DIFFERENCES IN BODY COMPOSITION BETWEEN SOCCER PLAYERS AND NON-ATHLETES

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SUMMARY

The aim of this study was to determine the differences in body composition between seccer players and non-athletes. The research was conducted over 48 respondents, 26 soccer athletes (aged 18 to 32) and 22 non-athletes (18 to 38 years old). The assessment of the body composition was based on the BIA technology on tanita scale (the model BC545N, and the variables taken into consideration in this measure are years of life, height, weight, BMI, percentage of body fat, percentage of water and percentage of free fat mass. Height was measured with anthropometer by Martin. The results of the analysis were made in the SPSS program package. For all the data collected in this study, discriptive statistics are presented, the central and dispersive parameters are calculated, and the distribution of normality is determined, while the differences in the variables for assessing the body composition are determined by T test for independent samples. The results showed that a statistically significant difference exists in 6 variables: AGE (t = -3.036 with coefficient of significance p = 0.04, which is far below the theoretical limit of 0.05. Variable weight in kilograms: TTKG (t = -3.685, with coefficient of significance p = 001), BMI variable (t = -3.180, coefficient of significance p = 004), body fat BFAT% (t = -5,579, with the significance coefficient p =, 000), then the variable VODA% (t = 6,285, p =, 000), and the variable percentage value of the muscle mass MISMASS% (t = 5,675 with the coefficient of significance p = .000).

***Keywords**: body composition, soccer, non-athletes, T-test*

INTRODUCTION

The body composition is most often seen as a two-component model consisting of: a) free fat body mass, and b) mass of body fat. This division allows us to calculate the optimal body mass (Marinović, Kvesić, according to: Mišigoj-Duraković, M. (1995).

People differ in their physical appearance and character traits. Ontogenetic development of a man encompasses a unique set of degree qualitative and quantitative changes of the organism, characterized as growth, differentiation, which refers to the creation of differences, and morphogenesis or design.
The constitution is a specific set of different, most of all morphological characteristics of a person by which it differs from others. It is influenced by the heritage, but also a number of factors of the environment (Kujundžić, Rađa, Blazević, according to: Mišigoj-Duraković, 2008). There are factors that influence the constitution and its goal of determining, which are endogenous and exogenous factors. Endogenous factors make up inheritance, gender and life, while exogenous influences of diet, sports, physical activity, and others (Kujundzic, Rađa, Blazevic).

According to previous findings, endogenous and exogenous factors interact with human growth and development. A heritage or an endogenous factor can be understood as a base and potential that a person has, while exogenous or external factors stimulate the realization of this potential. It is commonly known that sport plays a major role in the development of man as an exogenous factor, both in the body composition and in the intellectual sense.

The concept of adaptation in sports refers to the process of adjusting the human body to a certain training process or simply a particular sport, through the continuous exercise of it. In this research, the goal is to determine the adaptation of the morphological characteristics or the composition of the body to the continuous (perennial) exercise of soccer as an exogenous factor that affects the physical composition of man.

The amount of fat in the human body has a physiological and medical significance. It can significantly affect morbidity and mortality, it can change the effectiveness of drugs and anesthetics and can affect the ability of the human body to resist cold and starvation. Therefore, measuring the total amount of fat in the body provides very useful information. Durnin, J.V.G.A. & Womersley, J. (1974).
The purpose of this research is to determine the differences in the body composition between soccer players and non-athletes. Hypothetically, statistically significant differences between the partial indicators of these two groups are expected.

METHODS AND RESEARCH MATERIALS

Sample of respondents

The research was conducted on a sample of 48 respondents. 26 respondents for the sample of soccer, aged 18 to 32, consisting of members of the premier league club Sloboda-Tuzla, the criteria for inclusion in the study were that all respondents should be active athletes over 18 years old, to amateur or professionally deal with their main sport , and that they have a minimum of 10 years of experience in the training process of their sport. The sample of non-athletes was composed of 22 adult respondents, (aged 18 to 38) who were randomly selected, and the criterion was that they never actively engaged in sports.

Testing protocol

Testing was conducted during the competitive season 2017-2018. Testing was done in the afternoon in sports hall for both groups. During the introduction to the experiment, all respondents were asked not to drink alcohol at least three days prior to testing, and to have a normal sleeping rhythm, or to sleep at a minimum of seven hours. Everyone was told to be able to leave the research at any time, without any sanctions. Respondents are familiar with the experimental design of scientific research work, testing, and the benefits of this research.

Sample of variables

To evaluate the composition of the body of soccer athletes and non-athletes, a BIA-tehnology based tanita body scale was used, model (BC545N), and the variables taken into consideration in this paper are AGE, weight-TTKG, Body Mass Index-BMI, percentage body fat-BFAT%, percentage of water-VODA%, and muscle mass in percentage MISMASS% was calculated based on muscle mass in kilograms results. The height-VIS was measured with anthropometer by Martin.

Data processing methods

Results processing was done in the SPSS program package. For all the data collected in this research, discriptive statistics are presented, that is, the central and dispersion parameters are calculated:
AS - arithmetic mean,
SD - standard deviation,
Min - minimum range
Max - maximum range,

The distribution normality was tested on the basis of the measurements of the Skewness and Kurtosis.

