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Morphological profile of karate

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Abstract. *Morphological characteristics represent the primary information about the psychosomatic status of a person that determines the system of basic morphological latent dimensions, regardless of whether those dimensions were developed under the special influence of the external environment or not. The aim of the research is to determine the morphological profile of karate in relation to the weight category to which they belong. The research was conducted on a sample of 31 young karate fighters, aged 12 to 15 years. All respondents are medal winners at regional championships. The sample of anthropometric measures will consist of 13 measures, which are part of the battery of 39 measures of the International Biological Program (IBP). ANOVA test was used to determine the statistical significance of differences in the mean values of variables between karate players of different weight categories.*

Key words: *Skin fold, height, weight, diameter, fat tissue*



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Introduction

Martial arts is a global phenomenon that has outgrown its national borders and areas of influence and become a global phenomenon. Their origins are from the Far East, but their practice that exists on the market today is global and has changed significantly in relation to the original content and practice in their native cultures^{13,17}. What has changed the phenomenon of martial arts the most is their adaptation to a different cultural structure such as the Western one and their merging with other physical activities that already exist in Western culture¹⁵.

The form and application of the karate technique are conditioned by the specifics of situationally designed tasks (attack, interception, defense against different types of attacks, etc.)²³. Most motor and morphological dimensions can be measured by modern diagnostics².

Anthropometry (somatometry) is a method of measuring the human body, ie individual parts of the body, which quantitatively determines the morphological characteristics and sees an objective picture of the growth state of the examined person. Identification of anthropometric characteristics seeks to contribute to better success of young people in sports^{1,24}. More precisely, different and more numerous body structures in young athletes during the selection in different sports are of key importance⁵. The somatotype reflects the overall appearance of the human body and gives significance to the overall morphological status of the human body^{4,7}. By identifying anthropometric characteristics, we also assess the structure of the human body as a whole and in its individual components^{8,14}. The morphological status of top athletes is relatively homogeneous, dependent on sports, and can be defined as models of athletic achievement^{9,18}. The somatotype reflects the overall appearance of the human body and gives importance to the overall morphological status of the human body^{4,19}. Many studies have shown that somatotypes have a strong genetic basis⁹. Morphological characteristics represent the primary information about the psychosomatic status of a person that determines the system of basic morphological latent dimensions, regardless of whether these dimensions were developed under the special influence of the external environment (eg training), or not⁶. Morphological characteristics differ with respect to sex and age, as well as with respect to genetic factors. Also, given the accelerating phenomena and relatively rapid changes in the ecosocial conditions, research within this area should be repeated periodically, because the results become obsolete very quickly²¹.

Children in the period of 10-14 years belong to the pre-adolescent period or before puberty. In the physical development of children aged 10–14, there is a general good physical condition and a favorable relationship between morphological characteristics, height and body weight^{10,16}. Somewhat less changes occur in the organism, and the amount of muscles lags significantly behind the weight of the body, so children are not strong and durable enough^{11,12}. The organism still does not have the necessary qualities to overcome the heavier physical and mental efforts. Body composition can change significantly through the application of certain physical activities³. Practice has shown, and many authors in their research, that the morphological characteristics of athletes can affect the success in achieving sports results²². Therefore, favorable ie. adequate morphological characteristics of the athlete enable him to achieve favorable results in the discipline in which he is engaged^{20,23}. The aim of the research

is to determine the morphological profile of karate athletes aged (12 to 15 years) in relation to the weight category to which they belong.

Method of work

Sample of respondents

The research was conducted on a sample of 31 young karate fighters, aged 12 to 15 years. All respondents are medal winners at regional championships.

Starting from the set problem, subject, goals and tasks of the research and having in mind the organizational possibilities necessary for conducting this research, the optimal number of respondents was taken in order for the research to be conducted correctly and the results to be exact.

Part of the anthropological measurements was used from the archives of the health sports institution in East Sarajevo.

Respondents met the following conditions:

- To be medal winners at regional championships;
- To have no organic and somatic diseases;
- That they are both 12 to 15 years old.

Sample of measuring instruments

The sample of anthropometric measures will consist of 13 measures, which are part of the battery of 39 measures of the International Biological Program (IBP). The measurements were performed on symmetrical parts of the body, according to the instructions of the IBP, they will be measured on the left side.

