

POLITKO O.

Kharkov State Academy of Physical Culture

FEATURES OF MORPHOLOGICAL AND FUNCTIONAL CHARACTERISTICS OF YOUNG SWIMMERS 14–18 YEARS

Abstract. Purpose: to develop the model of morphofunctional characteristics of the strongest young swimmers aged 14–18 years. **Material and Methods:** the anthropometric and functional measurements, questionnaires, testing of 60 swimmers aged 14–18 years, methods of mathematical statistics. **Results:** the characteristic features of the model of morphological and functional performance of young swimmers of different age groups were identified. **Conclusions:** taking the obtained results allow to determine the suitability of the sport and the prospects of young swimmers with higher probability, according to their age and stage of long-term preparation.

Keywords: athletes, young swimmers, models, morphological and functional characteristics.

Introduction. The modern practice of sports swimming, and also various scientific researches specify that the world-class results are available to only especially gifted sportsmen having pronounced inborn advances to achievements at the certain competitive distances [5; 7; 8; 10].

It is known that indicators of a constitution play an essential role in the achievement of success in sports swimming [1; 3; 4; 5; 9]. The total sizes of a body and a proportion significantly influence the physical working capacity, the sports activity, a choice of sports specialization and have a high hereditary conditionality which, along with psychological, physiological, biochemical factors, give the chance to define prospects of sportsmen [1; 2; 3; 8]. A big body length and weight, a bigger ratio of length of a trunk and extremities give the chance for a sportsman to gather a high speed on a starting site of a distance, to carry out movements with bigger amplitude and power of fungal movements [1; 4]. In turn swimmers have to correspond to a morphological model of the strongest sportsmen on their overall, biomechanical and hydrodynamic features.

As a result of long-term researches the generalized model of morphofunctional characteristics were developed and standard requirements are developed to the level of physical development of swimmers, as a rule, of a high-class [1; 6; 9]. The usage of such models has restrictions in practice of youthful sport as during the various age periods of requirements imposed to these or those systems of an organism differ enough.

It should be noted that the intermediate model characteristics of young sportsmen developed earlier in the 70-80th years of the XX century became outdated

a little today. In this regard there is a need for an addition of scientific knowledge of features of morphofunctional indicators of young swimmers of 14-18 years old according to current trends of the development of sports swimming. In turn the development of intermediate group models of swimmers will allow increasing the efficiency of selection of the most perspective sportsmen at certain stages of long-term training.

Communication of the research with scientific programs, plans, subjects.

The work was performed within the Consolidating plan of RW in the sphere of physical culture and sport of Ukraine for 2011-2015 on a subject 2.13 "Modeling of technical and tactical actions of the qualified sportsmen in swimming and high-speed and power disciplines of track and field athletics" (No. of the state registration is 0111U000191).

The objective of the research: the development of group model characteristics of morphofunctional indicators of young swimmers at the age of 14–18 years old.

Material and methods of the research: analysis of scientific and methodical literature, anthropometrical and functional measurements, questioning, pedagogical testing, methods of mathematical statistics.

The data collection was carried out during the educational training camps which were organized by Federation of swimming of Ukraine, within the work of CNG. The surveyed contingent consisted of the strongest young swimmers boys of 14-18 years old (n=60) included in the main, reserve and youth structures of a national team of Ukraine. The level of their sports qualification corresponded to a rank of MSIC, MS and CMS, the I category in swimming.

So, at the time of inspection of sportsmen in the age group of 14 years old (n=10) the I sports category had 60%, and CMS – 40%. Among the 15-year-old swimmers (n=20) the I category was executed by 25% of sportsmen, CMS – 70%, and the status of MS – 5%. In the age group of 16-year old (n=27) only 3,7% of swimmers had the I category. The majority of them executed the standard of CMS – 59,3% and the status of MS – 37%. Other situation is observed among swimmers at the age of 17–18 years old (n=13) where 76,9% had the status of MS, and MSIC – 23,1%.

