DIFFERENCES IN BODY COMPOSITION BETWEEN KARATE ATHLETES AND NON-ATHLETES

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Abstract
The aim of this study was to determine the differences in the composition of the body between karate athletes and non-athletes. The research was conducted over 44 respondents, 22 karate athletes (aged 18 to 33) and 22 non-athletes (18 to 38 years old). Assessment of the body composition was based on the BIA technology, measured on the Tanita scale(model BC545N), and the variables taken into account in this measurement are age, weight,height, BMI, percentage of body fat, percentage of water, bone density, basal metabolic rate, and weight of muscle mass in kilograms and percentage. Height is measured by anthropometer per Martin. Results processing was done in the SPSS program package. For all the data collected in this study, discriptive statistics are presented, that is, the central and dispersive parameters are calculated, and the distribution normality is determined, while the differences in the variable means for assessing the composition of the body are determined by the T-test for independent samples. The results showed that a statistically significant difference exists in 6 variables: AGE (t = 3.023 with the coefficient of significance p = ,005, which is far below the theoretical limit of 0.05, the variable body weight in kilograms: TTKG (t = 2.528, with the coefficient of significance p = ,017), BMI (t = 2,994, coefficient of significance p = ,006), body fat BFAT% (t = 5,352, with coefficient of significance p = ,000), variable VODA% (t = 5,948, p =, 000) and the variable the percentage value of muscle mass MISMASS% (t = 5.355 with the coefficient of significance p = ,000).

Keywords: *Body composition, karate, non-athletes, T-test*

INTRODUCTION

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 ontogenetic variability of the body constitution is a kind of result of a continuous, complex and dynamic interplay between internal (endogenous) and exogenous factors.
During individual development, the genotype determines the limits of the body's reactionary norm to a complex set of environmental influences of a different nature. Therefore, every overall phenotype, at any given moment of ontogenesis, is determined by the norm of reaction to the surviving sequence of the middle of the previous period of life.
The body composition is most often seen as a two-component model consisting of: a) non-mass 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).
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 affect 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 the basis and potential of a person, 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 constituent 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 karate as an exogenous factor that affects the growth and development of man. The most obvious characteristics of people are certainly anthropometric characteristics. From ancient times, it is clear that people are exactly different in their anthropometric characteristics. Also, the dependence of behavior and various abilities of people that could be attributed to their anthropometric characteristics was noticed. Differences in anthropometric characteristics, or

in the morphological structure, must be made in relation to gender, and within the gender, age, race, nation, social and demographic characteristics, and the like. (Jakšić, D. 2010). The amount of fat in the human body has a physiological and medical significance. It can significantly affect morbidity and mortality, 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).

Today, karate is one of the most massive individual martial arts, which is distinguished by two competition disciplines: kata and sport fighting (kumite) (Koropanovski et al., 2011; Tabben et al., 2013). Top performance and sporting results in both disciplines are conditioned not only by the high level of technical performance, but also by the high level of motor and functional abilities, mental stability and suitable anthropometric predispositions (Lehmann & Jedliczka, 1998; Amusa & Onyewadume, 2001; Jukić et al., 2012).
The purpose of this research is to determine the differences in the body composition between karate athletes and non-athletes. Hypothetically, statistically significant differences between the partial indicators of these two groups are expected.

MATERIAL AND METHOD

Participants

The research was conducted on a sample of 44 respondents. 22 participants for the karate athletes (aged 18 to 33), made by participants of the national championship in Karate, Sarajevo April 2018, active karate competitors and representatives of BiH in karate from the following karate clubs: KBS ORKKA Lukavac, KK Winner Tuzla, KK Champion Ilidza , KK Bosna Sarajevo, KK Neretva Mostar, KK Novi Grad Sarajevo, KK Baščaršija Sarajevo and KK Blagaj Mostar. The criteria for inclusion in the study were that all respondents were active seniors over 18 years of age, to be amateur or professionally engaged in karate, and to have at least 10 years of experience in the training process of their home sport. The sample of non-athletes were 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 in April 2018 for each group separately. Testing was done in sports hall in the afternoon, for both groups. During the acquaintance with the experiment, all respondents were asked not to drink alcohol at least three days prior to testing, and have a normal sleeping rhythm, or to sleep at least seven hours at a time. 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, testing, and the benefits of this research.

