

Modeling of morpho-functional profile of sportsmen of high qualification who specialize in swimming in way butterfly stroke at distances of various lengths

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Purpose: the development of modern morpho-functional models of sportsmen of high qualification who specialize in swimming in way butterfly stroke at distances of various lengths.

Material & Methods: the analysis of scientifically-methodical literature, timekeeping, measurement of morpho-functional indicators with application of private techniques, methods of mathematical statistics. The contingent of the investigated was made by sportsmen who specialized in distances of 50, 100 and 200 meters in way butterfly stroke and had the level of sports qualification: MSU, MSIC.

Results: it is established that the morpho-functional profile of the sportsmen specializing in swimming in way butterfly stroke at distances of various length has the features; model morpho-functional characteristics of sportsmen, who act in swimming in way butterfly stroke at distances of 50, 100 and 200 meters, are developed.

Conclusions: the definition of compliance of individual characteristics of the sportsman to the morpho-functional status will allow choosing correctly remote specialization of the swimmer, to open his potential opportunities most fully.

Keywords: butterfly stroke, sportsmen, distances, morpho-functional characteristics, model.

Introduction

The modern level of development of swimming dictates need of search of the talented sportsmen, who are capable to achieve world-class results [1; 10; 12].

Such opportunity takes place only on condition of compliance of system of selection and orientation to the main components of structure of the competitive activity and special preparedness of swimmers that allows carrying out the choice of way and length of distance which as much as possible answer specific features of the specifically taken sportsman [5; 8; 11].

The significant role in the system of sports orientation belongs to morpho-functional indicators [2; 3; 4].

It is proved by experts that compliance of sportsmen by their genetically determined morpho-functional parameters of certain specialization considerably increases efficiency of the training process and, as a result, improves sports result [2; 8; 9].

Rather fully developed models of sportsmen, who act in different ways of swimming, occurred during the numerous researches in scientifically-methodical literature [1; 6; 7; 8].

However practice of elite sport in the conditions of intensification of training and competitive processes experienced the number of essential changes in recent years that could not to leave a mark on morpho-functional characteristics of sportsmen. Therefore, there was need of carrying out the scientific research for this branch for the purpose of the subsequent correction.

Communication of the research with scientific programs, plans, subjects

The researches were conducted according to the subject of the Built plan of RW in the branch of physical culture and sport for 2011–2015. “Modeling of technical-tactical actions of the qualified sportsmen in swimming and high-speed and power disciplines of track and field athletics”.

The purpose of the research

To develop modern morpho-functional models of sportsmen of high qualification who specialize in swimming in way butterfly stroke at distances of different length.

Research tasks:

1. To characterize features of morpho-functional profile of sportsmen of high qualification who specialize in distances of different length in way of swimming butterfly stroke.
2. To investigate the nature of changes of morpho-functional indicators depending on length of competitive distance in way of swimming butterfly stroke.
3. To develop model morpho-functional characteristics of sportsmen who specialize in swimming in way butterfly stroke at distances of 50, 100 and 200 meters.

Material and Methods of the research

The following methods were used for the solution of the put tasks: analysis of scientifically-methodical literature, timekeeping; measurement of morpho-functional indicators with

use of private techniques; methods of mathematical statistics.

Researches were conducted during the period from 2014 to 2016 during the championships and national cups of Ukraine on swimming.

The contingent of the investigated was made by sportsmen who specialized in distances of 50, 100 and 200 meters in way butterfly stroke and had the level of sports qualification: MSU, MSIC. Total of investigated – 24 swimmers.

Results of the research and their discussion

For definition of features morpho-functional to profile of swimmers of high qualification who specialize in swimming in way butterfly stroke at distances different lengths we have considered 34 parameters.

The received experimental material allowed constructing the average profile of sportsmen who successfully act in swimming in way butterfly stroke, irrespective of distance specialization (fig. 1).

Apparently from the figure 1, sportsmen who swim in the way

butterfly stroke have the average height, long trunk and short legs, well exercised muscle of shoulder girdle, trunk and extremities, have the big weight, considerable sizes of the clasping sizes that are coordinated with data of references [1; 8].

Having made the assumption that depending on length of competitive distance morpho-functional indicators of sportsmen will differ, we have distributed all swimmers on three groups, depending on the progress of overcoming distances of different slowness by them.

The carried-out analysis of the experimental data allowed to define value of morpho-functional indicators what inherent in sportsmen-delphinists who specialize in distances of 50, 100 and 200 meters (tab. 1).

Respectively models for distances of 50, 100 and 200 meters in way of swimming butterfly stroke were constructed (fig. 2, 3, 4).