Longitudinal and girth sizes of a body, body weight, VCL, excursion of a thorax were studied for the purpose of the development of model characteristics of swimmers. The assessment of physical development of sportsmen was received by means of calculation of indexes (a ratio of the anthropometrical indicators) characterizing proportions of a body and features of a constitution and also defined some indicators of physical fitness (a mobility in shoulder joints, an inclination forward, a high jump and length from a place). In total 44 parameters were studied.

Results of researches and their discussion. Standards (models) were created on the basis of the measurements of the uniform age group of swimmers and the calculation of an average size of a sign (tab).

Morphofunctional parameters of sportsmen-swimmers of 14-18 years old,
 $\bar{X} \pm \sigma$

№	Morphofunctional parameters	14 years old (n=10)	15 years old (n=20)	16 years old (n=27)	17-18 years old (n=13)
1	Body length, sm	175,0±6,04	181,18±6,30	183,76±5,72	185,54±6,17
2	Body weight, kg	61,79±5,45	66,08±7,60	73,62±5,52	76,35±6,00
3	VCL, l	5,06±0,73	5,62±0,76	5,88±0,74	5,89±0,72
4	Length of an arm, sm	78,45±2,95	81,95±3,17	82,41±2,74	83,58±2,72
5	Sweep of hands, sm	178,15±5,17	187,05±7,83	188,65±5,68	190,19±3,36
6	Length of a hand, sm	20,4±1,05	20,93±1,13	21,19±0,92	20,82±1,61
7	Length of a forearm, sm	24,55±1,40	26,45±1,93	25,87±1,37	26,85±1,92
8	Length of a shoulder	31,1±1,54	33,33±1,36	33,31±2,59	34,77±2,10
9	Length of a leg, sm	88,5±4,31	90,30±3,63	94,15±4,29	96,07±5,24
10	Length of a hip, sm	43,0±2,00	44,50±1,74	45,10±2,64	44,85±2,49
11	Length of a shin, sm	41,2±2,21	42,93±2,18	43,09±2,85	44,38±2,69
12	Length of a foot, sm	27,1±1,17	27,53±1,38	28,13±1,09	27,83±1,29
13	Length of a trunk, sm	57,05±3,69	59,65±4,07	60,15±3,66	61,65±2,49
14	Width of shoulders, sm	38,7±1,42	39,93±1,98	41,26±1,81	43,27±2,71
15	Width of a pelvis, sm	26,25±1,93	26,25±1,71	27,13±1,43	27,96±1,68
16	Width of a hand, sm	9,0±0,47	9,20±0,47	9,26±0,32	9,58±1,26
17	Girth of a thorax at rest, sm	90,8±4,08	93,28±4,79	96,74±3,77	97,69±2,72
18	Girth of a thorax on a breath, sm	97,4±4,38	99,75±4,08	103,15±3,86	103,69±2,88
19	Girth of a thorax on an exhalation, sm	86,8±4,18	89,03±4,32	93,07±3,86	93,50±2,81
20	Girth of a shoulder (intens.), sm	29,55±1,85	30,60±2,09	32,96±1,95	33,73±2,61
21	Girth of a shoulder (weakened), sm	26,9±1,24	27,55±2,27	29,93±1,81	30,73±2,17
22	Girth of a forearm, sm	24,45±1,72	24,68±1,70	26,17±1,46	26,81±1,25
23	Girth of a wrist, sm	16,25±0,98	16,25±0,72	17,06±0,80	17,31±1,15
24	Girth of a waist, sm	70,8±2,90	72,18±4,43	75,07±2,88	79,15±4,14
25	Girth of buttocks, sm	88,15±4,01	90,20±5,16	93,48±3,61	95,92±3,71
26	Girth of a hip, sm	48,0±2,20	49,25±3,73	51,80±3,21	53,19±2,68
27	Girth of a knee, sm	35,55±1,69	35,68±1,73	36,67±1,41	36,85±1,86
28	Girth of a calf, sm	35,15±2,01	34,38±2,11	36,24±1,83	35,73±3,76
29	Girth of an anklebone, sm	22,65±1,16	22,13±1,17	23,04±1,20	23,23±1,32
30	Length of an arm/Length of a body, s.u.	0,45±0,01	0,45±0,01	0,45±0,01	0,45±0,01
31	Length of a leg/Length of a body, s.u.	0,49±0,01	0,50±0,01	0,50±0,01	0,50±0,02
32	Width of shoulders/Length of a body, s.u.	0,22±0,01	0,22±0,01	0,22±0,01	0,23±0,01
33	Girth of thorax / Length of a body, s.u.	0,52±0,03	0,51±0,02	0,53±0,02	0,53±0,03
34	Index Quetelet, g · sm ⁻¹	352,93±26,68	364,18±34,19	400,49±24,76	411,35±27,57
35	VCL, ml · kg ⁻¹	81,87±9,33	85,03±7,79	80,27±9,64	76,64±8,48
36	Excursion of a thorax, sm	10,60±2,94	10,73±1,26	10,08±1,82	10,19±1,98
37	Width of shoulders/Width	1,48±0,10	1,53±0,11	1,52±0,10	1,55±0,12

