardasevic, Bjelica, & Vasiljevic, 2019).

For all variables, some values are better for players of CSC Zrinjski Mostar and some for players of FC Siroki Brijeg, although, insignificantly for statistics, which indicates that these players have very similar anthropometric parameters and body composition, which is again, not surprising, considering that these two 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 clubs for making a comparison

of their 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 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 players of all other football clubs in Bosnia and Herzegovina and Kosovo, because the 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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