Variables

To evaluate the composition of the body of karate athletes and non-athletes, the BIA-based body scans on the tanita scale (BC545N) were used, and the variables taken into consideration in this paper were AGE, weight-TTKG, Body Mass Index-BMI, percentage body fat-BFAT%, percentage of water-VODA%, bone density in kilograms-KOSTKG, basal metabolism in calories-KCAL, basal metabolism in kilojoules-KJ, weight of muscle mass in kilograms -MISKG and based on these parameters the muscle mass value in percent is calculated MISMASS% . The height-VIS was measured by Martin-anthropometer.

Data processing methods

The processing of results 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,
Normality of the distribution was tested on the basis of measurements of the Skewness coefficient and Kurtosis. Differences in variables for assessing the composition of the body between karate athletes and non-athletes were determined by the T-test for independent samples.

RESULTS

By the insight into the results of the discriptive statistics of the examined group of karate athletes (Table 1), good homogeneity of the investigated area of morphological characteristics of the karate athletes can be noted. In support of this conclusion, the size and mutual relations of the investigated parameters of the basic statistics, that is, the values of the individual variables, are determined, which is confirmed by the relations

between the arithmetic mean and the standard deviation. Coefficients of elongation and curvature (kurtosis, skewness) also speak of good value distribution.

Table 1. Discriptive statistics for karate athletes

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
AGE	22	18	33	22,73	3,718	1,434	,491	1,691	,953
VIS	22	175,0	195,0	184,636	4,9237	,112	,491	-,104	,953
TTKG	22	68,4	101,4	81,677	9,1997	,398	,491	-,472	,953
BMI	22	20,0	28,2	23,936	2,3317	-,005	,491	-,795	,953
BFAT%	22	6,3	19,6	12,086	3,8422	,607	,491	-,595	,953
VODA%	22	56,9	68,1	63,191	2,8303	-,590	,491	-,040	,953
MISKG	22	58,7	77,6	67,991	5,3085	,012	,491	-,758	,953
KOSTKG	22	3,1	4,0	3,523	,2544	,026	,491	-,659	,953
KCAL	22	1812	2471	2112,00	175,675	,132	,491	-,585	,953
KJ	22	7581,0	10339,0	8836,545	735,0115	,132	,491	-,584	,953
MISMASS%	22	76,4	89,0	83,523	3,6474	-,605	,491	-,617	,953
Valid N (listwise)	22								

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 mean and the standard deviation are within the boundaries of the normal. The coefficients of curvature and elongation (skewness and kurtosis) are also in the normal range, and research can be further processed.

Table 2. Discriptive statistics for 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
MISKG	22	51,2	86,9	68,414	9,3245	-,027	,491	-,579	,953
KOSTKG	22	2,7	4,4	3,550	,4533	-,046	,491	-,694	,953
KCAL	22	1590	2723	2153,50	320,453	-,031	,491	-,952	,953
KJ	22	6653	11393	9010,23	1340,699	-,030	,491	-,953	,953
MISMASS%	22	59,5	83,8	74,705	6,8075	-,720	,491	-,331	,953
Valid N (listwise)	22								

Tables 3 and 4 show the T-test for small independent samples between the tested karate group and the group of non-athletes. Analyzing the results of the T-test in Table no. 4, in which the differences between the arithmetic meanings of the group of karate athletes and non-athletes were tested, it is noticed that the statistically significant difference exists in 6 variables:
AGE (t = 3.023 with the coefficient of significance p = ,005, which is far below the theoretical limit of 0.05, the variable body weight in kilograms: TTKG (t = 2.528, with the coefficient of significance p = ,017), BMI (t = 2,994, coefficient of significance p = ,006), body fat BFAT% (t = 5,352, with coefficient of significance p = ,000), variable VODA% (t = 5,948, p =, 000) and the variable the percentage value of muscle mass MISMASS% (t = 5.355 with the coefficient of significance p = ,000).