	of a pelvis, s.u.				
38	Index Brok, s.u.	13,21±5,38	15,10±5,49	10,14±5,14	9,19±5,68
39	Absolute area of a top of a body, sq.m	1,77±0,10	1,87±0,13	1,97±0,10	2,02±0,11
40	Width of a pelvis/Length of a body, s.u.	0,15±0,01	0,14±0,01	0,15±0,25	0,15±0,01
41	Long jump from a place, sm	208,0±20,94	215,5±22,53	249,0±23,98	233,20±26,98
42	High jump, sm	42,5±13,38	44,0±15,64	55,0±12,75	55,40±9,21
43	Movement in shoulder joints, sm	33,0±24,91	44,42±12,32	37,24±20,93	45,54±20,93
44	Inclination down, standing on an eminence, sm	13,21±5,73	15,11±5,59	18,08±7,14	17,27±7,36

It is known that high indicators of the total sizes allow sportsmen –swimmers to perform their work of a high-speed and power orientation in an anaerobic zone of the power supply successfully. The important characteristic of the intensity of the process of the growth are body length and body weight. Length of a body positively affects, the increase of which on 10 sm reduces the water resistance on 5% on hydrodynamic qualities [1; 4].

So, when comparing the main total sizes of a body of swimmers of 14-18 years old it is revealed that the greatest values of length of a body are recorded at sportsmen of 17-18 years old (185,54±6,17 sm), and the smallest one at sportsmen of 14 years old (175,0±6,04 sm). Thus authentically the significant distinctions on a body length indicator are noted between groups of swimmers of 14 and 15 years old ($p < 0,05$). The processes of the increase in length of a body are a little slowed down at sportsmen after 15 years old.

Big indicators of a sweep of hands are a sign of the best opportunities of the sportsman. If a sweep of hands is more than length of a body, the increased suitability is observed. These data can be also used at the determination of individual speed and "step" of a cycle of fungal movements [3]. So, on this indicator the greatest size of a sweep of hands is noted at swimmers of 17-18 years old (190,19±3,36 sm), and the smallest at sportsmen of 14 years old (178,15±5,17 sm). The noticeable distinction is noted between the group models of swimmers of 14 and 15 years old (8,9 sm).

The insignificant divergence of values among representatives of the various age groups of 14-18 years old is noted on indicators of length of a hip, a shin and a foot at swimmers.