Sample of measuring instruments for assessment of morphological characteristics

a) *Longitudinal dimensionality of the skeleton* - Body height in cm (AVIST), Leg length in cm (ADUNO), Arm length in cm (ADURU); b) *Transverse dimensionality of the skeleton* - Shoulder width in cm (AŠIRA), Pelvic width in cm (AŠIKA), Hip width in cm (AŠIKA); c) *Body volume and weight*, Mean chest circumference in cm (AOGKS), Extended arm upper arm circumference in cm (AONAD), Thigh circumference in cm (AOBUT), Body weight in kg (AMAST), d) *Subcutaneous adipose tissue* - Skin upper arm fold in mm (AKNNA), Back skin fold in mm (AKNLE), Abdominal skin fold in mm (AKNTR).

Data processing methods

To determine the levels in the manifest space of the examined anthropometric measures of young karate athletes aged 12 to 15 years, the basic statistical parameters were applied: arithmetic mean (\bar{X}), standard deviation (SD), minimum (Min) and maximum (Max), range of results (Rasp).

To determine the normality of the distribution were calculated:

- *skunis-symmetry (SKW)*, which indicates whether the curve is distributed symmetrically or asymmetrically in relation to the mean and mode.

- kurtosis - elongation (CRT), which indicates how stretched the distribution is and when the observed distribution is not statistically significantly stretched from normal.
- ANOVA test was used to determine the statistical significance of differences in the mean values of variables between karate players of different weight categories.

Results and discussion

Statistical inference and estimation of central and dispersion parameters start from the assumption that the distributions of the measured results on the tests are normally distributed. To assess the normality of the curves of the results obtained by the measuring instruments used in this research, the Kolmogorov-Smirnov procedure was applied, which estimates the distributions by linear transformations of the moment coefficient of variables.

The average height of light karate athletes was $157.15 \text{ cm} \pm 5.25$, the minimum height was 148 cm and the maximum 164.70 cm. Other measures of longitudinal dimensionality (leg length, arm length) were consistent with body height.

The measures applied for transverse dimensionality had the following values: shoulder width was an average of 32.26 ± 1.27 , the minimum value was 29.60 and the maximum value was 34.20 cm; pelvic width was 24.41 ± 1.47 , minimum value was 22 and maximum 26.80 cm; hip width was 29.84 ± 1.37 cm, minimum value was 27.90 and maximum 32.50 cm.

Measures that measured body weight and circumference indicate that this is a sample that has been exposed to training activities for a long period of time. The average body weight for young karate athletes of light categories was 46.62 ± 4.88 kg, the maximum weight was 51.90 kg and the minimum 37.20 kg.

The measures that were applied to identify the subcutaneous adipose tissue were distributed in such a way as to check the thickness of the skin folds on large muscle regions and the results were quite small.

Table 1. Basic statistical parameters of anthropometric characteristics of lightweight karatist

Variables	N	AS	MED	MIN	MAH	RASP	SD	Skju	Kurt
AVIST	10	157.15	158.00	148	164.70	16.70	5.25	-0.33	-0.81
ADUNO	10	89.37	89.15	84.70	95.60	10.90	3.65	0.32	-1.21
ADURU	10	68.07	68.20	63.80	71.70	7.90	2.56	-0.11	-0.78
ASIRA	10	32.26	32.25	29.60	34.20	4.60	1.27	-0.68	1.27
ASIKA	10	24.41	24.35	22	26.80	4.80	1.47	0.23	-0.15
ASIKU	10	29.84	29.45	27.90	32.50	4.60	1.37	0.70	0.16
AOGKS	10	72.10	72.05	66.50	78.40	11.90	3.46	0.17	-0.04
AONAD	10	23.36	23.70	20.70	26.30	5.60	1.68	-0.01	-0.26
AOBUT	10	44.06	44.40	39	49	10	2.62	-0.15	1.65
AMAST	10	46.62	47.15	37.20	51.90	14.7	4.88	-0.86	0.01
KNNK	10	14.50	14.50	10	18.30	8.30	2.84	-0.06	-1.32
KNT	10	10.64	10	6.70	16	9.30	3.22	0.50	-0.97
ANNL	10	10.07	9.50	7.40	15	7.60	2.44	0.85	0.08

Table 2 shows the basic parameters of the applied variables for the assessment of anthropometric characteristics of middle category karate players. The examined sample of selected karate players is relatively homogeneous and most of the applied anthropometric measures have a normal distribution.

There are variations of the results within each of the measured variables. This is especially pronounced with variables that measured subcutaneous adipose tissue thickness and body weight.

The average height of karate middleweight was $169.45 \text{ cm} \pm 3.41$, the minimum height was 164.00 and the maximum 174.00 cm. Other measures of longitudinal dimensionality (leg length, arm length) were consistent with body height.

The measures applied for transverse dimensionality had the following values: shoulder width was an average of 34.97 ± 2.03 , minimum value was 31.90 and maximum value was 38.00 cm; pelvic width was 25.59 ± 1.09 , minimum value was 24.10 and maximum 27.40 cm; hip width was 30.28 ± 1.09 cm, minimum value was 28.90 and maximum 32.30 cm.

