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Features of morphological and functional characteristics and physical preparedness of sprinters 15–16 years old, specializing in various swimming methods

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Purpose: *to develop model morphological and functional characteristics and indicators of physical preparedness of 15–16-year-old sprint swimmers specializing in various swimming methods.*
Material & Methods: *analysis and generalization of scientific and methodological literature, pedagogical observation, testing, anthropometric measurements, methods of mathematical statistics.*
Results: *scientific knowledge on the features of the morphological and functional characteristics and physical preparedness of sprint swimmers specializing in various methods of swimming is supplemented. The study of the level of physical fitness showed a difference in the development of motor qualities of sprinters depending on their main way of swimming, which is due to the structure of the technique of performing movements in water.*
Conclusions: *the results allow us to say that the objectivity of sports orientation in sprinting depends on the integrated use of morphological, functional and pedagogical criteria, which can make it possible to establish the tendency of young athletes to this or that way of swimming.*

Keywords: *swimmers, sprinters, specialization, physique, preparedness, orienteering.*

Introduction

The constant growth of sports achievements in sports swimming requires further study of the individual capabilities of athletes. In accordance with this, the development of criteria for the selection and prediction of the prospects of young swimmers is an urgent problem in the preparation of athletes. Along with the sports result, which is currently the only indicator of a swimmer's giftedness, coaches should also take into account other scientifically based selection criteria, such as body proportions, body length and weight, functional features, and physical fitness [2; 3]. The justified orientation of young swimmers to this or that distance should be based on indicators of its morphotype and physical fitness. In swimming, sports orientation mainly covers the stage of specialized basic training [3; 9; 10].

The purely sprinter type is quite rare (6%). At distances of 50 and 100 m, athletes with a high quantitative content of AL-fibers (at least 70%) achieve success [1; 9]. Sprinters are distinguished by large values of length and body weight, size of coverage, limb length, anaerobic power and functional mobility [1]. High adolescents with long limbs, well-developed muscles of the upper extremity belt, light legs, with a front crawl shape and great mobility in the joints should be oriented towards specialization in back swimming. Specializing in butterfly – adolescents of medium and above average height, with a relatively long body, with developed muscle groups of the whole body, greater mobility in the joints and high strength indicators. Adolescents of relatively small stature with relatively long strong legs, large foot and hand sizes, and high mobility in the ankle and knee joints are generally more prone to swimming breaststroke [2; 4; 8; 11]. So, the selection should not be based on one or two, even important criteria, but in the whole complex of indicators that could objectively evaluate the individual characteristics of athletes.

Purpose of the study: to develop model morphological and functional characteristics and indicators of physical preparedness of 15–16 year old swimmers-sprinters specializing in various swimming methods.

Objectives of the study:

1. To establish the features of the morphological and functional indicators of swimmers-sprinters 15–16 years old, specializing in various methods of swimming.

2. To evaluate the level of physical fitness of young swimmers-sprinters, representatives of various swimming methods.

Material and Methods of the research

Research methods: analysis and synthesis of scientific and methodological literature, pedagogical observation and testing, anthropometric measurements, methods of mathematical statistics.

The work examined morphological and functional indicators, their ratio, and also tested the physical fitness of athletes. The studied contingent consisted of 15 qualified sprint guys aged 15–16 years, specializing in various swimming methods. The level of sports qualification of swimmers corresponded to the level of CMS and MS.

Results of the research

The results of the study of anthropometric indicators of 15–16 year old swimmers specializing in various swimming methods are shown in Table 1. Among total body sizes, sprinter athletes specializing in crawling on their backs have the largest average body lengths and exceed the results of the generalizing model. Slightly lower indicators of body length in young men specializing in freestyle swimming and in the method of breaststroke. The smallest body length is recorded in sprinters specializing in butterfly stroke. There is no significant difference in body mass indices among young

men, representatives of different swimming methods. Values range from 65.80–64.0 kg. The greatest body weight is set for sprinters who specialize in swimming the way the crawl on the chest. The length of the limbs of swimmers, of various specializations depends on the nature of the working movements and their relative contribution to the swimming speed. However, in such parameters as the length of the arm, hand, forearm, trunk, lower leg and foot, the greatest results belong to representatives of swimming by the breaststroke method. The greatest leg lengths belong to athletes specializing in back crawl swimming.

