Characteristics of physical progression in martial arts

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Abstract

Objective of the study was to contrast the physical growth metrics of athletes who practice judo and taekwondo.

Methods and structure of the study. Fifty-seven young men, aged between 17 and 21, who specialize in judo and taekwondo, and who have achieved the first-adult category in their respective sports, were examined. All participants underwent necessary anthropometric measurements. The somatotype was assessed using the Hit-Carter method. The athletes' respiratory function was evaluated through spirometry, and their hand grip strength was measured using dynamometry. The index method was employed to evaluate their physical development.

Results and conclusions. Judoists in the middle weight categories, aged 17 to 21, tend to have a well-proportioned physique, while taekwondo athletes often have a more athletic build. Additionally, judoists tend to have a higher percentage of muscle mass compared to taekwondo athletes. The physical characteristics of martial artists are more influenced by their body type than by their specific sport.

There were notable differences in the vitality index between athletes with balanced mesomorphic and endomorphic body types, as well as between athletes with balanced mesomorphic and ectomorphic body types. Similarly, there were differences in the body mass index between athletes with ectomorphic and endomorphic body types. Furthermore, there were variations in the proportionality of development between athletes with balanced mesomorphic and ectomorphic body types, as well as between athletes with ectomorphic and endomorphic body types.

Keywords: *anthropometry, somatotype, physical development, boys, judo, taekwondo.*

Introduction. The high level of sports achievements in martial arts indicates the need for a comprehensive study of their individual typological characteristics at all stages of sports training [3, 6]. Of particular importance in solving strategic problems of choosing a sports specialization in martial arts and predicting the future prospects of athletes is the assessment of their somatotype [1]. Identifying indicators of physical development of athletes involved in various types of martial arts expands the understanding of the patterns of adaptation of the body to extreme environmental influences, including intensive training loads [2, 4, 5].

Objective of the study was to contrast the physical growth metrics of athletes who practice judo and taekwondo.

Methods and structure of the study. The study involved 28 judoists and 29 taekwondoists, middle weight categories, aged 17-21 years, with the sports qualification of the 1st adult category – Master of Sports. All athletes underwent the necessary anthropometric measurements. The somatotype was assessed using the Heath-Carter method [7]. External respiration was studied using the spirometry method, the strength of the flexor muscles of the hand – using the dynamometry method. To determine physical development, the index method was used: the Yarkho-Kaupe weight-height index, the Erisman index and the Levee index for chest and height, the proportionality index, the strength and vitality indices.

Results of the study and discussion. The anthropometric indices of martial artists show that with the same average body weight, taekwondoists are taller, have a longer torso and lower limbs, compared to judoists. Judoists, in turn, have significantly larger chest circumference and shoulder width values and significantly smaller pelvis width values, compared to taekwondoists ($p<0,05$). Analysis of the component composition of body weight in martial artists revealed that judoists have a higher relative muscle mass of the body than taekwondoists. No significant differences in the relative content of bone and fat mass of the body in the groups of martial artists were found (Table 1).

In the process of determining the somatotype of martial arts athletes, it turned out that they have three body types: ecto-mesomorphic, balanced mesomorphic and endo-mesomorphic. In judokas, the predominant morphotype is balanced mesomorphic, and in taekwondo athletes, ecto-mesomorphic. Thus, among judokas, the balanced mesomorphic body type is found in 46% of athletes, ecto-mesomorphic – in 25% and endo-mesomorphic – in 29%. Among taekwondo athletes, the balanced mesomorphic somatotype was found in 36% of athletes, ecto-mesomorphic – in 39% and endo-mesomorphic – in 25%. When studying the external respiration parameters in martial artists, significantly higher values of VC and chest excursion were found in judoists ($p<0,05$). Thus, in judo representatives, the average VC values were 4300+18,9 ml and chest excursion – 6,8+0,8, and in taekwondo athletes, respectively, 4100+17,8 ml and 5,8+0,6. No reliable differences were found in the dynamometry results in martial artists. In judo athletes, the average values of the strength of the flexor muscles of the right hand were 49,5+3,6 kg, and in taekwondo athletes – 60,3+4,2 kg.

A study of the level of physical development in representatives of various types of martial arts revealed the following. Judokas have significantly lower values of the weight-height index and the proportionality index, compared to taekwondo athletes ($p<0,05$), which indicates a lower location of the general center of gravity in judokas and, accordingly, greater body stability (Table 2).

We also found statistically significant differences in the values of physical development indices in athletes depending on their somatotype. For example, the value of the Yarkho-Kaupe weight-height index in athletes with a balanced mesomorphic body type averaged 405,2+9,8 g/cm, in endo-mesomorphic – 410,8+8,3 g/cm, and in ecto-mesomorphic – 390,4+10,2 g/cm. The Erisman chest-height index in martial artists with a balanced mesomorphic somatotype was equal to 6,2+0,2 c.u., in endo-mesomorphic – 6,4+0,3 c.u., and in ecto-mesomorphic – 5,7+0,2 c.u. The value of the vital index in individuals with a balanced mesomorphic body type averaged 68,5+1,8 ml/kg, in endo-mesomorphic – 63,8+2,3 ml/kg and in ecto-mesomorphic – 61,7+2,2 ml/kg. The typological series of decreasing indicators of weight-height and chest-height indices can be traced in the following sequence: endo-mesomorphic somatotype, balanced mesomorphic and ecto-mesomorphic, and the typological series of decreasing indicators of vital and strength indices: balanced mesomorphic, endo-mesomorphic and ecto-mesomorphic morphotype.

Conclusions. Judokas of the middle weight categories, aged 17-21, have a balanced mesomorphic

Table 1. Morphological indicators of athletes engaged in various types of martial arts (M+m)

Morphological indicator	Type of martial art	
	Judo (n=28)	Taekwondo (n=29)
Body length, cm	172,0+3,6	175,6+3,8*
Torso length, cm	55,1+2,3	57,6+1,8 *
Upper limb length, cm	75,1+1,5	74,8+1,4
Lower limb length, cm	91,5+2,7	93,7+1,8 *
Chest circumference, cm	92,1+1,1	90,6+1,0*
Shoulder width, cm	41,2+2,3	39,6+1,1*
Pelvis width, cm	24,9+1,5	26,7+1,2*
Fat mass, %	7,5+0,5	7,1+0,7
Muscle mass, %	52,5+3,1	50,8+2,8*
Bone mass, %	20,4+1,2	19,3+1,6

*Note: n – sample size; * – differences between are significant at $p<0,05$.*

Table 2. Comparative analysis of physical development indicators in athletes engaged in various types of martial arts (M+m)

Physical development indicators	Type of martial art	
	Judo (n=28)	Judo (n=28)
Weight-height index, g/cm	402,5+8,7	390,3+11,2*
Vital index, ml/kg	60,5+1,9	58,9+2,1
Proportionality index, %	67,3+3,2	73,9+3,6*
Leavy chest-height index, %	51,3+4,1	50,2+2,8
Erisman chest-height index, c.u.	6,2+0,2	5,8+0,4*
Strength index, %	69,2+3,9	67,9+4,2

*Note: n – sample size; * – differences between judokas and taekwondokas are significant at p<0,05.*

body type, while taekwondo athletes have an ecto-mesomorphic body type. The physical development indicators of martial artists depend to a greater extent on the body type than on the sports specialization.

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