The greatest size of a body weight at swimmers of 17-18 years old is (76,35±6,00 kg), and the smallest is (61,79±5,45 kg) at sportsmen 14 years old. The reliability of distinctions on an indicator of a body weight is revealed between groups of sportsmen of 14 and 15, 15 and 16 years old ($p < 0,05$). Thus the most essential distinction of this indicator is noted between sportsmen of 15 and 16 years old – 7,54 kg.

Index Quetelet represents the relation of a mass to a length of a body and reflects the level of physical development of the sportsman. Its greatest values are revealed at sportsmen of 17-18 years old (411,35±27,57 $g \cdot sm^{-1}$). The sportsmen having an indicator, bigger in comparison with other swimmers, are more massive,

i.e. possess bigger weight per unit length of a body. Therefore, their potential opportunities in the development of bigger power in the fungal movement are slightly higher concerning other swimmers. The noticeable change of this indicator is noted between groups of sportsmen of 15 and 16 years old.

Some researches show that the body profile is wider, the bigger carrying power it possesses that reduces the water resistance operating on the swimmer [4]. Indicators of a width of shoulders and pelvis are higher in the age group of 17-18 years old. Thus in indicators of an index the relation of a width of shoulders to a width of pelvis the greatest distinctions are noted between swimmers of 14 and 15 years old.

Its functionality depends on the sizes of a body of a person: VCL, oxygen consumption, buoyancy. The vital capacity of lungs is connected with buoyancy of a body in turn [1; 4]. Buoyancy of a body indirectly characterizes hydrodynamic qualities of swimmers. The carried-out analysis of parameters of functional indicators of swimmers showed that the greatest values of VCL are noted at sportsmen of 17-18 years old ($5,89 \pm 0,72$ l), and the smallest at sportsmen of 14 years old ($5,06 \pm 0,73$ l). This indicator significantly doesn't change, but systematically increases between various age groups.

It is known that it is possible to judge the degree of the development of muscle mass of segments of extremities by the girths sizes of a shoulder, a forearm, a hip and a shin indirectly that in a certain measure characterizes manifestation of power qualities at sportsmen [1]. Thus the noticeable distinctions of these indicators are revealed between groups of swimmers of 15 and 16 years old.

The greatest indicators of a girth of a thorax at rest are recorded at swimmers of 17-18 years old ($97,69 \pm 2,72$ sm), and the smallest is at sportsmen 14 years old ($90,8 \pm 4,08$ sm). The noticeable increase is observed between groups of swimmers of 14 and 15 years old (2,48 sm), 15 and 16 years old (3,46 sm) in this indicator.

The indicator of an absolute surface area of a body considerably increases at swimmers from 14 to 16 years old (from $1,77 \pm 0,10$ to $1,97 \pm 0,10$ sq.m), and then rates of its growth are slowed down. The insignificant distinction of this indicator is noted between sportsmen of the age groups of 16 and 17-18 of years old ($0,05$ sq.m). Thus the greatest sizes are observed at swimmers of 17-18 years old ($2,02 \pm 0,11$ sq.m).

Besides the anthropometrical indicators, characteristics of special flexibility and specific features of mobility in joints were studied at swimmers. Thus some fluctuations between the various age groups of sportsmen are noted. So, the analysis of the mobility in shoulder joints of swimmers showed that the best indicators ($33,0 \pm 24,91$ sm), and in the test "inclination down, standing on an eminence" – in the group of 16 years old ($18,08 \pm 7,14$ sm) are noted at the 14-year age at swimmers.

A high jump and a long jump from a place were used for the definition of a level of the development of high-speed and power abilities. So, the greatest indicators are noted at swimmers of 16 years old in the test a long jump ($249,0 \pm 23,98$ cm), and in height are at sportsmen of 17–18 years old ($55,40 \pm 9,21$ sm). In these tests the essential distinctions of indicators between the groups of 15 and 16 years old are noticeable (33,5 and 11 sm respectively).

Thus, characteristics features of model morphofunctional indicators of sportsmen–swimmers of 14-18 years old were revealed during the conducted research.