The measurement results of the swimmer's body size allow us to judge their strength capabilities, as they pass through muscle groups that perform the main work when swimming [2, 9; 11]. So, among the indicators of coverage of the forearm, wrist, ankle and lower leg, the greatest indicators are for rabbits. At the same time, the largest girth sizes of the waist and hips were set in the sprinter swimming with a crawl on the back, and the shoulders and knee of athletes specializing in the breaststroke. In terms of shoulder widths, the results between the swimmers are not significantly different.

The body proportions indices make it possible to judge the features of physique and physical development and can be used as criteria for selecting and determining specialization in a particular swimming method. The greatest proportionality indices of the body are "shoulder width to body length" (0.25±0.01 conv. units), "Width of shoulders to the width of the pelvis" (1.19±0.06 conv. units) It is among the of swimmers by the method of breaststroke (Figure 1). They also have the largest index "leg length to body length" – 0.56±0.01 conv. units In terms of absolute body surface area, representatives of sprinter swimming with a crawl on the chest and on the back are ahead of other specializations (1.76±0.05 ml, respectively). According to the Ketle index, representatives of swimming using the butterfly stroke method (20.44±0.53 kg·m²) and free style (20,26±0,23 kg·m²) have the highest values, and the lowest value was found for swimmers on the back (19 64 ± 1,04 kg·m²).

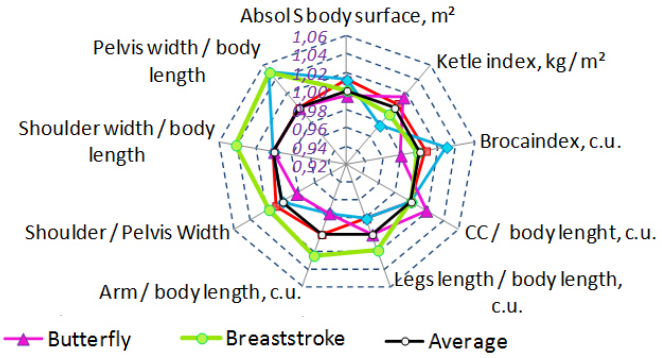

Fig. 1. Ratio of the body proportions indices of sprinters 15–16 years old, specializing in various methods of swimming

Studies of the external respiration function of young

Table 1

Model characteristics of the physical development of young swimmers-sprinters 15–16 years old, specializing in various methods of swimming

