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BODY COMPOSITION OF YOUNG SOCCER PLAYERS

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ABSTRACT

Purpose: *The main aim of this study was to examine and analyse the body composition of young soccer players across different age groups.*

Methods: *A cross-sectional study was carried out among 126 young soccer players divided into age categories: U15 – 53 players (age=14.68±0.47); U17 – 51 players (age=16.47±0.50); U19 – 22 players (age=18.05±0.38). The subjects' height was measured using an anthropometer, while their body composition was measured using the TANITA BC-420MA digital scale.*

Results: *On average, soccer players in the U15 group had significantly lower body height, weight, body mass index and fat free mass than U17 and U19 players, but had a higher percentage of body fat ($p < 0.05$). In addition to the percent of body fat mass, which tends to significantly decrease with age, the results also demonstrate significant non-linear increases in body height, weight, and lean body composition concurrent with the players' ages.*

Conclusion: *These results indicate that younger soccer players have lower absolute values of morphological characteristics compared to senior players.*

Keywords: *BMI, anthropometry, fitness, body fat, soccer*

TELESNA SESTAVA MLADIH NOGOMETAŠEV

IZVLEČEK

Cilj: *Glavni cilj te raziskave sta bili proučitev in analiza telesne sestave mladih nogometašev v različnih starostnih skupinah.*

Metode: *Med 126 mladimi nogometaši, razdeljenimi po starostnih kategorijah U15 – 53 igralcev (starost = 14,68 ± 0,47) –, U17 – 51 igralcev (starost = 16,47 ± 0,50) – in U19 – 22 igralcev (starost = 18,05 ± 0,38) –, je bila izvedena presečna študija. Telesna višina vseh udeležencev je bila izmerjena z antropometrom, telesna sestava pa z digitalno tehtnico TANITA BC-420MA.*

Rezultati: *Nogometaši iz skupine U-15 so imeli v povprečju bistveno nižjo telesno višino, težo, indeks telesne mase in maso brez maščobe kot igralci U-17 in U-19, vendar so imeli višji odstotek telesne maščobe ($p < 0,05$). Poleg odstotka telesne maščobne mase, ki se s starostjo značilno zmanjšuje, rezultati kažejo tudi značilno nelinearno povečanje telesne višine, telesne mase in puste telesne sestave, sočasno s starostjo igralcev.*

Zaključek: *Ti rezultati kažejo, da imajo mlajši nogometaši nižje absolutne vrednosti morfoloških značilnosti v primerjavi s starejšimi.*

Ključne besede: *ITM, antropometrija, telesna pripravljenost, telesna maščoba, bioelektrična impedanca*

INTRODUCTION

Soccer is one of the most popular sports today, played by men, women and children all over the world. In the last few years, numerous studies have tried to gather as much information as possible about the abilities and characteristics of young soccer players (Čović et al., 2017; Nikolaidis et al., 2016; Castillo, Yanci, Cámara, & Weston, 2016; Figueiredo, Gonçalves, Coelho e Silva, & Malina, 2009), with the aim of achieving better planning and programming of sports training, but also of higher-quality selection. Studies have confirmed the importance and role of body composition as one of the key indicators of physical fitness and general health of athletes in soccer (Mala, Maly, Zahalka, & Hrasky, 2015). Body composition provides us with an athlete‘s detailed physiological profile (Mala et al., 2015), which is considered one of the key elements of the soccer game because it greatly affects the possibility to complete 90 minutes of competitive play. Researching the influence of body composition on player performance in soccer is particularly complex, because success in the game depends on how the individual characteristics of 11 players come together to form a dynamic team. Previous research has pointed to the negative effects of excess adipose tissue, considering that it acts as dead weight in activities during which the body’s mass must be repeatedly raised against gravity during locomotion and jumping (Reilly, 1997; Talović et al., 2018), which ultimately leads to reduced performance and increased energy requirements in the soccer game. In contrast, a high percentage of fat-free mass is a desirable indicator given that it contributes to the production of power during high-intensity activities such as soccer. Body composition data can be an indicator of an athlete’s nutritional state; moreover, it can provide information on current body fluid homeostasis (Andreoli et al., 2003). Andreoli et al. (2003) state that the assessment of intracellular and extracellular mass is one of the best predictors of muscle efficiency that can ultimately predict physical performance. Changes in body composition, such as an increase in lean mass or a decrease in fat-free mass, can therefore be expected to improve a player’s performance in regards to the specific speed and agility demands experienced during a soccer game.