Differences in variables for assessing the body composition between soccer players and non-athletes were determined by the T-test for independent samples.

RESULTS

By examining the results of the discriptive statistics of the investigated group of soccer players (Table 1), a good homogenity of the investigated space of the morphological characteristics of athletes can be noted. In support of this conclusion, the size and interrelationships of the parameters of the basic statistics, that is, the values of individual variables, are measured, which is confirmed by the relations between the arithmetic means and the standard deviations. Coefficients of elongation and curvature (kurtosis, skewness) also speak of good value distribution.

Table 1. Central and dispersion parameters of morphological characteristics for the soccer athletes

	N	Range	Minimum	Maximum	Mean		Std. Deviation	Variance	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
AGE	26	14	18	32	22,58	,874	4,456	19,854	,807	,456	-,358	,887
VIS	26	24,5	169,5	194,0	179,562	1,3136	6,6979	44,862	,412	,456	-,706	,887
TTKG	26	33,0	62,4	95,4	77,292	1,4777	7,5350	56,777	,217	,456	,079	,887
BMI	26	5,7	20,6	26,3	23,912	,2808	1,4317	2,050	-,620	,456	-,310	,887
BFAT%	26	10,8	6,0	16,8	12,231	,5872	2,9940	8,964	-,531	,456	-,567	,887
VODA%	26	9,2	58,7	67,9	63,308	,4867	2,4819	6,160	,231	,456	-,762	,887
MISMASS%	26	10,26	79,02	89,28	83,5242	,55550	2,83250	8,023	,414	,456	-,621	,887

The results of the discriptive statistics of the investigated group of non-athletes also point to a good value distribution. The relations of the arithmetic means and the standard deviations are

within the normal boundaries. The coefficients of curvature and elongation (skewness and kurtosis) are also in the normal range.

Table 2. Central and dispersion parameters for the group of non-athletes

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
AGE	22	18	38	27,45	6,323	,137	,491	-1,349	,953
VIS	22	164,6	200,0	183,000	8,7778	-,221	,491	,406	,953
TTKG	22	64,0	128,0	92,814	18,4989	,301	,491	-1,170	,953
BMI	22	18,8	39,5	27,786	5,5619	,577	,491	-,086	,953
BFAT%	22	11,8	37,4	21,373	7,1750	,721	,491	-,335	,953
VODA%	22	45,3	65,0	55,536	5,3311	-,441	,491	-,657	,953
MISMASS%	22	59,5	83,8	74,705	6,8075	-,720	,491	-,331	,953

Tables 3 and 4 shows the T-test for small independent samples between the tested group of soccer athletes and the group of non-athletes. Analyzing the results of the T-test in table 4, in which the differences in the arithmetic means of the group of soccer athletes and non-athletes were tested, it can be noted that a statistically significant difference exists in 6 variables:
AGE (t = -3.036 with a coefficient of significance p = 0.04, which is far below the theoretical limit of 0.05, where non-athletes, the average age of 27.45, were older than the tested group of soccer athletes whose average age was 22.58 (T = -3,685, with significance coefficient p = 001), where non-athletes (AS = 92,81) were tougher than soccer athletes (AS = 77,29). The BMI variable (t = -3.180, coefficient of significance p = 004), where non-athletes also had a significantly higher body mass index (AS = 27.78) compared to soccer athletes (AS = 23.91). Body fat BFAT% (t = -5.579, with a coefficient of significance p =, 000), where the soccer players had a significantly lower percentage of body fat (AS = 12.23) compared to the tested non-athlete group whose body fat weight was AS = 21.37%. The variable VODA% (t = 6,285, p =, 000) where soccer athletes had a higher percentage of water (AS = 63,30%) compared to non-athletes (AS = 55,53%). Variable percentage of muscle MISMASS% (t = 5,675 with coefficient of significance p =, 000), where the muscle mass in percentage of soccer athletes (AS = 83,52) was greater than the value of the arithmetic mean of this variable for the group of non-athletes (AS = 74,70.

Table 3. Group Statistics

	Grupa	N	Mean	Std. Deviation	Std. Error Mean
AGE	NO	26	22,577	4,4558	,8738
	NS	22	27,455	6,3225	1,3480
VIS	NO	26	179,562	6,6979	1,3136
	NS	22	183,000	8,7778	1,8714
TTKG	NO	26	77,292	7,5350	1,4777
	NS	22	92,814	18,4989	3,9440
BMI	NO	26	23,912	1,4317	,2808
	NS	22	27,786	5,5619	1,1858
BFAT%	NO	26	12,231	2,9940	,5872
	NS	22	21,373	7,1750	1,5297
VODA%	NO	26	63,308	2,4819	,4867
	NS	22	55,536	5,3311	1,1366
MISMASS%	NO	26	83,5242	2,83250	,55550
	NS	22	74,7045	6,80752	1,45137