No. i/o	Parameters	F/c (n=5)		B/c (n=2)		Butterfly (n=4)		Breaststroke (n=4)		X̄ (n=15)
		X̄	±σ	X̄	±σ	X̄	±σ	X̄	±σ	
1.	Body length, cm	179,60	4,04	182,00	2,83	178,00	4,62	179,50	4,20	179,47
2.	Body weight	65,80	2,77	65,00	1,41	64,00	3,56	64,25	1,71	64,80
3.	VC, L	4,18	0,27	4,05	0,07	4,10	0,28	4,25	0,26	4,16
4.	Arm length, cm	74,80	4,21	73,50	3,54	72,00	4,24	75,00	4,69	73,93
5.	Brush length, cm	17,80	1,30	18,00	0,00	17,50	1,29	19,50	1,00	18,20
6.	Forearm length, cm	29,40	2,30	28,00	0,00	30,25	2,63	30,75	1,50	29,80
7.	Body length, cm	53,00	2,55	54,50	2,12	53,50	3,70	54,75	2,06	53,80
8.	Foot length cm	98,60	2,70	100,00	0,00	97,75	3,10	99,25	2,06	98,73
9.	Shin length, cm	46,60	3,36	46,50	2,12	46,00	3,16	50,25	1,71	47,40
10.	Thigh length, cm	52,40	1,14	49,50	3,54	51,00	1,41	49,00	1,83	50,73
11.	Foot length, cm	26,80	0,84	26,50	0,71	26,25	1,71	27,75	0,50	27,07
12.	Shoulder width cm	46,80	1,64	46,00	1,41	45,50	1,29	46,00	1,83	46,13
13.	Width of the pelvis, cm	38,00	1,00	38,50	2,12	37,25	1,89	38,50	2,08	38,00
14.	Brush Width cm	10,40	0,55	10,50	0,71	9,75	0,96	10,00	0,82	10,13
15.	CC in rest, cm	96,20	1,92	96,50	3,54	96,25	2,75	96,25	1,50	96,27
16.	CC on inspiration, cm	102,60	2,51	104,00	1,41	102,25	3,50	102,25	3,30	102,60
17.	CC on the exhale, cm	91,80	1,64	92,50	2,12	91,75	2,22	91,50	1,29	91,80
18.	Shoulder circumference, cm	34,60	1,52	33,00	1,41	34,50	2,08	35,00	2,83	34,47
19.	Forearm circumference, cm	26,80	1,79	25,50	0,71	26,75	2,50	26,00	2,16	26,40
20.	Wrist girth, cm	20,20	1,48	20,00	1,41	18,75	0,96	18,75	0,96	19,40
21.	Waist circumference, cm	78,80	2,77	81,50	2,12	76,50	2,52	79,25	3,59	78,67
22.	Hip circumference, cm	61,20	2,77	62,50	2,12	58,50	3,79	61,00	2,94	60,60
23.	Girth of the knee, cm	36,00	2,35	34,00	1,41	35,50	3,11	36,00	2,71	35,60
24.	Ankle circumference, cm	24,00	1,58	21,50	0,71	23,00	1,41	23,50	2,52	23,27
25.	Girth of the leg, cm	42,00	3,08	37,50	4,95	38,25	6,13	37,75	3,59	39,27

Table 2

Assessment of the physical preparedness of 15–16 year old sprint swimmers specializing in various swimming methods

Parameters	F/c (n=5)		B/c (n=2)		Butterfly (n=4)		Breaststroke (n=4)		$\bar{X}$ (n=15)
	$\bar{X}$	±σ	$\bar{X}$	±σ	$\bar{X}$	±σ	$\bar{X}$	±σ	
Mobility in the shoulder joints, cm	63,40	8,73	65,00	8,49	64,50	5,07	65,50	3,51	64,47
Torso forward, cm	11,40	1,52	11,00	1,41	11,50	3,00	11,00	1,41	11,27
Jumping up for 30 s, times	16,00	1,58	15,00	1,41	15,50	2,38	17,50	1,73	16,13
Flexion-extension of the arms in the supine position for 30 s, times	20,00	2,00	16,50	0,71	18,50	2,08	20,75	1,26	19,33
Raising bent legs in a hang for 30 s, times	16,60	3,05	15,00	0,00	15,75	1,89	17,75	1,50	16,47
Long jump, cm	212,00	11,90	197,00	1,41	207,25	20,89	215,00	11,97	209,53
Dynamometry of the right hand, kg	48,20	4,87	54,00	2,83	47,50	4,36	47,75	4,50	48,67
Dynamometry of the left hand, kg	47,40	5,64	52,00	1,41	45,50	5,07	48,75	3,30	47,87
Power index, F/kg	0,75	0,04	0,83	0,06	0,74	0,06	0,78	0,05	0,75
Speed at 50 m, m s^{-1}	2,10	0,04	1,81	0,03	1,92	0,04	1,66	0,02	1,90
Speed at 100 m, m·s^{-1}	1,91	0,04	1,73	0,01	1,72	0,03	1,50	0,04	1,72
ICB V100/50 m	0,91	0,01	0,95	0,01	0,90	0,00	0,91	0,03	0,91

sprinter swimmers, representatives of various specializations, made it possible to assess the characteristics of the development of the body of athletes and the possibility of their functional systems. The analysis showed that the greatest indicators of chest coverage (CC, cm) at rest (96.50 cm), while inhaling (104.0 cm) and exhaling (92.50 cm) belong to representatives of swimming with a crawl on the back. A little inferior to them and have almost the same meaning sprinters who specialize in other methods of swimming. Excursion of the chest (EC) among swimmers of various specializations is almost the same (10.50–11.50 cm), and the largest among swimmers on the back (11,50±0,71 cm). The highest levels of VC in athletes, representatives of swimming by the method of breaststroke and crawl on the chest, and range from 4.18 to 4.65 liters. In sprinters in swimming with a crawl on the chest, the highest indices of the Stange test were recorded (48.60±3.97 s), and for representatives of swimming by the breaststroke method – Genchi (28,75±6,40 c).