Table 3. Group Statistics

	Grupa	N	Mean	Std. Deviation	Std. Error Mean
AGE	KA	22	22,73	3,718	,793
	NS	22	27,45	6,323	1,348
VIS	KA	22	184,636	4,9237	1,0497
	NS	22	183,000	8,7778	1,8714
TTKG	KA	22	81,677	9,1997	1,9614
	NS	22	92,814	18,4989	3,9440
BMI	KA	22	23,936	2,3317	,4971
	NS	22	27,786	5,5619	1,1858
BFAT%	KA	22	12,086	3,8422	,8192
	NS	22	21,373	7,1750	1,5297
VODA%	KA	22	63,191	2,8303	,6034
	NS	22	55,536	5,3311	1,1366
MISKG	KA	22	67,991	5,3085	1,1318
	NS	22	68,414	9,3245	1,9880
KOSTKG	KA	22	3,523	,2544	,0542
	NS	22	3,550	,4533	,0966
KCAL	KA	22	2112,00	175,675	37,454
	NS	22	2153,50	320,453	68,321
KJ	KA	22	8836,55	735,011	156,705
	NS	22	9010,23	1340,699	285,838
MISMASS%	KA	22	83,523	3,6474	,7776
	NS	22	74,705	6,8075	1,4514

Table 4. Independent Samples Test

	Levene's Test for Equality of Variances		t-test for Equality of Means						
								95% Confidence Interval of the Difference	
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
AGE	10,487	,002	-3,023	42	,004	-4,727	1,564	-7,883	-1,571
			-3,023	33,975	,005	-4,727	1,564	-7,905	-1,549
VIS	4,175	,047	,763	42	,450	1,6364	2,1457	-2,6939	5,9667
			,763	33,024	,451	1,6364	2,1457	-2,7291	6,0018
TTKG	16,546	,000	-2,528	42	,015	-11,1364	4,4048	-20,0255	-2,2472
			-2,528	30,789	,017	-11,1364	4,4048	-20,1224	-2,1503
BMI	10,484	,002	-2,994	42	,005	-3,8500	1,2858	-6,4448	-1,2552
			-2,994	28,160	,006	-3,8500	1,2858	-6,4831	-1,2169
BFAT%	8,251	,006	-5,352	42	,000	-9,2864	1,7352	-12,7882	-5,7845
			-5,352	32,129	,000	-9,2864	1,7352	-12,8204	-5,7524
VODA%	8,074	,007	5,948	42	,000	7,6545	1,2868	5,0576	10,2515
			5,948	31,967	,000	7,6545	1,2868	5,0332	10,2759
MISKG	7,801	,008	-,185	42	,854	-,4227	2,2876	-5,0393	4,1938
			-,185	33,318	,855	-,4227	2,2876	-5,0752	4,2297
KOSTKG	8,393	,006	-,246	42	,807	-,0273	,1108	-,2509	,1964
			-,246	33,031	,807	-,0273	,1108	-,2527	,1982
KCAL	9,809	,003	-,533	42	,597	-41,500	77,914	-198,736	115,736
			-,533	32,577	,598	-41,500	77,914	-200,095	117,095
KJ	9,806	,003	-,533	42	,597	-173,682	325,975	-831,526	484,163
			-,533	32,578	,598	-173,682	325,975	-837,210	489,846
MISMASS%	8,194	,007	5,355	42	,000	8,8182	1,6466	5,4953	12,1411
			5,355	32,139	,000	8,8182	1,6466	5,4648	12,1716