Measures that measured body weight and circumference indicate that this is a selected sample that has been exposed to training activities for a long period of time. The average body weight for young karate athletes of the middle categories was 60.14 ± 1.65 kg, the maximum weight was 62.90 kg and the minimum 57.80 kg.

The measures that were applied to identify the subcutaneous adipose tissue were distributed in such a way as to check the thickness of the skin folds on large muscle regions and the results were quite small.

Table 2. Basic statistical parameters of anthropometric characteristics of middle category karate players

Variables	N	AS	MED	MIN	MAH	RASP	SD	Skju	Kurt
AVIST	11	169.45	169.00	164.00	174.00	10.00	3.41	-0.40	-0.71
ADUNO	11	95.01	94.90	90.70	99.80	9.10	3.04	0.01	-1.09
ADURU	11	71.20	71.00	67.90	74.80	6.90	2.68	-0.01	-1.67
ASIRA	11	34.97	34.10	31.90	38.00	6.10	2.03	0.34	-1.34
ASIKA	11	25.59	25.70	24.10	27.40	3.30	1.09	0.14	-0.84
ASIKU	11	30.28	30.30	28.90	32.30	3.40	1.09	0.31	-0.56
AOGKS	11	79.59	80.90	70.40	84.10	13.70	3.85	-1.42	2.41
AONAD	11	25.67	25.40	24.10	27.40	3.30	1.07	0.38	-0.88
AOBUT	11	45.40	46.00	40.90	47.30	6.60	1.91	-1.69	2.44
AMAST	11	60.14	59.70	57.80	62.90	5.10	1.65	0.36	-0.94
KNNK	11	12.52	12.00	8.00	18.00	10.00	4.00	0.29	-1.79
KNT	11	12.33	10.40	7.40	19.00	11.60	4.29	0.78	-0.99
ANNL	11	10.83	10.00	6.70	18.00	11.30	3.84	0.84	-0.58

Table 3, shows the basic parameters of the applied variables for the assessment of anthropometric characteristics of karate heavyweights. The examined karate sample is relatively homogeneous and most of the applied anthropometric measures have a normal distribution.

There are variations of the results within each of the measured variables. This is especially pronounced with variables that measured subcutaneous adipose tissue thickness and body weight.

The average height of karate of heavier categories was $171.10 \text{ cm} \pm 2.13$, the minimum height was 168.00 and the maximum 174 cm. Other measures of longitudinal dimensionality (leg length, arm length) were consistent with body height.

The measures applied for transverse dimensionality had the following values: shoulder width was an average of 36.65 ± 1.30 , minimum value was 34.90 and maximum value was 38.50 cm; pelvic width was 27.22 ± 2.03 , minimum value was 25.50 and maximum 31.70 cm; the width of the hips was 31.98 ± 2.52 cm, the minimum value was 29.10 and the maximum 38.00 cm.

Measures that measured body weight and circumference indicate that this is a sample that has been exposed to training activities for a long period of time. The average body weight for young karate athletes in the heavier categories of 70 kilograms was 75.78 ± 4.75 kg, the maximum weight was 82.90 kg and the minimum 70.60 kg.

Table 3. Basic statistical parameters of anthropometric characteristics of heavyweight karate over 70 kilograms.

Variables	N	AS	MED	MIN	MAH	RASP	SD	Skju	Kurt
AVIST	10	171.10	171.00	168.00	174.00	6.00	2.13	0.09	-1.29
ADUNO	10	95.91	97.10	90.90	99.70	8.80	2.96	-0.58	-0.97
ADURU	10	73.92	73.95	71.50	76.10	4.60	1.52	0.11	-0.81
ASIRA	10	36.65	36.85	34.90	38.50	3.60	1.30	-0.18	-1.31
ASIKA	10	27.22	26.55	25.50	31.70	6.20	2.03	1.44	1.56
ASIKU	10	31.98	32.05	29.10	38.00	8.90	2.52	1.48	3.44
AOGKS	10	82.29	82.25	74.80	89.30	14.50	3.81	-0.20	1.55
AONAD	10	28.46	27.10	26.00	35.50	9.50	3.11	1.53	1.93
AOBUT	10	49.30	48.05	46.50	61.00	14.50	4.22	2.84	8.55
AMAST	10	75.78	75.25	70.60	82.90	12.30	4.75	0.25	-1.73
KNNK	10	15.89	15.50	11.00	21.00	10.00	2.91	0.20	-1.11
KNT	10	15.51	15.25	11.70	19.30	7.60	2.32	0.34	0.03
ANNL	10	13.92	13.05	10.10	18.00	7.90	2.40	0.40	-0.31

Differences in anthropometric characteristics between weight categories of karate athletes aged 12 to 15 years

In this part of the research analysis, the answer to the research problem will be given. The basic question is: is there a difference in the measured characteristics between karate players of different weight categories. To make the insight as complete as possible, the analysis was performed with the ANOVA test.

