Anthropometric characteristics of professional football players in relation to the playing position and their significance for success in the game

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Abstract

Purpose:	Football is a game in which anthropometric characteristics are important factors for specific player positions, where morphological characteristics differ in relation to the competitive level and the position in the game. Body composition is an important indicator of the physical fitness and general health of athletes so today its often discussed in scientific literature. The aim of the research was to determine the differences in the anthropometric characteristics of the professional football players in relation to the player's position and to determine their importance in the game.
Material:	Twenty-nine male football players of the national team of Serbia participated in the research, in which the body height, weight and Body mass index were measured.
Results:	The results of the study indicate that statistically significant differences in body height and body weight were recorded between goalkeepers and midfielders ($p < 0.01$) and goalkeepers and attackers ($p < 0.05$) in favor of goalkeepers, while no statistically significant differences were recorded in the Body Mass Index. The lowest height, weight and BMI were recorded in the midfielders.
Conclusions:	Based on the results of the research it can be concluded that the morphological characteristics have a vital role in determining the success of athletes. Football coaches can use the results of this study as a means to better understand and interpret anthropometric characteristics and their importance in relation to the gaming position. The acquaintance of noticed differences could improve the training process as well as the selection at the early age.
Keywords:	Morphological characteristics, geographical area, selection of football players.

Introduction

Football is a game in which anthropometric characteristics are important factors for specific gaming positions [1]. Morphological characteristics [2, 3] successfully distinguish footballers compared to the competitive level and the game position [4] and they are important factors in selecting players in team sports [5, 6] describing the structure of the body of the player based on a large number of anthropometric data [7], which define the longitudinal and transversal dimensionality of the skeleton, mass and volume of the body [8] and they are under great influence of endogenous and exogenous factors [9]. In many studies it has been confirmed that the morphological characteristics of athletes can influence the success in achieving sports results [10, 11]. The data on body weight and height show a great variation [12]. Insufficient height by itself is not a lack for football, although it affects the position of the team [13]. Footballers who play in different positions have specific morphological characteristics [14, 15], that is, defender players are the highest and the heaviest, as confirmed in the research [16] says that defenders are on average six centimeters higher and seven pounds heavier than

attackers. Unlike defensive players, midfield players, backs and wings show a tendency for a lower height [13]. The body mass index is used to classify athletes as normal, overweight or obese [17, 18], which is used in adults as an internationally recognized indicator of overweight and obesity [19]. Body composition is an important indicator of the physical fitness and general health of athletes [20] and today it is often discussed on this topic in scientific literature. According to some authors, Claessens, et al., [21] form of the body and its morphology, in addition to physical abilities, psychological characteristics and energy capacity of the system, is one of the main factors determining sports performance. Therefore, the diagnosis of body condition is often the subject of research, based on which a real insight into the current state of the defined population and possible negative or positive trends of growth and development over a certain period of time [22, 23].

Regarding the above mentioned current research, it was realized with the aim of diagnosing differences in the anthropometric characteristics of Serbian national football players in relation to the play position and determine the relevance of these characteristics for success in the game, and it is based on the hypothesis that there is differences in anthropometric characteristics.

Material and Methods

Participants

The study included a sample of 29 male players, members of national team of Serbia, the average age of (Mean-Std.Dev.) 26.83 ± 3.94, body height 185.76 ± 7.47 cm, body weight 77.24 ± 7.45 kg, BMI 22.43 ± 1.13 kg/m^2.

Research Design

All anthropometric variables [Body Height (cm), Body Weight (kg), Body Mass Index (kg/m^2)] were measured according to standard procedures of the International Society for the Advancement of Kinanthropometry (ISAK) [24]. To measure the body height and weight of players, a stadiometer and a calibrated scale were used with a precision of 0.1 cm and 0.1 kg, while BMI was calculated by dividing the body mass with the square height of the body in meters [25].

Statistical Analysis

All the data collected by the study were processed by descriptive and comparative statistics. From the space of descriptive statistics, for each variable, the measures of central tendency and dispersion measures were calculated: Mean, Minimum, Maximum, Range Deviation, Standard Deviation, while to calculate the distribution: Skewness and Kurtosis.

From the space of comparative statistics, a discriminative parametric procedure, a variance analysis with one factor Anova and PostHoc was used, which determined differences in relation to the player position. The statistical program for personal computers SPSS for Windows version 20.0 was applied for data processing.