Apparently from the provided charts, sportsmen who specialize in swimming in way butterfly stroke at different distances in general have the similar anthropometrical profile. However there are some divergences in values of the studied parameters depending on the competitive length.

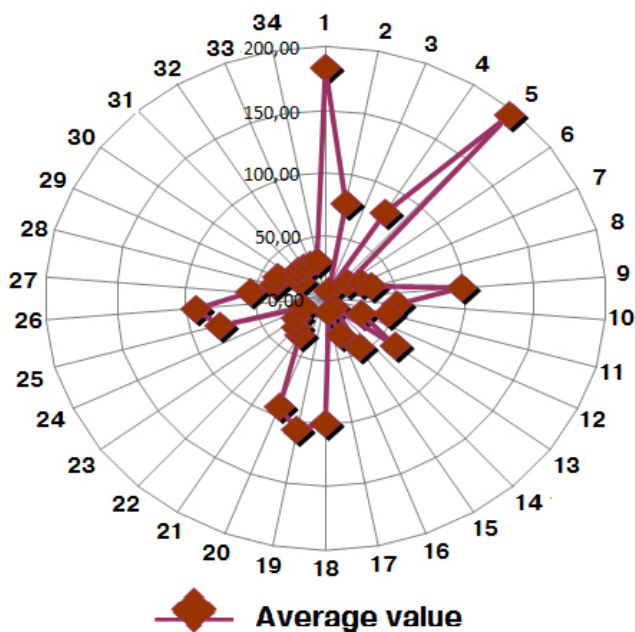


Fig. 1. Morpho-functional profile of the sportsman who specializes in swimming in way butterfly stroke:

1. Body length; 2. Body weight; 3. VCL; 4. Length of arm;
5. Scope of arms; 6. Length hand; 7. Length of forearm;
8. Length of shoulder; 9. Length of leg; 10. Length of hip;
11. Length of shin; 12. Length of foot; 13. Length of trunk;
14. Width of foot; 15. Width of shoulders; 16. Width of pelvis;
17. Width of hand; 18. Girth of thorax - at rest; 19. -on inhalation;
20. -on exhalation; 21. Girth of shoulder (external); 22. Girth of shoulder (relaxed);
23. Girth of forearm; 24. Girth of wrist; 25. Girth of waist; 26. Girth of buttocks;
27. Girth of shin; 28. Girth of knee; 29. Girth of hip; 30. Girth of ankle-bone;
31. HR after dream; 32. HR at rest; 33. HR after load; 34. Bending down.

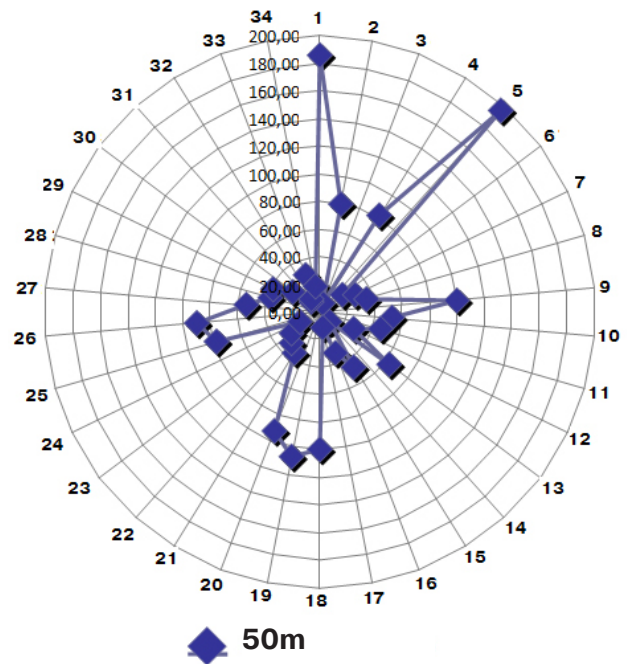


Fig. 2. Model morpho-functional profile of swimmers who specialize in way butterfly stroke at distance of 50 meters:

1. Body length; 2. Body weight; 3. VCL; 4. Length of arm;
5. Scope of arms; 6. Length hand; 7. Length of forearm;
8. Length of shoulder; 9. Length of leg; 10. Length of hip;
11. Length of shin; 12. Length of foot; 13. Length of trunk;
14. Width of foot; 15. Width of shoulders; 16. Width of pelvis;
17. Width of hand; 18. Girth of thorax - at rest; 19. -on inhalation;
20. -on exhalation; 21. Girth of shoulder (external); 22. Girth of shoulder (relaxed);
23. Girth of forearm; 24. Girth of wrist; 25. Girth of waist; 26. Girth of buttocks;
27. Girth of shin; 28. Girth of knee; 29. Girth of hip; 30. Girth of ankle-bone;
31. HR after dream; 32. HR at rest; 33. HR after load; 34. Bending down.