In order to show the differences in the morphological characteristics of young karate athletes of light and medium weight categories, tables 4, 5, 6 and 7 show the arithmetic means (SV),

standard deviations (SD), number of subjects (N), difference between groups (F), degrees of freedom (DF) significance of difference (P).

Table 4. Significance of differences in measures of morphological characteristics – longitudinal dimensionality - between weight categories

Variables	SV	SD	N	F	DF
AVIST	165.63	6.59	51	16,817	4
ADUNO	92.89	4.24	51	5.62	4
ADURU	71.15	4.89	51	3,298	4

A review of anthropometric measures that measured the longitudinal dimensionality of the body clearly shows that there is a statistically significant difference in body height, leg length and arm length between karate hopefuls of different weight categories.

It should be noted that the training system of young karate athletes aged 12 to 15 must primarily be directed towards harmonious psychosomatic development with the help of means, methods and loads adapted to their biological and chronological development.

Table 5. Significance of differences in measures of morphological characteristics - transverse dimensionality - between weight categories

Variables	SV	SD	N	F	DF
ASHIRA	34.38	2.25	51	9,390	4
ASHIKA	25.82	1.63	51	5,608	4
ASHIKU	30.65	1.85	51	3,573	4

By analyzing the results of anthropological measures that measured the transverse dimensionality of the skeleton, we can clearly see up to between karate players aged 12 to 15 years of different weight categories, there is a statistically significant difference in all three applied measures. The results showed that the heavier the karate players, the greater the width of the shoulders, the width of the pelvis and hips.

Table 6. Significance of differences in measures of morphological characteristics - volume and body weight between weight categories

Variables	SV	SD	N	F	DF	P
AOGKS	78.33	4.85	51	14,156	4	,000
AONAD	26.04	2.41	51	10,568	4	,000
AOBUT	46.00	3.40	51	7,206	4	,000
AMAST	60.89	10.46	51	122,104	4	,000

By analyzing the results of anthropometric measures that were applied to check the circumference and body weight, we see that there is a statistically significant difference between the measures of chest circumference, thigh circumference, body weight and measures of upper

arm circumference. The difference was expressed in such a way that the karate players of lighter weight categories had better values of these results. We can conclude that karateists of higher weight categories had a larger chest circumference, a larger thigh circumference and an upper arm circumference.

Table 7. Significance of differences in measures of morphological characteristics - subcutaneous adipose tissue between weight categories

Variables	SV	SD	N	F	DF	P
AKNNA	14.10	3.18	51	1,966	4	,116
AKNLE	13.05	3.63	51	4,520	4	,004
AKNTR	11.87	3.54	51	3,079	4	,025

Examining the results of anthropometric measures that measured the thickness of subcutaneous adipose tissue, we can conclude that there is a statistically significant difference in the measures of skin fold of the upper arm and abdomen, while in the measure of skin fold of the upper leg there is no statistically significant difference. The difference was expressed in the way that karate players of lighter weight categories had better values of results, ie they had a smaller thickness of skin folds in all measured places in relation to karate players of higher weight categories.

Conclusion

The research was conducted with the aim of determining the differences between young karate athletes aged 12 to 15 years of different weight categories in morphological characteristics. The subject of this research was the morphological characteristics of young karatekas of different weight categories.

The research was conducted on a sample of 31 karate athletes aged 12 to 15 years \pm 6 months, clinically healthy and without damage to the locomotor system. Anthropometric measures for this research were determined so as to representatively cover the morphological space of karate players aged 12 to 15 years.

Based on the obtained results, statistical data processing and interpretation, the following conclusions were drawn: a measure of body height and leg length. From the analysis of the results of arithmetic mean differences in measures that measured the transverse dimensionality of the skeleton of karate players aged 12 to 15, we can conclude that karate players of higher weight categories had statistically better results in measures of shoulder, pelvis and hip width. From the analysis of the results of arithmetic mean differences in measures that measured the volume and body weight of karate athletes aged 12 to 15, we can conclude that karate players of higher weight categories had better values of chest circumference, thigh circumference and body weight. From the analysis of the results of the differences of arithmetic means in the measures that measured the subcutaneous adipose tissue of karate players aged 12 to 15, we can conclude that the karate players of lighter categories had significantly lower values in all measured places.



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