

Model characteristics of physical development and special physical preparedness of swimmers 12–15 years old

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Purpose: to develop model characteristics of indicators of physical development and special physical preparedness of young athletes of 12–15 years.

Material & Methods: analytical generalization of scientific literature data, pedagogical testing, anthropometry, spirometry, methods of mathematical statistics.

Results: established criteria for young athletes of different ages on the basis of indicators of physical development and special physical preparedness for the purpose of increasing the effectiveness of the intermediate selection in the acquisition of training groups.

Conclusions: the use of the proposed model characteristics of physical development and special physical fitness of young athletes at the stages of preliminary basic and specialized basic training makes it possible to determine their prospects for further sports development.

Keywords: athletes, swimmers, physical development, preparedness, model characteristics.

Introduction

Each stage of a multi-year sports training has its own set of criteria that determines the prospects for achieving the heights of sportsmanship. Therefore, the central place in the training of swimmers is sport selection and the orientation of their training [1; 2; 8; 9; 10].

Continuous growth of world achievements in women's swimming, against the backdrop of the current socio-economic conditions for the development of sports in Ukraine, points to the need to improve the selection and preparation of the sports reserve. In the program for Youth Sports School and Sports School, which is still active in Ukraine [7], the control-transfer standards are given basically without quantitative indicators. In this regard, for effective implementation of the process of long-term preparation, it is necessary to revise the program and regulatory provisions, clarify the regulatory requirements for the physical condition of the body of young swimmers of different age groups in the selection and current pedagogical control.

In earlier studies, model characteristics and regulatory requirements for the level of physical development and special preparedness of swimmers of various qualifications [1; 2; 4; 5; 6; 11; 12 and etc.]. However, to date, the previously developed regulatory indicators, as criteria for selecting young swimmers, are somewhat outdated. Therefore, there is a need to supplement the scientific knowledge of quantitative regulatory criteria, based on the model characteristics of physical development and physical fitness of young athletes 12–15 years, in order to improve the efficiency of selection at the stages of preliminary basic and specialized basic training.

Purpose of the study: to develop model characteristics of indicators of physical development and special physical preparedness of young athletes of 12–15 years.

Objectives of the study:

1. Determine the level of sports qualification of young swimmers, depending on age.
2. Identify features of morphofunctional characteristics and special physical preparedness of young athletes aged 12–15 years old.
3. To develop step-by-step model characteristics of physical development and physical preparedness of female swimmers 12–15 years old.

Material and Methods of the research

Research methods: analytical generalization of scientific literature data, pedagogical testing, anthropometric measurements, spirometry, methods of mathematical statistics.

Morphofunctional indicators of physical development, their correlation, and also testing of special physical fitness of athletes. Data collection was carried out during training camps, as part of the CRG of the Federation of Swimming of Ukraine. A total of 36 female athletes aged 12–15 years, with different qualifications (MS, KMS, I and II sports categories), who were in the preliminary basic stage (12 years) and specialized basic training (13–15 years) were examined. The sports experience of the girls was from 3 to 9 years.

Results of the research and their discussion

A questionnaire survey of female swimmers aged 12 to 15 allowed to establish the level of their sports qualification (Figure 1). So, from the age of 13, the athletes fulfill the CMS standard (33,3%), and from the age of 14 – MS (21,4%). At the same time, the training of athletes began in the age range from 7 to 9 years, which is the most optimal age for starting swimming.

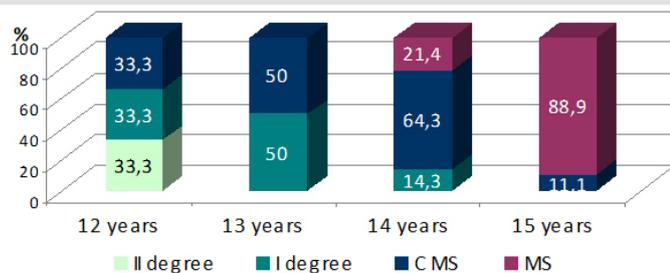


Figure 1. Level of sports qualification of women female swimmers 12–15 years

One of the main criteria of physical development is anthropometric indicators, which are largely genetically determined and determine the hydrodynamic qualities of the swimmer, on which the sports achievements at a particular distance depend substantially [1; 2].

In the course of the study it was found that at the current stage

of development of women's swimming, the body lengths of individual champions and Olympic Games prize winners averaged $179,37 \pm 5,35$ cm, and body weight – $66,56 \pm 5,29$ kg. At the same time, the growth of the strongest athletes sometimes exceeds 185 cm. Therefore, when picking up teams and intermediate selection, preference should be given to athletes with specific physique, in particular, high values of total body size.