It has been proven that age influences physical performance, especially in young people, because of its strong relationship to the growth of individuals and their level of experience (França et al., 2022; Mroczek, Golachowska, & Kaczorowska, 2022). However, to date there has been little research on the body composition trends of adolescent soccer players (U15, U17 and U19). This information is of great interest for coaches, especially when it comes to optimizing and selecting training programmes that can improve players‘ long-term development. Therefore, the aim of this study was to examine and analyse the body composition of young soccer players across different age groups.

METHODS

Sample of subjects

This cross-sectional study included 126 young soccer players. Players were categorized by age categories: U15 – 53 players (14.68±0.47 years); U17 – 51 players (16.47±0.50 years); U19 – 22 players (18.05±0.38 years). All participants had competed at the regional level in Bosnia and Herzegovina. The testing was conducted at the Institute of Sport at the University of Sarajevo by the Faculty of Sports and Physical Education. The protocols were carried out by qualified personnel of the research team. Participation in this study was voluntary, all players and their parents were fully informed verbally and in writing about the demands and nature of the study, and written parental consent was obtained for all participants.

Body composition

Body height in all subjects was measured with a possible error of 0.1 cm using an anthropometer (Holtain 610, Crymych, United Kingdom), and body composition was measured using the Tanita scale (Tanita BC-418, Tokyo, Japan). The measurements took place early in the morning (09:00) for three consecutive days. A group of 40 to 45 players was evaluated each day and the average time between the first and last review was approximately 35 minutes. At the time of evaluation, participants were in a fasted state and wore only their underwear. During the testing procedure all participants were barefoot with their arms held nearly 45° from their trunk. Body composition variables included: body mass (BM), body mass index (BMI), body fat percentage (BF%), fat mass (FM) and fat-free mass (FFM) (Kapo et. al., 2018).

Statistical analysis

Descriptive statistics were presented as means ± standard deviation (Mean±SD). Normality and equality of variance of the variables were assessed using a Shapiro-wilk test. A one-way analysis of the variance (ANOVA) and post hoc comparisons using the Bonferroni adjustment were conducted to investigate differences in age and body composition between groups. All data were processed using IBM SPSS Statistics software 22.0 (SPSS Inc., Chicago, IL, USA). The significance level was set at $p \leq 0.05$.

RESULTS

The variables for body composition (U15, U17 and U19) of subjects are shown in Table 1. The results of the one-way ANOVA between groups suggest significant differences in body composition. The U15 group had significantly lower body mass ($F = 29.308$, $p \leq 0.01$); body height ($F = 42.636$, $p \leq 0.01$), greater BF% ($F = 15.003$, $p \leq 0.01$), and lower FFM ($F = 39.543$, $p \leq 0.01$) than their older peers. In terms of FFM, the U17 group also had a significantly lower mean value than the U19 group (Table 2).

Table 1. Results of descriptive parameters of U15, U17 and U19

	U15 (n=53)	U17 (n=51)	U19 (n=22)	ANOVA	
	Mean±SD	**Mean±SD**	**Mean±SD**	**F**	**p**
Age [years]	14.68±0.47	16.47±0.50	18.05±0.38	687.822	**.000***
BM [kg]	53.61±7.85	61.52±9.80	69.43±6.28	29.308	**.000***
Height [cm]	165.14±6.48	174.55±7.38	179.22±6.01	42.636	**.000***
BMI [kg · m^{-2}]	19.72±2.35	19.91±2.85	21.65±1.43	5.121	**.007***
BF [%]	13.48±5.29	9.77±2.84	8.86±2.98	15.003	**.000***
FM [kg]	7.45±3.82	6.22±2.69	6.20±2.21	2.348	.100
FFM [kg]	46.21±5.76	54.32±10.03	63.22±5.70	39.543	**.000***