Results

Table 1 shows numerical quantitative indicators of the physical status of the football players. The highest average height, weight and BMI was recorded in the goalkeeper, then with defensive players and attackers, while the lowest height, weight and BMI were recorded in the midfielders. An analysis of the symmetry of the results in the goalkeeper indicates that there are no significant deviations from the normal distribution, however, in

terms of homogeneity, there is a platykurtic curve. For defensive players, attackers and midfielder, distribution of frequencies with statistically negative asymmetry in body height and weight is present, while in BMI scores there are no significant deviations from normal distribution.

With defensive footballers and midfielder, a platykurtic curve in the Body Weight variable was formed, while the leptokurtic curve was formed in the BMI variables. Unlike the defensive and midfielders, the striker has a platykurtic curve in the Body Height variant. In order to determine statistically significant differences between the player's positions, depending on the numerical parameters for the assessment of body status, a variance analysis with one factor-Anova was used (Table 2). It is evident from Table 2 that statistically significant differences were recorded in body height (p <0.018) and body weight (p <0.019), as opposed to BMI, where no statistically significant difference was recorded.

By analyzing the results of PostHoc Table 2, the differences in the anthropometric characteristics in relation to the player's position are shown. Statistically significant differences in body height and body weight were recorded between goalkeepers and midfielders (p <0.01) and goalkeepers and attackers (p <0.05) in favor of goalkeepers. Figure 1 shows the average values of the anthropometric characteristics of the football players.

Discussion

The aim of this research was to determine the differences in the anthropometric characteristics of male footballers of the national team of Serbia in accordance with their playing positions and to determine the relevance of these characteristics for the success of the game. The results of the study confirm the hypothesis that there are statistically significant differences in anthropometric characteristics in body height and weight, while in BMI there were no statistically significant differences. The values of BMI for Serbian footballers are 22.43 ± 1.13kg/m^2, and they correspond to the values of four elite European leagues (England, Italy, Germany and Spain) and their BMI values range from 22.8 ± 1.1 kg/m^2 to 23.2±

Table 1. Descriptive parameters of the football player in relation to the player's position

Position	Variables	N	Mean	Std.Dev.	Max.	Min.	Range	Skewness	Kurtosis
Goalkeeper	Body Height	4	194.25	5.31	201	190	11	.708	-2.065
	Body Weight		85.75	7.41	94	79	15	.230	-4.517
	BMI		22.82	1.34	24.47	21.38	3.09	.358	-1.368
Defender	Body Height	10	187.50	5.35	195	177	18	-.309	.459
	Body Weight		78.90	5.38	85	70	15	-.369	-.978
	BMI		22.43	1.14	24.84	20.45	4.39	.487	2.009
Midfielder	Body Height	11	181.73	5.35	194	165	29	-.309	.459
	Body Weight		73.27	5.38	82	60	22	-.369	-.978
	BMI		22.16	1.14	23.55	21.68	1.87	.487	2.009
Forward	Body Height	4	184	7.39	191	175	16	-.475	-2.716
	Body Weight		75.50	9.88	85	62	23	-1.044	1.097
	BMI		22.43	2.19	25.58	20.24	5.34	.354	1.326

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Table 2. Differences in the anthropometric characteristics of the football player - Anova, Post Hoc

Anthropometry	Position				Anova	
	GK	DF	MF	FW	F	p
Body Height	194.25±5.315*#	187.50±5.35	181.73±5.35	184±7.39	4.026	.018
Body Weight	85.75±7.41*#	78.90±5.38	73.27±5.38	75.50±9.88	3.970	.019
Body Mass Index	22.82±1.34	22.43±1.14	22.16±1.14	22.43±2.19	.457	.715