Thus, in the course of the study, the morphological and functional characteristics of young men-sprinters of 15–16 years were established, which made it possible to identify some differences among athletes, representatives of various swimming methods.

A study of the various aspects of the physical fitness of the young sprints showed a difference in the development of their motor qualities (Table 2).

In young men, under the influence of training loads, the indicators for testing mobility in the shoulder joints are not significantly different. So, in the test «twisting straight arms back and forth» for young men specializing in swimming в/с and butterfly stroke, the best results were found. The representatives of the breaststroke take the last place, which is associated with the specifics of the swimming technique in this way. In the test "torso forward", which characterizes the level of development of flexibility in the spinal column, the results vary from 11.0 to 11.50 cm. Under the influence of training loads, swimmers have sufficiently developed mobility in the shoulder joints and in the spinal column, allowing more efficient performance of technical movements one way or another swimming.

A comparative analysis of the results of the study allowed us to assess the level of power qualities of sprinters 15–16 years old, representatives of various swimming methods. Depending on the method of swimming, the strength of the muscles of the hand (right and left) is also different in swimmers. Young men who specialize in crawling on their backs have the best results. For swimmers specializing in butterfly and breaststroke swimming methods, the results are slightly lower. Swimmers specializing in backstroke also have the highest strength index values. (0,83±0,06 F/kg). Among swimmers, the level of speed-strength preparedness is significantly different. So, the best results belong to swimmers who specialize in breaststroke in the exercises "jumping upwards in 30 s" (17.50±1.73 times). "Flexion-extension of the arms at the stop lying down in 30 seconds" (20.75±1.26 times), "Lifting of bent legs in a hang in 30 s" (17.75±1.50 times.) "Long jump from a place" (215.0±11.97 cm). Slightly inferior to swimmers who specialize in breaststroke are young men who specialize in crawl swimming on their chests. Physical fitness on land for swimmers of various swimming methods corresponds to the ability of muscles to show strength, as well as the biomechanical conditions of its implementation in a competitive exercise.

The analysis of the data of the index of special anaerobic endurance (ISO), as the ratio of swimming speed at a distance of 100 m to 50 m, showed that the best results are representatives of back crawl (0.95 conv. units), slightly lower among swimmers specializing in crawl and breaststroke (0.91 conv. units). Young men who specialize in butterfly swimming have the lowest ISO values, which is 0.90 conv. units. Thus, the results of the studies made it possible to establish differences in the structure of the physical fitness of young sprinters, representatives of various swimming methods.

Conclusions / Discussion

The findings of the study suggest that the objective conduct of sports orientation in sprinting depends on the integrated use of morphological, functional and pedagogical criteria that will establish the predisposition of young athletes to one or another way of swimming at a certain stage of long-term improvement. It should be borne in mind that at the first

and second stages of long-term sports selection, the main role is played by genetically determined traits characteristic of small variability under the influence of training.

The results confirm the conclusions of specialists [1–12] that morphological and functional indicators and indicators of physical development, according to which sprint swimmers are somewhat different from each other, determine success in a particular swimming method. However, one must take into account the fact that the hallmark of the strongest swimmers in the world at a distance of 50 m freestyle is that the vast majority of them successfully participate in swims and at other distances. A generalization of the practical experience of the leading swimmers shows that most of them are able to show high results at several competitive distances. So, it is advisable to consider the issue of orientation choice of competitive disciplines taking into account the individual capabilities of the athlete's body.

Prospects for further research are connected with the establishment of modern model characteristics of young swimmers, representatives of other distance specializations.

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