As a result of the comparative analysis of the features of the physique of young female athletes, it was revealed that the length of the body during the age development from 12 to 15 years increases by approximately 5% (Table 1, Figures 2, 3). The most intensive increase in body length takes place in the zone from 12 to 13 years (3,2%), and after 13 years the growth rate is somewhat slowed down.

At the age from 12 to 13 years, the greatest peak in the increase in the total body size is observed, such as arm length (3,2%), shoulder length (5,0%), brushes (3,5%), trunks

Table 1
Model characteristics of physical development of young female swimmers, $\bar{X} \pm \sigma$

No. i/o	Parameters	12 years (n=6)	13 years (n=12)	14 years (n=10)	15 years (n=8)
1.	Body length, cm	164,03±3,61	169,17±8,40	170,14±6,70	171,63±5,68
2.	Body weight, kg	49,10±5,41	52,86±5,91	53,50±4,74	57,38±4,47
3.	Arm span, cm	166,50±5,29	169,75±9,16	171,27±7,48	171,38±7,13
4.	Arm length, cm	72,50±2,18	74,79±3,77	75,18±3,49	76,19±3,26
5.	Length of brush, cm	18,33±1,26	18,98±1,50	19,09±1,14	19,13±1,46
6.	Length on the forearm, cm	23,83±1,76	23,63±1,45	24,23±1,27	24,26±1,99
7.	Shoulder length, cm	29,33±1,53	30,79±1,63	30,82±2,27	31,00±2,95
8.	Length of foot, cm	87,33±1,53	88,54±5,22	89,86±3,73	91,88±3,35
9.	Shank length, cm	39,15±1,09	40,25±3,86	39,59±3,31	40,69±2,12
10.	Length of the foot, cm	25,17±0,29	25,46±1,44	25,27±1,63	25,28±1,57
11.	Length of trunk, cm	52,17±1,44	55,42±3,29	55,23±4,34	55,13±2,37
12.	Shoulder width, cm	35,25±1,83	36,08±2,02	35,64±2,00	36,63±2,81
13.	Pelvic width, cm	25,33±1,53	25,46±1,30	25,82±1,25	25,50±1,20
14.	Width of brush, cm	7,50±0,50	8,19±0,41	8,00±0,45	7,88±0,99
15.	Circumference of chest. cells at rest, cm	83,17±2,84	84,21±3,41	86,55±4,66	89,25±4,19
16.	Circumference of chest. cells on inspiration, cm	88,33±3,33	90,92± 3,50	91,82±3,60	94,75±4,41
17.	Circumference of chest. cells on exhalation, cm	80,33±3,25	79,96± 3,17	81,82±4,38	85,25±4,81
18.	Shoulder girth (strained)	26,08±2,18	26,46± 1,53	26,50±1,64	28,06±1,61
19.	Shoulder girth (relaxed)	23,83±2,08	24,54± 1,25	24,14±1,50	26,13±1,53
20.	Girth of forearm, cm	20,83±1,04	21,96± 0,66	21,68±0,93	23,19±1,25
21.	Circumference of wrist, cm	14,50±0,50	14,96±0,69	14,64±0,60	14,94±1,24
22.	Waist circumference, cm	64,05±5,29	64,54±2,23	65,32±3,20	69,44±3,25
23.	Girth of buttocks, cm	84,57±2,18	86,17± 4,69	87,55±4,18	91,00±3,47
24.	Hip circumference, cm	47,17±2,36	47,88±2,76	47,95±2,82	51,63±2,52
25.	Circumference of knee, cm	33,17±1,04	33,42±1,28	33,36±1,45	35,44±2,11
26.	Chest circumference, cm	32,33±2,25	32,38±1,68	32,68±1,86	33,81±1,58
27.	Ankle circumference, cm	21,50±1,06	20,83±1,09	21,18±1,06	21,00±1,89
28.	VC, l	3,86±0,42	3,97±0,47	4,20±0,59	4,52±0,15
29.	MVC, ml·kg ⁻¹	78,62±3,25	75,10±8,85	78,50±9,22	78,77±4,54
30.	Excursion of the chest, cm	8,00±0,02	10,96±1,41	10,00±2,42	9,50±1,04
31.	Chest circumference / length of body, cond. units	0,51±0,01	0,50±0,02	0,51±0,03	0,52±0,02
32.	Length of legs / body length, cond. units	0,53±0,01	0,52±0,01	0,53±0,01	0,54±0,01
33.	Arm length / body length, cond. units	0,44±0,01	0,44±0,01	0,44±0,01	0,44±0,01
34.	Shoulder width / pelvis, cond. units	1,39 ±0,09	1,42±0,08	1,38±0,10	1,47±0,16
35.	Shoulder width / body length, cond. units	0,21±0,01	0,21±0,01	0,21±0,01	0,21±0,02
36.	Pelvic width / body length, cond. units	0,15 ±0,01	0,15±0,16	0,15 ±0,01	0,15±0,01
37.	Quetelet index, kg·m ⁻¹	18,26±1,23	18,22±1,0	18,72±1,47	19,47±1,08
38.	Absol. area. of bodies, ml	1,53±0,09	1,63±0,14	1,63±0,10	1,69±0,09