Table 1

Morpho-functional indicators of sportsmen who specialize in swimming in way butterfly stroke at distances of different length, $\bar{X} \pm m$

№	Indicators	Distance		
		50 m	100 m	200 m
1	Body length, sm	185,58±7,34	185,56±8,22	183,29±4,82
2	Body weight, kg	78,96±9,12	80,67±9,31	78,00±9,00
3	VCL, l	6,24±1,23	6,51±1,13	6,85±1,32
4	Length hand, sm	81,65±5,32	82,67±6,46	79,29±8,04
5	Scope of arms, sm	196,23±17,10	198,33±22,45	193,86±16,26
6	Length hand, sm	20,65±3,06	20,78±3,73	19,43±1,62
7	Length of forearm, sm	28,69±3,86	29,89±4,17	28,64±2,31
8	Length of shoulder, sm	34,38±3,10	35,11±3,41	36,07±2,62
9	Length of leg, sm	99,00±6,88	100,33±7,42	96,07±4,09
10	Length of hip, sm	52,31±4,31	53,44±4,56	51,00±7,64
11	Length of shin, sm	46,27±4,61	46,06±4,68	46,71±3,61
12	Length of foot, sm	28,19±2,12	27,89±2,43	28,00±1,04
13	Length of trunk, sm	62,77±7,11	64,11±6,53	58,57±5,16
14	Length of foot, sm	10,27±1,70	10,39±1,11	9,86±1,84
15	Width of shoulders, sm	47,42±4,86	47,33±5,72	47,71±3,82
16	Width of pelvis, sm	31,46±5,48	30,94±2,88	31,00±2,88
17	Girth of hip, sm	52,88±9,11	52,33±4,38	50,36±7,59
18	Girth of knee, sm	36,96±4,45	35,71±3,25	36,50±2,07
19	Girth of shin, sm	37,62±2,88	38,17±3,67	37,57±3,56
20	Girth of ankle-bone, sm	24,25±3,56	24,29±4,71	22,10±2,30
21	HR after dream, bpm ⁻¹	9,57±1,40	10,29±2,14	9,25±3,30
22	HR at rest, bpm ⁻¹	11,40±1,84	11,50±2,27	13,60±2,07
23	HR after load, bpm ⁻¹	28,50±6,26	27,89±6,39	30,40±1,67
24	Bending down, sm	18,42±8,11	21,22±7,53	21,33±8,64
25	Width of hand, sm	11,31±1,20	11,33±1,44	11,29±2,20
26	Girth of thorax – at rest, sm	99,88±5,92	101,22±6,51	100,71±7,25
27	Girth of thorax – on inhalation, sm	106,62±5,80	108,72±5,84	108,29±7,31
28	Girth of thorax – on exhalation, sm	92,08±15,76	98,11±6,09	97,50±7,99
29	Girth of shoulder (external), sm	34,54±2,20	35,07±2,52	33,75±2,79
30	Girth of shoulder (relaxed), sm	30,96±3,23	32,33±3,12	30,71±2,45
31	Girth of forearm, sm	26,08±1,88	26,89±1,95	26,86±2,29
32	Girth of wrist, sm	16,67±1,71	16,57±1,90	16,70±1,79
33	Girth of waist, sm	78,29±6,77	78,21±7,38	78,17±7,03
34	Girth of buttocks, sm	88,75±17,64	87,86±22,11	95,93±7,16

The analysis of the data provided in table 1 allows distributing indicators of morpho-functional development of sportsmen-swimmers on several groups:

- The first group of parameters is characterized by the growth of numerical values together with the increase in length of distance. It is possible to distinguish from them: VCL, shoulder length, girth of thorax, HR at rest and after load, bending down.
- Among indicators which values decrease with the increase in length of distance are: growth, girth sizes of waist and hip.
- Parameters which reach the greatest values only at separate distances.

So, the largest sizes of length of foot, width of pelvis, girth of waist, hip, knee, are observed at swimmers who successfully overcome distance of 50 meters.

Sportsmen who specialize in swimming at distance of 100 meters butterfly stroke have the largest weight, length and scope of arms, the linear sizes of hand, forearm, leg, hip and trunk, value of width of foot and hand clasping, the sizes of

thorax, shoulder, forearm, shin, and anklebone, and also HR value after dream.