Table 2. Differences among the categories

	Group (I)	Group (J)	Mean Difference (I-J)	Sig.
BM [kg]	U15	U17	-7.90	**.000***
	U15	U19	-15.81	**.000***
	U17	U19	-7.91	**.001***
Height [cm]	U15	U17	-9.41	**.000***
	U15	U19	-14.08	**.000***
	U17	U19	-4.67	**.024***
BMI [kg · m^{-2}]	U15	U17	-0.19	.693
	U15	U19	-1.92	**.002***
	U17	U19	-1.73	**.007***
BF [%]	U15	U17	3.71	**.000***
	U15	U19	4.61	**.000***
	U17	U19	0.90	.385
FM [kg]	U15	U17	1.23	**.049***
	U15	U19	1.24	.123
	U17	U19	0.01	.990
FFM [kg]	U15	U17	-8.10	**.000***
	U15	U19	-17.00	**.000***
	U17	U19	-8.89	.000*

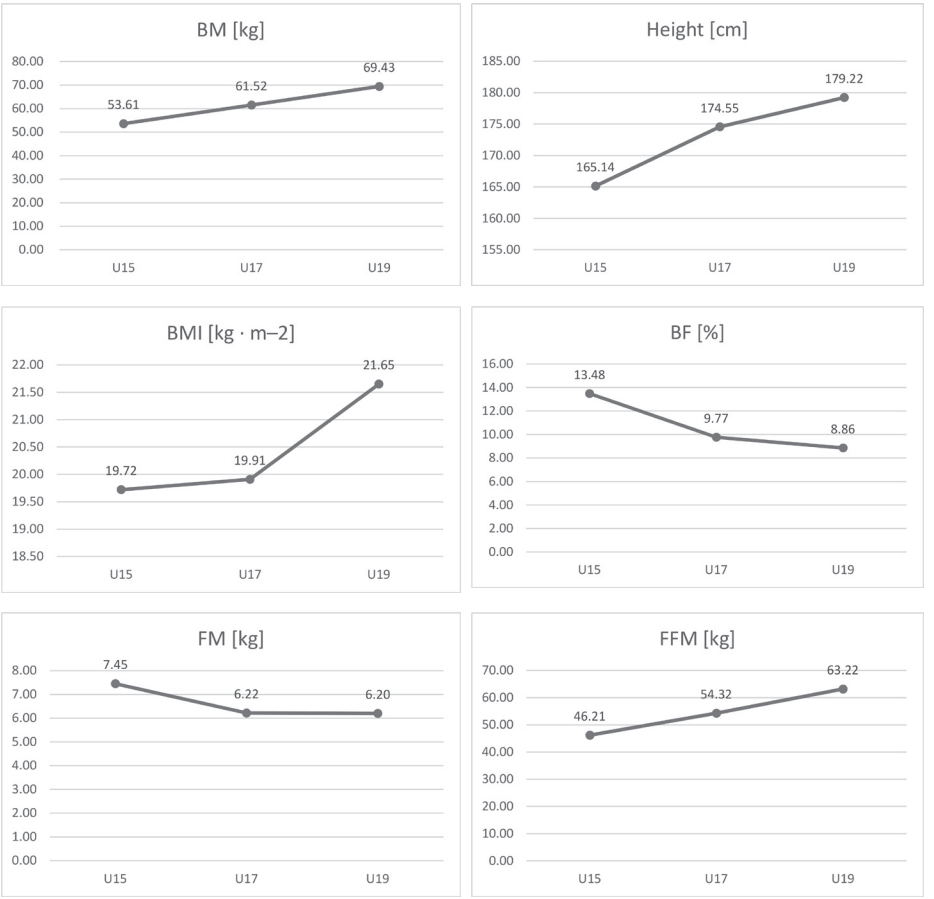

Figure 1. Body composition trend lines according to age groups

DISCUSSION

The aim of this study was to examine and analyse the body composition of young soccer players across different age groups (U15, U17, U19). To generalize the findings of this study, the age of a soccer player effects their body composition (Graph 1). The mean body height, weight, body mass index and fat-free mass of U15 soccer players was significantly lower than those of the U17 and U19 age groups, while the percentage of body fat mass and total fat mass was significantly higher. Our results showed that the U19 group was substantially taller and heavier than the younger groups while exhibiting a lower BF% and greater FFM. In comparison to the previous studies (Spehnjak et al., 2021; Nikolaidis et al., 2016), the current sample of soccer players has similar body size when comparing height and weight. It is evident that there is a trend of increasing height and body mass from U15 to U19. These results indicate that the morphological growth of young soccer players continues during that period, which is in agreement with previous studies (Spehnjak et al., 2021, Matta, Figueiredo, Garcia, & Seabra, 2014, Da Silva, Bloomfield, & Marins, 2008).

Body mass index results show that young soccer players in all selections have BMI values in a normal range. These results are also in agreement with the results of previously published studies (Spehnjak et al., 2021; Nikolaidis et al., 2016; Mroczek et al., 2022).

However, as a predictor of high performance and especially motor and functional abilities, indicators of FFM play a significantly greater role (Milsom, Barreira, Burgess, Iqbal, & Morton, 2014). Regarding the FFM expressed in kg, the results show that there is an evident increase from an average of 46.2 kg in the U15 selection, over 54.3 kg in the U17 all the way to 63.2 kg in the U19. These increases of 16.1% between U15 and U17 and 15.1% between U17 and U19 are attributable primarily to increased muscle mass considering the results in Figure 1. Similar results were obtained in some earlier studies by Milsom et al. (2015), who reported that FFM increased by 29.1% between U15 to U17. Evidently, this is the period in which there is a significant increase in fat free mass in young soccer players, and Mala et al. (2020) state that the highest percentage of relative lean mass was observed in the U18 category. The same authors state that age had a significant influence on the proportions of muscle mass, and thus a significant increase in the percentage of muscle mass.