DISCUSSION

The main discovery of this study is the existence of a statistically significant difference between the partial indicators of the morphological space of karate athletes compared to non-athletes. The results of this study are compatible with the results of earlier research by Chaabe`ne, H., Hachan, Y., Franchini, E., Mkaouer. B., Chamari, K., (2012), who also found a low percentage of fat tissue in top karate athletes. The percentage of fat tissue in karate athletes varies in different studies with respondents of different nationalities. Thus, for example, the results of this study suggest that BiH karate athletes have a lower percentage of fat tissue than Polish karate athletes, where Polish karate athletes have 16.8% according to Sterkowicz-Przybycień (2010), while BiH karate athletes have a biger fat percentage than Japanese karate athletes who have 7.5% fat tissue in the Imamura et al. Research, 1997.

The results of this study could be explained on the track of the Sterkowicz study (1992), which shows that karate athletes are characterized by a harmonious body constitution and a low percentage of fat tissue, where the percentage of fat tissue of 13 athletes of kyokushin karate was 12.16 ± 2.31%, while the percentage fatless tissue was 87.84 ± 2.22%. Similar results were confirmed by research by Sterkowicz-Przybycień (2005) when the sample of the subjects, in addition to karate athletes, was extended to other martial arts (judo, wrestling, boxing, fencing and jj-jitsu). The results of this study in height indicators did not show a statistically significant difference with regard to the group of non-athletes; however, there is a significant difference in height indicators relative to the study María B. Sánchez-Puccini, Rodrigo E. Argothy-Bucheli, José F. Meneses-Echávez , Carlos, Alejandro López-Albán, and Robinson Ramírez-Vélez, 2014 who worked on a study designed to assess the anthropometric and physical abilities of male elite karate athletes in Colombia (167.4 ± 9.3 cm), while the percentage of body fat Studies (13.6 ± 3.0%), and the body adiposity index (25.1 ± 3.6) are quite similar to the results of this study, so we can say that the karate athletes sample in this study had a longitudinal dimension of the skeleton with a relatively low percentage of fat tissue, which confirms the research Abdel-Baser (2010) who came to the conclusion that for sporting success, besides the technique, longitudinal dimenzionality plays an important role, followed by a small percentage of fatty tissue.

We see that non-fat body weight is the dominant feature in the composition of the karate athletes body compared to non-athletes, although this is not shown in the MISKG variable, which represents the muscle mass of the subjects in kilograms, where the values of the T-test showed that there is not much difference between karate athletes compared to non-athletes, because the variable is expressed in kilograms and we can not know what its contribution to the overall composition of the body, so for this reason we calculated the total muscle mass in percentages expressed by the variable MISMASS%, where we can clearly see the statistically significant difference between karate athletes and non-athletes in the benefit of a group of karate athletes. Considering that a statistically significant difference was found in most of the variables of the investigated space, although several variables had T-test values low, but with a coefficient of significance <0.05, we can say that the hypothesis of this study was confirmed.

CONCLUSION

By examining the results of the study of this paper, the differences in body weight between karate athletes and non-athletes and insight into other indicators of the body composition, we can conclude that a high percentage of non-fat body mass, low percentage of fat tissue, low body mass index that is in the normal range, and good hydration, what characterizes karate athletes. Sport as a significant exogenous factor in the ontogenetic development of man, significantly contributes to the development of morphological characteristics of man, as confirmed by numerous other studies. This research will provide feedback on the extent and quality of the contribution of karate to the human body composition.

This research will be useful in complementing knowledge of morphological characteristics and the importance of this research is also reflected in obtaining relevant information on the constitutive status of karate practicioners. 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 which are benefits of karate practice in certain anthropological segments, which will be of great benefit to institutions for physical education, sports colleges, researchers, trainers and professors of physical education, as well as parents of future karate practicioners.