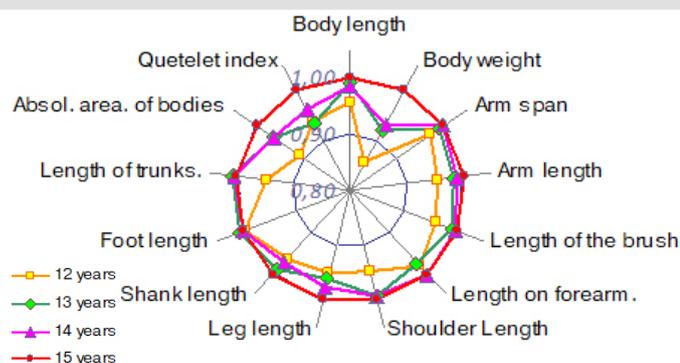


Figure 2. Ratio of the total body size of female athletes 12–15 years

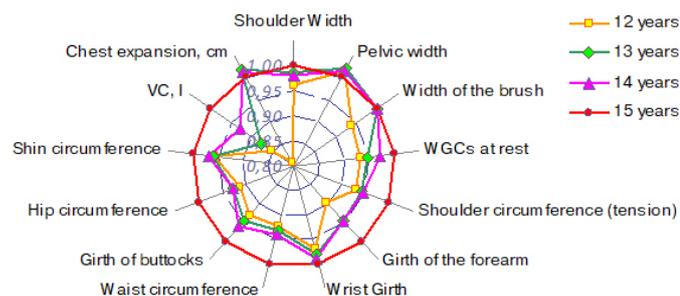


Figure 3. Ratio of circumference indicators of female athletes 12–15 years

(6,2%) and shin (2,8%), as well as the width of the shoulders (2,3%) and the brushes (9,2%).

Body mass indexes from 12 to 15 years increase by 16,9%, with the highest increase in the 12–13 age group (7,7%). At 13–14 years, the rates are slightly reduced and in 15 years reach $57,38 \pm 4,47$ kg. The absolute surface area of the body increases significantly from 13 years (6,5%) and 15 years (3,7%). Among the indices of the Quetelet index, the greatest increase is observed in 14 (2,74%) and in 15 years (4,01%).

In the age zone from 14 to 15 years, the girls have a significant increase in girth body size. Thus, chest circumference (CC) is increased at rest (3,1%), CC are inhaled (3,2%) and exhaled (4,2%), and shoulder circumference (5,9%), forearm (7,0%), waist (6,3%), buttocks (3,9%), thighs (7,7%), knees (6,2%) and lower legs (3,5%).

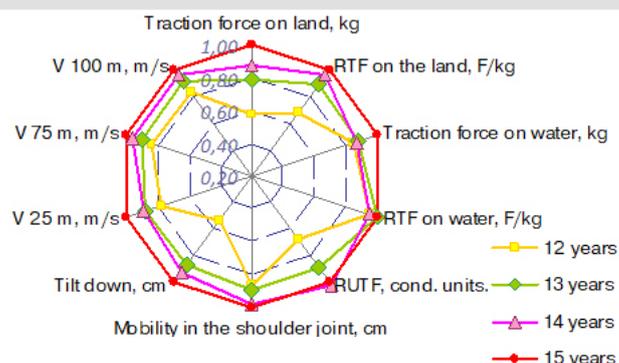


Figure 4. Ratio of special physical preparedness of female athletes 12–15 years

Under the influence of large training loads, mainly aimed at the development of endurance, in girls from 12 to 15 years, the indicators of VC increase from $3,86$ to $4,52 \pm 0,15$ l (17,1%). The highest peak in the VC is in the 13–14 age group (5,8%) and 14–15 years (7,6%). The size of the chest excursion (CE) from 12 to 15 years increases by 18,7%. It should be noted that the remaining anthropometric indicators of young athletes of different age groups do not significantly differ.

