Features of the physique in young martial arts athletes

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Abstract

Objective of the study was to identify the features of the physique of young martial arts athletes aged 9-13 years.

Methods and structure of the study. The somatic features (more than 30 signs and indices characterizing the size and proportions of the body) of boys aged 9 to 13 years were studied. At each age, two groups were compared: athletes specializing in various types of wrestling (surveyed in 2018), and a control group of schoolchildren not involved in sports (surveyed in 2013-2017). The total number of subjects was 686 people.

Results and conclusions. The features of body proportions in young wrestlers are revealed: absolutely and relatively wide shoulders, absolutely and relatively elongated torso. Athletes are distinguished by an increased development of chest and forearm girths; schoolchildren who do not play sports have larger waist, buttocks, shoulders and hips. The development of subcutaneous fat deposition in two samples does not fully correspond to the circumference dimensions: the thickness of the skin-fat fold over the triceps and on the abdomen (straight line) is greater in athletes. At the same time, the thickness of the skin-fat fold on the forearm of martial artists is less than that of boys from the control group. Such a combination of somatic characteristics in martial artists specializing in different types of wrestling is considered as a wrestling body type.

A comparative analysis of martial arts athletes and schoolchildren who are not involved in sports revealed the most informative signs in relation to sports selection (ratio of skeletal dimensions) and the level of physical activity and their specificity (circumference dimensions of the body and subcutaneous fat deposition). Growth processes at all stages of ontogenesis significantly correct the morphological features of athletes in different sports.

Keywords: morphological features, anthropometry, age-related variability, wrestling, boys aged 9-13, youth sports.

Introduction. Currently, wrestling is often preferred by boys of school age. Many researchers in the field of sports and medicine define martial arts as the most natural and traditional types of physical activity that also perform some psychological functions [5]. Decrease in aggressiveness, increase in emotional stability and sports self-regulation in the course of competitive activity can have a beneficial effect on the formation of personal characteristics in boys, especially during the period of functional restructuring [6].

Wrestling exercises optimize physical development. In childhood, it is easier to develop such qualities as speed, agility, flexibility, they also act as the foundation for further growth and improvement of sportsmanship. However, it is important to know how a child's body develops under stress, how morphological features are formed in the process of growth and development, and whether there are significant differences between children involved in martial arts and not involved in sports.

The problem of selection and further successful specialization remains the most relevant in sports anthropology. A large number of publications that analyze the somatic characteristics of combatants are mainly devoted to adult athletes with certain qualifications.

Objective of the study was to identify the somatic characteristics of young martial arts athletes in comparison with children who do not go in for sports.

Methods and structure of the study. The object of the study was the materials of a comprehensive anthropometric examination of combat athletes, students of sports schools in Moscow at the age of 9-13 years. The survey was conducted throughout 2018. Among boys of all ages, the most popular were freestyle and Greco-Roman wrestling, sambo, judo, boxing (hereinafter referred to as "athletes"). The "control" groups included Moscow schoolchildren of the same age, examined in 2013-2017. Anthropometric program corresponded to standard methods [2]. GPM anthropometric instruments (Diethelm-Keller-Siber-Hegner, Switzerland) were used to measure the longitudinal and transverse dimensions of the skeleton, the girth dimensions of the trunk and limbs. The thickness of skin-fat folds at various points of the body was measured with a Holtain caliper (Great Britain). Various indices were calculated to describe body proportions (see table). Body mass index was calculated using the Quetelet formula: BMI = body weight/body length2 [11]. In the future, the following abbreviations will be used in the text, table and figure: body mass index - BMI, skin-fat fold on the abdomen 1 - vertical or straight (abdominal), on the abdomen 2 - diagonal or oblique crease above the iliac crest.

All materials were collected in compliance with the rules of bioethics: the parents of the examined chil-