Note: Goalkeeper – GK; Defender – DF; Midfiwlder – MF; Forward – FW. * - Goalkeeper vs Midfielder; $p < 0.01$; # - Goalkeeper vs Forward; $p < 0.05$
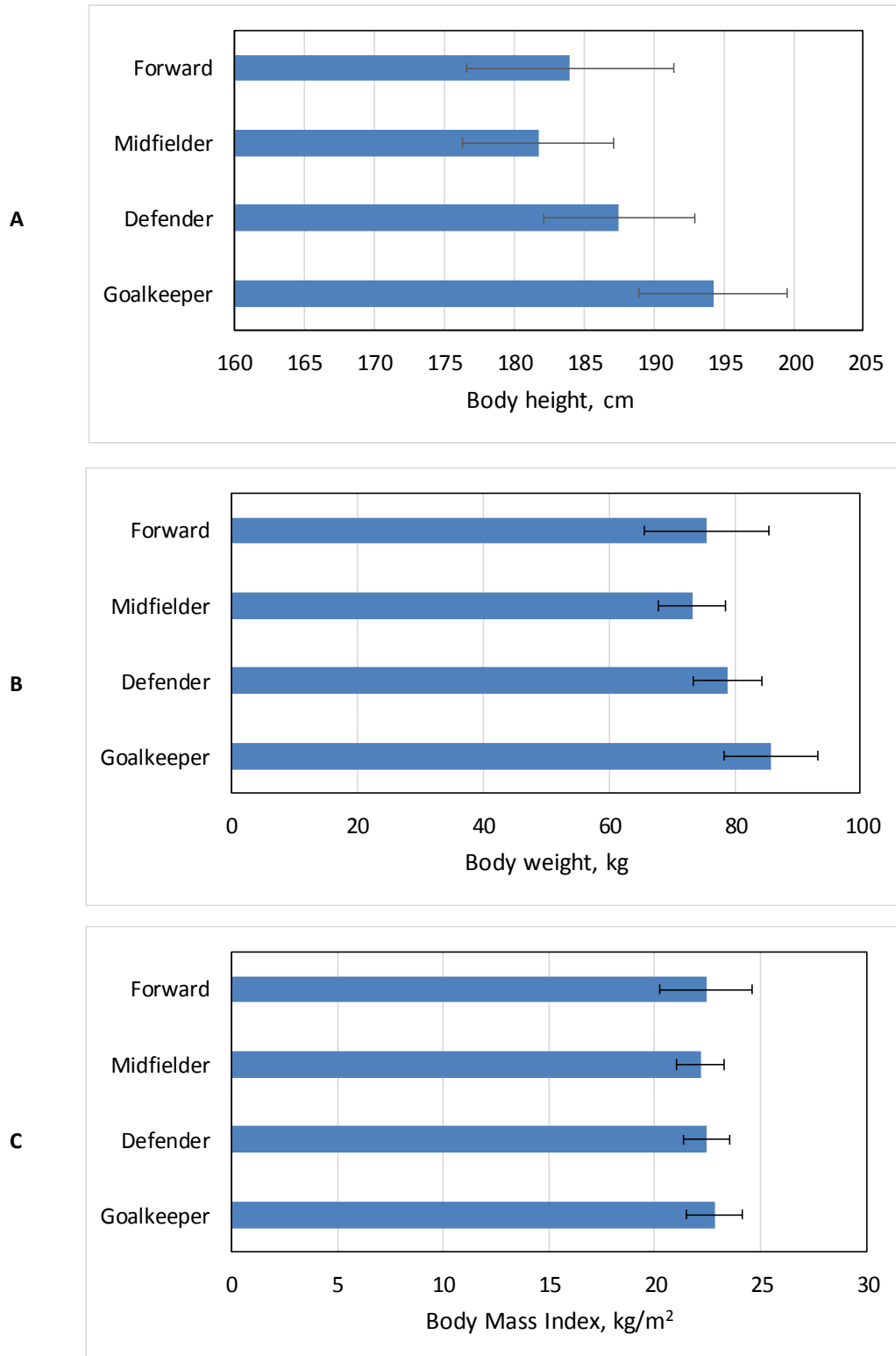
Figure 1. Antropometric characteristics of the soccer players: (**A**) Body height; (**B**) Body weight, (**C**) Body Mass Index.

1.1 kg/m² [15, 17]. Similar values of BMI were recorded by Bangsbo [26], with Danish footballers (23.87 kg/m²), Bunc, & Psotta [27], with players from Czech Republic (23.58 kg/m²), Rahkila, & Luthanen [28], football players from Finland (23.35 kg/m²), Vanfraechem & Tomas [29], with players from Belgium (23.41 kg/m²) and Ćorluka et al. [60], with players from Bosnia and Herzegovina (22.3-23.5 kg/m²).