The greatest values are reached by shin length, width of shoulders, girth of buttocks, HR values at rest and after loading at swimmers for whom the main distance are 200 meters.

Thus, we can claim that depending on length of competitive

Table 2

Model morpho-functional indicators of athletes who specialize in way of swimming butterfly stroke at distance of 50 meters

№	Indicators	Model values
1.	Body weight, kg	78,96
2.	VCL, l	6,24
3.	Width of shoulders, sm	47,42
4.	Girth of ankle-bone, sm	24,25
5.	HR(at rest), bpm ⁻¹	11,4

distance, the anthropometrical profile of swimmers-delphinists changes.

The carried-out correlation analysis allowed to determine the number of parameters which considerably influence sports result ($0,5 \leq r \leq 0,85$), and to develop model characteristics of sportsmen which successfully swim distances of 50, 100 and 200 meters in the way butterfly stroke (tab. 2, 3, 4).

Apparently from the provided tables, model values of body weight at swimmers who specialize in distance of 50 meters in the way butterfly stroke have to make 78,96 kg, at the same time at distance of 200 meters this indicator has to equal 78,00 kg. This divergence is predetermined by specifics of work on each of distances. So, the result considerably depends on power indicators on 50-meter piece which increase goes in parallel with hypertrophy of miofibrils which promotes the increase in absolute body weight. In turn distances of 200 meters result are mainly influenced by power endurance which depends on stock in muscles of substrata of power supply, speed of their renewal, inter-muscular coordination and innervations of muscles, but not on muscular weight.

Comparison of model values of VCL at sportsmen who specialize in swimming at distances of 50, 100 and 200 meters in the way butterfly stroke allows seeing the growth of this indicator along with the increase in length of competitive distance. This results from the fact that performance of physical activity longer time imposes more severe requirements to the level of functional development of the sportsman.

Model indicators of width of shoulders at sportsmen who swim distance of 100 meters have smaller values, than other representatives of way have butterfly stroke. In turn anklebone girth at them is bigger, than at sportsmen who specialize in distance of 50 meters.

If to compare sportsmen who swim distance of 200 meters, with sportsmen who specialize in distance of 100 meters in the way butterfly stroke, then in the first model values of length of shoulder and width of pelvis are big, and shin girth are smaller.

Thus, the developed model characteristics can serve as reference points during definition of distance specialization of the sportsman who will give opportunity to open its potential opportunities most fully.

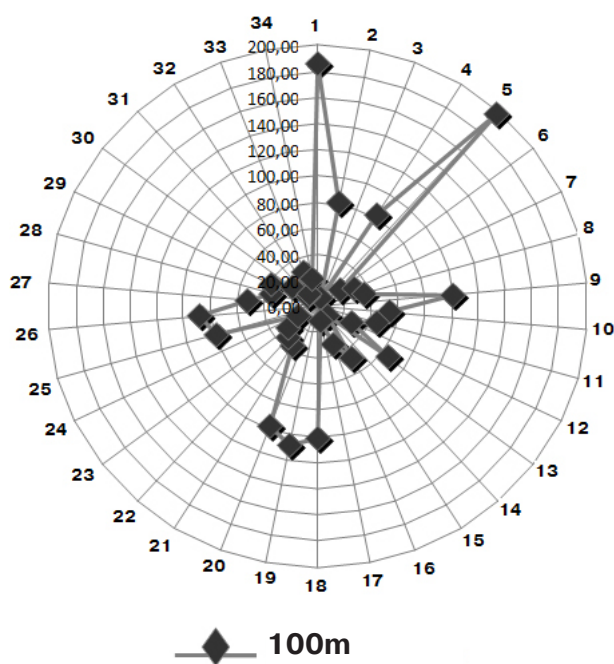


Fig. 3. Model morpho-functional profile of swimmers who specialize in way butterfly stroke at distance of 100 meters

1. Body length; 2. Body weight; 3. VCL; 4. Length of arm; 5. Scope of arms; 6. Length hand; 7. Length of forearm; 8. Length of shoulder; 9. Length of leg; 10. Length of hip; 11. Length of shin; 12. Length of foot; 13. Length of trunk; 14. Width of foot; 15. Width of shoulders; 16. Width of pelvis; 17. Width of hand; 18. Girth of thorax - at rest; 19. -on inhalation; 20. -on exhalation; 21. Girth of shoulder (external); 22. Girth of shoulder (relaxed); 23. Girth of forearm; 24. Girth of wrist; 25. Girth of waist; 26. Girth of buttocks; 27. Girth of shin; 28. Girth of knee; 29. Girth of hip; 30. Girth of ankle-bone; 31. HR after dream; 32. HR at rest; 33. HR after load; 34. Bending down.