In previous studies, it has been reported that the BF% tends to decrease with age (Leão et al., 2019; Milsom et al., 2015; Nikolaidis et al., 2011) which was also confirmed in this study. BF% in young soccer players in our research ranged from approximately 8.86±2.98% in the U19 selection to 13.48±5.29% in the U15 category. These results are consistent with most previously published studies. Thus, Marković and Bradić (2009) state that elite soccer players have a relatively low percentage of body fat of around 10%. These results are consistent with the results of Mala et al. (2020), who state that the percent of adipose tissue in younger players (U12 to U15) was greater than 10%, while older players (U16 to adult) had lower BF% values. In this study, it is interesting that young soccer players from the U15 selection have body fat percentage

values close to the older categories, which deviates from some earlier research. Specifically, in the study by Spehnjak et al. (2021), the percentage of body fat in the U15 category was 12.9 ± 6%, and in the study by Nikolaidis et al. (2016) was 17.4 ± 3%. The reason for this may be the higher training load of the players in this study, but since there are no objective indicators, this remains based on assumptions.

This study has some limitations. One of the limitations was that the athlete's dietary intake was not monitored during the stay-at-home orders. Another is that longitudinal data would be more informative to account for the fact that this study did not assess the players maturity status.

CONCLUSION

Based on the results of the realized study, it is possible to confirm most of the conclusions of previously conducted studies that studied the morphological characteristics of young soccer players. The determination of the morphological profile is important from the aspect of selection and prediction of future success in the game. The process of identification and selection of young soccer players is very demanding, and morphology is one of the factors that can influence the final success of individuals in the soccer game. The results of this study, as well as the conclusions of earlier research, indicate that younger soccer players have lower absolute values of morphological characteristics compared to senior players. These values should be taken into account, especially when it comes to the U15 category as well as all younger categories, which means, when the process of growth and development has not yet concluded, and which is known to depend on a large number of both exogenous and endogenous factors. Finally, it should be noted that the morphological profile is the basis for monitoring growth and development, and that it most often follows the development curve of young soccer players with minor individual deviations.

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