**Table 1.** *Main statistical parameters of anthropometric traits in groups of boys 9-13 years old.*

Traits	Athletes		Control		p-values
	M	SD	M	SD	(Student's test)
9 years old	**N = 34**		**N = 64**		
Height, cm	138,33	6,10	136,75	5,75	н/з
Weight, kg	32,40	5,15	32,02	6,27	н/з
BMI	16,85	1,81	17,02	2,63	н/з
Chest circumference, cm	66,62	4,53	63,77	5,24	0,001
Trunk length, cm	41,05	2,72	39,52	2,01	0,005
Leg length, cm	74,44	4,37	73,42	3,93	н/з
Shoulder width, cm	30,31	1,80	28,60	1,65	0,000
Pelvic width, cm	21,58	1,62	20,84	1,39	0,027
Trunk length/Height, %	29,68	1,50	28,90	0,97	0,008
Shoulder width/Height, %	21,91	0,90	20,92	1,01	0,000
Pelvic width/Shoulder width,%	71,20	3,46	72,97	4,68	н/з
11 years old	**N = 81**		**N = 114**		
Height, cm	145,55	6,04	146,47	7,33	н/з
Weight, kg	38,57	6,29	41,07	10,43	н/з
BMI	18,13	2,17	18,94	3,56	н/з
Chest circumference, cm	70,05	5,02	70,30	8,05	н/з
Trunk length, cm	43,72	2,69	42,11	2,48	0,000
Leg length, cm	78,46	4,06	79,92	4,90	0,024
Shoulder width, cm	31,76	2,00	30,81	1,74	0,001
Pelvic width, cm	23,02	1,60	22,85	1,98	н/з
Trunk length/Height, %	30,03	1,22	28,76	1,03	0,000
Shoulder width/Height, %	21,83	1,22	21,04	0,77	0,000
Pelvic width/Shoulder width,%	72,59	4,49	74,13	4,26	0,017
13 years old	**N = 43**		**N = 106**		
Height, cm	158,54	8,69	159,35	7,92	н/з
Weight, kg	50,90	11,22	51,12	12,56	н/з
BMI	20,13	3,22	19,95	3,73	н/з
Chest circumference, cm	78,15	6,47	76,58	8,37	н/з
Trunk length, cm	47,61	2,99	45,37	2,67	0,000
Leg length, cm	87,06	5,34	88,27	5,04	н/з
Shoulder width, cm	35,07	1,87	33,65	2,19	0,000
Pelvic width, cm	25,51	1,88	24,79	1,96	0,040
Trunk length/Height, %	30,05	1,36	28,47	0,89	0,000
Shoulder width/Height, %	22,14	0,84	21,12	0,88	0,000
Pelvic width/Shoulder width,%	72,74	3,79	73,73	4,50	н/з

dren signed informed consent protocols, the data were depersonalized.

Results of the study and their discussion. Table 1 presents the main statistical parameters of anthropoometric traits and indices for 3 out of 5 age groups for both samples. To reduce the size of the table, only those indicators that have significant intergroup differences or are used for the discussion are presented. A comparative analysis of the average values of anthropometric indicators demonstrates the absence of statistically significant intergroup variation in height, body weight and BMI. At the same time, there are significant differences in trunk length, shoulder width and body proportions in all age groups.

Comparison of the average values of body circumferences and skinfold thickness demonstrate different vectors of intergroup variability.

Figure 1 shows the normalized values of body circumferences and skinfolds at all ages combined, thus giving the possibility to trace the general trend in the development of muscle and fat components, which otherwise did not manifest itself at a significant level at separate age group.
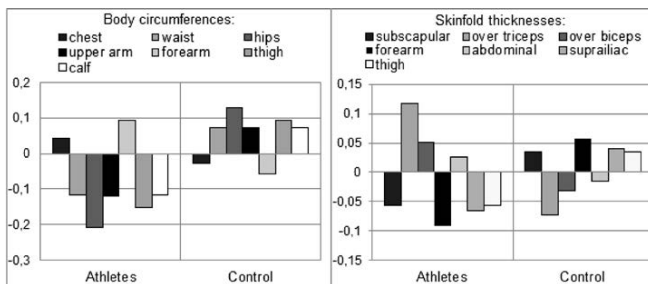
Figure 1. *Results of a comparative analysis of body circumferences and skinfolds in groups of boys 9-13 years old (combined). Notes: circumferences chest – p<0.05, hips – p<0.001, forearm – p<0.01, thigh – p<0,0; skinfold over triceps – p<0.01, abdominal – p<0.05, thigh – p<0,05*

Athletes are characterized by increased development of chest and forearm circumferences, while schoolchildren who are not engaged in sports have larger waist, hip, arm and thigh circumferences. The amount of subcutaneous fat in the two samples does not quite correspond to the trend revealed in the body circumferences: the thickness of the skinfold above the triceps and on the abdomen is greater in athletes. At the same time, the thickness of the skinfold on the forearm in athletes is smaller, than in the boys of the control group. This combination of somatic characteristics in wrestlers is noted by many researchers and is considered as a body type typical for wrestling [1, 3, 7, 8, 10, 12].

Based on the results of this analysis, it can be stated that young wrestlers are most different from boys

who are not involved in sports, in longitudinal and transverse skeletal dimensions: they have absolutely and relatively wider shoulders, absolutely and relatively longer trunk at all ages. This supports the results of comparative studies of highly qualified wrestlers and non-professionals [8]. The lack of a coordinated trend in the development of the muscular component was also revealed in a study of anthropometric and functional parameters in 14-16-year-old athletes specializing in freestyle wrestling. It was noted that in young men and in 80% of adolescents with candidate in sports master qualification, muscle tissue was only moderately developed, in athletes with the first adult rank – even underdeveloped [9]. It can be assumed that in the process of growth and development, especially in the prepubertal and pubertal periods (11-13 years), the development of the muscular component and, accordingly, the size of body circumferences largely depends on biological age [4].

Conclusions. A comparative analysis of male wrestlers and their non-sports peers showed the most informative features regarding sports selection (body proportions of skeletal traits), as well as those influenced by the level of physical activity and its specific type (body size and subcutaneous fat deposition). Growth processes at all stages of life cycle significantly change morphological characteristics of athletes in different sports. The necessity to evaluate the biological age and rate of maturation in young athletes becomes one of the important task in further research.

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