The average body weight of the Serbian football players is 77.24 ± 7.45 kg, and they are in line with the average body weight of footballers competing in the German Bundesliga 77.5kg, England Premier League 73.3kg, Italian Serie A 74.3kg and Spanish La Liga 75.0 kg [15, 30]. The identical values of body weight were recorded in Norway's players 72.2kg, 73.1kg in Saudi Arabia players, and 76.4kg in South American football players [6, 31, 32], which indicates that Serbia's footballers are in rank with world footballers. The average body height and weight for professional football players is around (180-185cm and 70-75kg) when all players are taken into account [3, 33, 34]. The highest body height is scored in goalkeepers and defenders, while the midfielders are the smallest [3, 35, 36]. Research suggests that professional players differ from their playing position in anthropometric characteristics such as body height, weight, and body mass index. In particular, the goalkeepers who took part in the FIFA World Cup (2002 and 2006) were significantly higher, heavier, and had higher BMI values than defenders, strikers and midfielders, with the midfielders having the least values of anthropometric characteristics: height and weight [37, 38]. In our research, the goalkeepers had a higher body height (194.25cm) and body weight (85.75cm) than the midfielders (181.73cm; 73.27kg) and the attackers (184cm; 75.50kg). The reason for the higher weight of the goalkeepers can be justified by the fact that goalkeepers are less likely to run in the game, therefore they consume less energy, while other players tend to be lighter and leaner in order to run a greater distances in the field [39], which is confirmed by the researches [14, 30, 40, 41, 59], which are in agreement with our results. Footballers of Serbia have a higher body height than Croatian football players [42], Portugal, Brazil and Iran [30, 43, 44].

Research shows that the geographical area as a determinant of growth has an impact on the selection of football players [45], this is confirmed by the research carried out by Popović, et al., [46] that people in Serbia are very high with an average of 181.96cm and very close to the highest nations in Europe. Observing the body height and weight of players from different geographic regions show that players differ significantly in this regard. Such differences can be the result of ethnic and cultural influences or the result of a different style of football, where teams from different countries prefer different types of players [15, 47]. Anthropometric research in footballers [3, 6, 34] have shown that body height and weight are important factors [48]. Thus, football differs from other individual sports in that there are no definite characteristics of each player [49], where the anthropometric characteristics of

height and weight are necessary for good performance [1], and their relationship is equally important because of the fact that top football involves a duel game, head-ball strikes, alternate attack and defense, all of which relates to effective realization during the match [50]. Physical height is an advantage for the goalkeeper, attackers and defensive players who play the most in the game with hands and head, while midfielders, wings and back wings tend to have a lower height [12]. It is precisely this anthropometric characteristic for midfielders that allows them to move more efficiently and cover larger distances of the field [51] also, lower body height allows them to handle the ball well in order to overcome defensive players [31, 33] because a small body height keeps the center of gravity closer to the ground, and their dynamic balance is facilitated during dribbling. The average body height for goalkeepers who participated in the last World Championships was 188.9 ± 5.0 cm, and these values allow goalkeepers to stop the shots under the crossbar [52]. Thus, the height of the body at the goalkeeper is an obvious advantage which can compensate for their lower body weight. It is also necessary that the goalkeepers have a strong and muscular body, so that they can enter the air duels against the attackers [53]. For defenders, the body height is suitable when the ball wants to be hit with the head, from a jump or from the ground [14] and they are the highest and heaviest players due to frequent jumps to perform in tactical tasks [54]. Attackers with higher body height have the advantage of hitting high balls, while lower height attackers have the advantage of dribbling [3, 30]. The body height, weight, BMI ratio, as well as the percentage of fat mass in the overall body weight for trainers is important information. Optimal BMI values can result in an improvement in the general level of the physical and anaerobic strength [55-58]. In athletes whose BMI values between 18.5 and 20.0 are worsening work capabilities and VO_{2max} low-level athletes BMI may be able to perform submaximal exercise as well as athletes whose BMI values are in the normal range but they will work with a higher percentage of their VO_{2max} and have a significantly higher heart rate for the same O_2 consumption level [59].

Morphological characteristics have a vital role in determining the success of athletes [47, 60, 61], and especially for the realization of motor assignments [62-65], which confirms research that morphological characteristics in specific motor capabilities participate with 42% of variability, so that bigger players have greater strength and better precision of kickballs and headers [45]. Based on all of the above, the role of a trainer is to pay attention to these characteristics when creating a team, because it is necessary to adjust the configuration of his team and the style of play to his players who do not have adequate physical attributes of the conventional positions in the team, which are compensated by superior knowledge, skill and motivation [13].

Conclusion

Football is a game in which anthropometric

characteristics are important factors for specific player positions, where morphological characteristics differ in relation to the competitive level and the position in the game. In this study, there were differences in the anthropometric characteristics between the goalkeeper and the attacker, the midfielders and the defending players. The goalkeepers were the highest and the heaviest, while the midfielders had the lowest body height and body weight. Football coaches can use the results of this study as a means to better understand and interpret anthropometric characteristics and their importance in relation to the gaming position. The acquaintance of noticed differences could improve the training process as well as the selection at the early age.

Conflicts of Interest
The authors declare no conflict of interest.

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