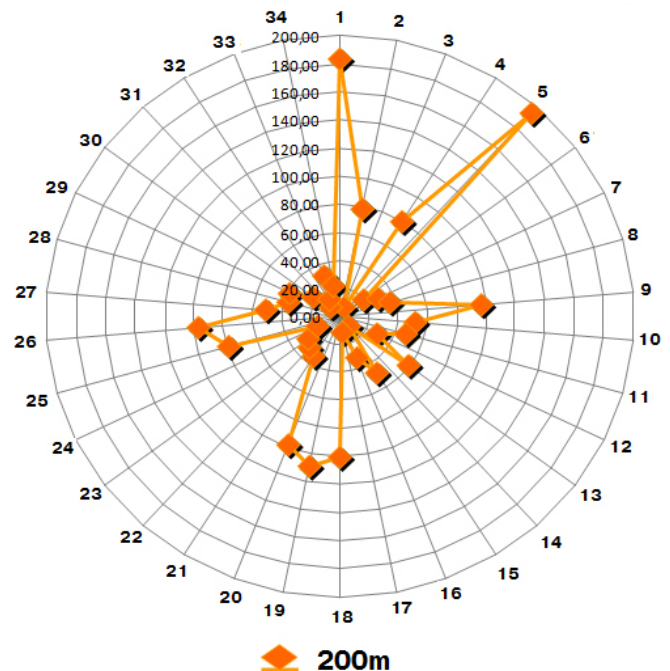


Fig. 4. Model morpho-functional profile of swimmers who specialize in way butterfly stroke at distance of 200 meters

1. Body length; 2. Body weight; 3. VCL; 4. Length of arm; 5. Scope of arms; 6. Length hand; 7. Length of forearm; 8. Length of shoulder; 9. Length of leg; 10. Length of hip; 11. Length of shin; 12. Length of foot; 13. Length of trunk; 14. Width of foot; 15. Width of shoulders; 16. Width of pelvis; 17. Width of hand; 18. Girth of thorax - at rest; 19. -on inhalation; 20. -on exhalation; 21. Girth of shoulder (external); 22. Girth of shoulder (relaxed); 23. Girth of forearm; 24. Girth of wrist; 25. Girth of waist; 26. Girth of buttocks; 27. Girth of shin; 28. Girth of knee; 29. Girth of hip; 30. Girth of ankle-bone; 31. HR after dream; 32. HR at rest; 33. HR after load; 34. Bending down.

Table 3
Model morpho-functional indicators of athletes who specialize in way of swimming butterfly stroke at distance of 100 meters

No	Indicators	Model values
1.	VCL, l	6,51
2.	Length of shoulder, sm	35,11
3.	Width of shoulders, sm	47,33
4.	Width of pelvis, sm	30,94
5.	Girth of shin, sm	38,17
6.	Girth of ankle-bone, sm	24,29
7.	HR (after load), bpm ⁻¹	28,50

Conclusions

1. The result in swimming is closely connected with indicators of anthropometrical development and functional condition of the sportsman.

2. Sportsmen who specialize in swimming in way butterfly stroke at distances of 50, 100 and 200 meters in general have the similar anthropometrical profile. However there are some divergences in values of morpho-functional parameters depending on distance length.

3. Indicators of morpho-functional development of swimmers-delphinists change depending on length of the competitive distance.

4. The definition of distance specialization of the sportsman in

Table 4
Model morpho-functional indicators of sportsmen who specialize in way of swimming butterfly stroke at distance of 200 meters

No	Indicators	Model values
1.	Body length, sm	183,29
2.	Body weight, kg	78,00
3.	VCL, l	6,85
4.	Scope of arms, sm	193,86
5.	Length of shoulder, sm	36,07
6.	Length of foot, sm	28,00
7.	Width of shoulders, sm	47,71
8.	Width of pelvis, sm	31,00
9.	Girth of thorax at rest, sm	100,71
10.	Girth of waist, sm	78,17
11.	Girth of buttocks, sm	95,93
12.	Girth of shin, sm	37,57

way of swimming butterfly stroke has to be based on comparison of its individual characteristics with model most of which fully answer anthropometrical profile of swimmers who successfully perform at distances of 50, 100 and 200 meters.

Prospects of the subsequent researches consist in the definition of degree of correlation interrelation between morpho-functional indicators of the swimmers of high qualification and sports result at distances of 50, 100 and 200 meters in way butterfly stroke.

Conflict of interests. The authors declare that there is no conflict of interests.

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