To study the structure of the strength preparedness, the maximum traction force on land and the thrust in the water on the leash were measured, on the basis of which the relative traction force to the body mass (RTF) was calculated, as well as the ratio of the use of the traction force (RUTF) (Table 2, Figure 4). For girls from 12 to 15 years, the strength of traction on land is significantly increased (89,9%). The maximum increase occurs in 13 years (49,4%) and further increases. Less intensive rates of increase in draft in the water than on land, in girls aged 12 to 13 years (10,7%) and from 14 to 15 years (15,8%). The difference between 12 and 15-year-olds is 26,4%. At the same time, the strength of the draft in the water is somewhat inferior to the normative requirements reflected in the program for the Youth Sports School [3].

The insignificant transfer of the effect of force development of muscles on land has been clearly observed for its realization in specific conditions in water. The analysis of the RUTF indicators showed that, from 12 to 15 years, they on average decrease from 64,02 to 42,63 on 33,5%. The traction force on land increases more intensively than in the water, as it is complementary to the basic swimming preparation, within which the proportion of spe-

Table 2 Model characteristics special physical readiness of young female swimmers

Parameters	12 years (n=6)		13 years (n=12)		14 years (n=10)		15 years (n=8)	
	\bar{X}	$\pm\sigma$	\bar{X}	$\pm\sigma$	\bar{X}	$\pm\sigma$	\bar{X}	$\pm\sigma$
Traction force on land, kg	14,67	3,06	21,92	3,42	24,36	3,93	27,86	3,53
RTF on the land, F·kg ⁻¹	0,30	0,03	0,42	0,07	0,45	0,06	0,47	0,05
Traction force on water, kg	9,33	1,53	10,33	1,83	10,18	1,47	11,79	1,58
RTF on water, F·kg ⁻¹	0,18	0,02	0,20	0,04	0,19	0,03	0,20	0,02
RUTF, cond. units.	64,02	2,79	47,80	7,99	42,27	5,66	42,63	5,51
t 25 m, s	18,53	2,81	16,51	1,88	15,43	1,50	14,44	1,74
V 25 m, m·s ⁻¹	1,37	0,21	1,53	0,16	1,57	0,23	1,75	0,18
t 75 m, s	60,07	9,09	54,97	6,07	51,79	3,82	47,28	1,95
V 75 m, m·s ⁻¹	1,26	0,19	1,37	0,14	1,45	0,11	1,51	0,16
t 100 m, s	77,67	10,60	69,98	6,51	66,50	5,20	64,03	4,57
Mobility in the shoulder joint, cm	36,00	6,08	34,83	11,23	31,68	12,28	31,00	7,81
Tilt down, cm	10,67	0,58	17,64	2,73	18,79	4,81	20,33	1,53

cialized training strength exercises gradually increases.

Under the influence of specific training loads with age and qualification, girls of 12–15 years have improved flexibility indicators. According to the results of the "tilt down" test, the difference reaches 90,5%, and the average absolute swimming speed ($V, m \cdot s^{-1}$) on distance 25 m (27,7%), 75 m (19,8%) and 100 m (21,3%).

Conclusions

1. As the age increases, the girls notice an increase in the level of sports achievements. So, from the age of 13, the athletes fulfill the CMS standard (33,3%), and from the age of 14 – MS (21,4%). Age of the beginning of swimming is in the range of 7–9 years.

2. As a result of the study, differences in physical fitness and preparedness among athletes' swimmers of 12–15 years old,

which gradually increase depending on the age and level of athletic skill, were revealed. Along with the sporting success, which is now in fact the only indicator of the swimmer's perspective, it is necessary to take into account other scientifically grounded selection criteria, such as body proportions, length and body weight, VC, the level of special physical readiness.

3. The developed step-by-step model characteristics can be used as reference points for the intermediate selection and monitoring of the physical condition of the body of swimmers to identify the most promising athletes, and can be recommended for use in the work of the coaches of the Children's Sports School and the Sports School specializing in sports swimming.

Prospects for further research are related to the development of model characteristics of physical development and preparedness of young swimmers taking into account distance specialization.

Conflict of interests. The author declares that no conflict of interest.

Financing sources. This article didn't get the financial support from the state, public or commercial organization.

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Received: 27.02.2018.

Published: 30.04.2018.

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