Table 4. T-test for independent samples

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
AGE		5,657	,022	-3,125	46	,003	-4,8776	1,5610	-8,0198	-1,7354
				-3,036	36,887	,004	-4,8776	1,6064	-8,1329	-1,6224
VIS		,663	,420	-1,538	46	,131	-3,4385	2,2356	-7,9384	1,0615
				-1,504	38,865	,141	-3,4385	2,2864	-8,0637	1,1868
TTKG		27,589	,000	-3,917	46	,000	-15,5213	3,9622	-23,4969	-7,5458
				-3,685	26,865	,001	-15,5213	4,2117	-24,1651	-6,8776
BMI		22,948	,000	-3,427	46	,001	-3,8748	1,1307	-6,1509	-1,5988
				-3,180	23,359	,004	-3,8748	1,2186	-6,3935	-1,3561
BFAT%		16,086	,000	-5,925	46	,000	-9,1420	1,5430	-12,2479	-6,0360
				-5,579	27,149	,000	-9,1420	1,6385	-12,5031	-5,7808
VODA%		12,166	,001	6,640	46	,000	7,7713	1,1703	5,4155	10,1271
				6,285	28,601	,000	7,7713	1,2364	5,2410	10,3016
MISMASS%		16,185	,000	6,027	46	,000	8,81969	1,46330	5,87421	11,76516
				5,675	27,115	,000	8,81969	1,55404	5,63168	12,00769

DISCUSSION

The main discovery of this study is the existence of a statistically significant difference between the partial indicators of the morphological space of soccer athletes compared to non-athletes. The results of this study are partially compatible with the results of Kujundzic, H., Rađa, A., Blazevic, F., who also found a much larger fat composition of non-athletes compared to a sample of soccer athletes, which is compatible with the results of this paper, while among other things, found a higher height and an insufficient component of fat-free body weight, while soccer athletes from the study of this work had a more pronounced percentage of fat-free body weight. This difference can be attributed to the fact that the research of Kujundzic, H., Rađa, A., Blazevic, F. was done on a sample of young athletes aged 12 to 15 years old, in contrast to our research which is done on a sample of seniors, which can be explained with the results of the research of Gil, SM, Gil, J., Ruiz, F., Irazusta, A., & Irazusta, J. (2010), who found that boys aged 14 and 15 were lower and more skinny than older players. The soccer players in this study mainly had a mesomorphic somatotype with the exception of individuals aged 14 who were more ectomorphic compared to adult players, as well as in the research by H., Rađa, A., Blazevic, F., which is in line with the results of our research.

Joksimović, Smajić, Molnar and Stanković in the research (2009) found that the average height of the players in the European Championship 2008, 182.97 ± 6.59 cm, and the weight of 77.88 ± 6.98 kg, where we clearly notice the compatibility of body weight with the results of this paper, while the soccer players from this research are slightly lower than the height of the players in the 2008 European Championship.

This research is quite compatible with the research by Saha, S., (2017), a researcher whose aim was to determine the somatotypic characteristics and body composition of Indian university soccer players, and found that they possessed 9.31% of body fat, which is slightly lower than the results of our work, while athletes from our work had a higher height and weight than Indian athletes, as found in the work of Saha, S., (2017) that the Indian university soccer player had a lower height, weight, thinness and mesomorphic value of a somatotype component from a foreign athletes.

Similar results in the morphological characteristics of soccer players were obtained in a research conducted by Đurašković, Joksimović and Joksimović (2004), who determined the weight-height indicators of the 712 players in the World Cup 2002. The results showed that the average height of the participants is 180.90 ± 6.13 cm and the average weight is 75.91 ± 6.38 kg, which does not differ much from the obtained indicators from this study.

That elite athletes have a significantly different body composition compared to sadentary population of the same age, was determined by Raković, A., Savanović, V., Stanković, D., Pavlović,

R., Simeonov , A., Petković, E., (2015), as the results of our study shows too.

Researching the morphological characteristics of this work on a sample of soccer athletes and comparing them with a sample of non-athletes, are in line with many previous researchs by other researchers, which clearly identifies a significant difference between soccer athletes and non-athletes, and among athletes who practice soccer at a professional level in relation to amateur level. Given that the T test, the established difference on a statistically significant level in 6 variables of the investigated morphological space, we can fully conclude that the established hypothesis has been confirmed.

CONCLUSION

By inspecting the results of this paper's research, the differences in body weight between soccer athletes and non-athletes and insight into other body composition indicators, we can conclude that a high percentage of fat-free body weight, low fat percentage, low body mass index that is within the normal range, and good hydration, what characterizes soccer athletes.

This research will be useful in complementing knowledge about morphological characteristics and the importance of this research is also reflected in obtaining relevant information on the constitutive status of soccer players.

Sport, as a significant exogenous factor in the ontogenetic development of human, significantly contributes to the development of morphological characteristics of human, as confirmed by numerous other studies. This research will provide feedback on the extent and quality of the contribution of soccer to the human body composition.

The research will also contribute to other researchers who deal with similar issues, and the knowledge of this research will be part of the mosaic in finding answers that are used by soccer in certain anthropological segments, which will be of great benefit to the institutions for physical education, kinesiology departments, sports colleges, researchers, trainers and professors of physical education, as well as the parents of future soccer athletes.

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