REFERENCES

1. Amusa, L.O., i Onyewadume, I.U., (1999). Antropometry, body compozition and somatotypes of Botswana karate players: A descriptive study. *Department of phisical education, Health and Recreation, University of Botswana, Gaborone, Botswana*
2. Abdel-Baser, E. A. (2010). Using the Length and Weight of the Body and Some Dynamic Parameters to Perform Ura Mawshi Geri Skill to Predict Kumite Players' Performance. *World 3: 127-131*.
3. Burke D. T., Al-Adawi S., Lee Y. T., Audette J. (2007). Martial arts as sport and therapy. *J. Sports Med. Phys. Fitness 47, 96–102*
4. Chateau-Degat M.-L., Papouin G., Saint-Val P., Lopez A. (2010). Effect of adapted karate training on quality of life and body balance in 50-year-old men. *J. Sports Med. 1, 143–150*.
5. Chaabe`ne, H., Hachana, Y., Franchini, E., Mkaouer. B., Chamari, K., (2012). Physical and Physiological Profile of Elite Karate Athletes. *Sports Medicine 42(10):829-43*
6. Durnin, J.V.G.A. & Womersley, J. (1974). Body fat assessment from total body density and its estimation from skinfold thickness. *British Journal of Nutrition, 32: 77- 97*
7. Fritzsche, J., & Raschka, C. (2007). Sportanthropologische Untersuchungen zur Konstitutionstypologie von Elitekarateka/Sports anthropological investigations on somatotypology of elite karateka. *Anthropologischer Anzeiger*, 317-329.
8. Ilić S. I. (2015). *Application of different methodological procedures in defining anthropological dimensions of athletes*. (Doctoral thesis). Faculty of Sport and Physical Education, University of Niš.
9. Jakšić, D. (2010). *Application of different statistical methods in defining morphological types*. (Master work). Faculty of Sport and Physical Education, University of Novi Sad.
10. Katić, R., Blažević, S., Krstulović, S., & Mulić, R. (2005). Morphological structures of elite karateka and their impact on technical and fighting efficiency. *Coll Antropol*, *29*(1), 79-84.
11. Kujundzic, H., Rađa, A., Blazevic, F. Differences in somatotype between young footballers and non-athletes. *25 summer school of kinesiologist of the Republic of Croatia*
12. Koropanovski, N., Berjan, B., Božić, P., Pazin, N., Sanader, A., Jarić, S. (2011). Anthropometric and Physical Performance Profiles of Elite Karate *Kumite* and Kata Competitors. *Journal of Human Kinetics,* 30: 107-114.
13. Mišigoj-Duraković et al. (1995), *Morphological Anthropometry in Sports*. Zagreb: Faculty of Physical Culture
14. Marinović, M., Kvesić, M. Tanita vaga as an instrument for measuring some anthropological measures in school and sport
15. Ohno, M., Nishisaka, S., Ikeda, Y., (1998). Body mass index, percent body fat and normal weight obesity. *Department of Preventive Medicine, Jikei University School of Medicine. *SBH Life Science Research Institute, Tokyo, JAPAN*
16. Pieter, W., Bercades, L., Kim, G. D. (2006). Relative total body fat and skinfold pattering in Filipino national combat sport athletes. *Journal of Sports Science and Medicine,* 5: 35-4
17. Pieter, W., Bercades, L. T., & Center, O. (2009). Somatotypes of national elite combative sport athletes. *Brazilian Journal of Biomotricity*, *3*(1), 21-30.
18. Rubiano, F., Nunez, C., Heymsfiel, S.B. (1999). A comparation of body compozition techniques. *Obesity Research Center, St. Luke's /Roosevelt Hospital, Columbia University, NY, NY 10025*
19. Sterkowicz, S. (1992). Sprawność fizyczna karateków. Physical fitness of karate athletes. *(English and in Polish). Physical Education and Sport,* (1-2), 59-67.