For the purpose of the determination of an individual level of physical development of the sportsman it is recommended to carry out the comparison to reference indicators for a similar age group of persons and to find a difference in indicators from a standard. Coaches can be guided by these data at a selection and with a bigger degree of probability to reveal prospects of sportsmen in swimming at a certain stage of long-term training.

Conclusions:

1. Features of the growth rate of various indicators of total and girth sizes of a body, functional indicators and indexes of physical development of the strongest swimmers of Ukraine in the age range of 14-18 years old are revealed.

2. Model characteristics of a morphofunctional state reflect features of maturing of an organism, the level of the development of specific physical abilities of young swimmers and provide the reliable forecast of their potential opportunities at the stages of the specialized – basic preparation and the maximum realization of individual opportunities.

3. The offered model morphofunctional criteria of swimmers of 14-18-year old supplement the knowledge of a constitution of young swimmers and arm trainers with standard criteria for carrying out the selection of perspective young swimmers in specialized CYSS, SCYSOR and SHSS.

Prospects of further researches are connected with studying of features of morphofunctional characteristics of young sportswomen-swimmers.

References:

1. Bulgakova N. Zh. Otbor i podgotovka yunykh plovtsov [Selection and training of young swimmers], Moscow, 1986, 191 p. (rus)
2. Volkov L. V. Teoriya sportivnogo otbora: sposobnosti, odarennost, talant [Theory of sports selection: ability, giftedness, talent], Kyiv, 1997, 128 p. (rus)
3. Davydov V. Yu., Avdiyenko V. B. Otbor i oriyentatsiya plovtsov po pokazatelyam teloslozheniya v sisteme mnogoletney podgotovki (Teoreticheskiye i prakticheskiye aspekty) [Selection and orientation of swimmers in terms of physique in the long-term preparation], Volgograd, 2012, 344 p. (rus)
4. Onopriyenko B. I. Plavaniye : Fizkultura i sport [Swimming: Physical Culture and Sports], 1971, pp. 36–38. (rus)
5. Platonov V. N. Plavaniye [Swimming], Kyiv, 2000, 496 p. (rus)
6. Politko Ye. V. Visnik Chernigivskogo natsionalnogo pedagogichnogo universitetu im. T. G. Shevchenka [Journal of T. Shevchenko Chernihiv National Pedagogical University], Chernigiv, 2013, vol. 112, iss.4, pp. 184–188. (rus)
7. Popov O., Partyka L. Nauka v olimpiyskom sporte [Science in Olympic sports], Kyiv, 2001, vol. 1, pp. 43–48. (rus)
8. Sergienko L. P. Sportivniy vidbir : teoriya ta praktika. U 2 kn, Kniga 1, Teoretichni osnovi sportivnogo vidboru [Sports selection: Theory and Practice], Ternopil, 2009, 672 p. (ukr)
9. Filimonova I. Ye. Morfo-funksionalnyye osobennosti plovtsov vysokogo klassa i ikh znachenije dlya otbora i dalneyshego sportivnogo sovershenstvovaniya : avtoref. kand. ped. nauk [Morpho-functional features of the swimmers and their high-end value for the selection and the further improvement of sports :PhD thesis], Moscow, 1977, 25p. (rus)

10. Shinkaruk O. A. Otbor sportsmenov i oriyentatsiya ikh podgotovki v protsesse mnogoletnego sovershenstvovaniya (na materiale olimpiyskikh vidov sporta) [The selection of athletes and their orientation in the process of preparing a multi-year improvement (based on Olympic sports)], Kyiv, 2011, 360 p. (rus)

Received: 15.01.2015.

Published: 28.02.2015.

Olena Politko: *PhD (Physical Education and Sport); Kharkov State Academy of Physical Culture: Klochkivska str. 99, Kharkov, 61058, Ukraine.*

ORCID.ORG/0000-0001-6481-196X

E-mail: elena.politko@gmail.com