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The relationship model of technical and tactical and morpho-functional characteristics of highly skilled swimmers specializing in 50 m butterfly

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Purpose: *development of model of the technical and tactical actions, morpho-functional characteristics of highly qualified athletes-swimmers specializing in the 50m butterfly way.*

Material & Methods: *the analytical synthesis of scientific literature data, filming of competitive activity, getting of timing, anthropometry, methods of mathematical statistics.*

Results: *developed model of technical and tactical actions, morphofunctional characteristics of highly qualified swimmers and determined the most important factors affecting athletic performance.*

Conclusions: *the identification and assessment of the most important for the success of sports perfection indicators will allow drawing conclusions about the correctness of the training process according to chosen swimming specialization.*

Keywords: *models of highly skilled swimmers, 50 m butterfly, technical and tactical actions, morphological and functional characteristics.*

Introduction

Practice of sport of the highest achievments in the conditions of intensification of the training and competitive process underwent a number of essential changes in recent years. The increase of level of the competition and the growth of sporting achievements on the international scene in sports swimming shows that the most talented sportsmen, who are adapted for performance of high loadings both on volume, and on intensity, became champions [5; 6].

Training of high-class sportsmen in modern sport is inseparably linked with modeling – the process of development and use of various types of the models reflecting the structure of competitive activity and readiness of sportsmen [5].

Today the significant amount of works is connected with the research of morphofunctional models in the field of sports swimming, determining the level of readiness of sportsmen [1; 2; 7; 8]. A number of works are devoted to modeling of the structure of the competitive activity [3; 5; 6; 9], to consideration of combination of components of the structure of the competitive activity and readiness [4]. In spite of the fact that the large volume of experimental material is stored up in this field of knowledge at the moment, the developed model characteristics became outdated a little for today. Therefore the matter demands addition of scientific knowledge according to the current trends of development of sports swimming. In this regard the development technical and tactical, morphofunctional model characteristics and determination of informative parameters will allow to allocate the most priority criteria, defining achievements of sportsmen in modern swimming. The comparison of individual data of a sportsman to model indicators allows defining the compliance of his opportunities to the requirements dictated by specifics of this or that swimming discipline to reveal reserves of the further improvement of his skill.

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 purpose of the research

The development of model technical and tactical and morphofunctional characteristics of the highly skilled sportsmen-swimmers, specializing in a distance of 50 m by using the way butterfly.

Material and Methods of the research

Methods of the research: analytical synthesis of data of scientific literature, video filming of competitive activity, timekeeping, anthropometry, methods of mathematical statistics.

Data collection was carried out during the educational-training camps. The research was conducted during the championships and Cups of Ukraine on swimming and educational-training camps which were organized by the Federation of swimming of Ukraine (2010–2015). The examined group of sportsmen consisted of the strongest swimmers, members of a national team of Ukraine on swimming (HMS, MSIC, MS), participants of final races at a distance of 50 meters in swimming by using the way butterfly.

Results of the research and their discussion

The analysis of technical and tactical actions of the swimmers, acting at a distance of 50 meters butterfly was carried out with use of the author's computer program Videochronometr (A.s. No. 27884). The technology of the software fixes: time and rate of fungal movements of the sportsman during passing of control pieces of a distance; to calculate automatically speed and «step» of a cycle of fungal movements. Unlike already existing ways of breakdown of competitive distances on various sites [5; 9], we used more detailed method of the accounting of indicators. 6 sites were allocated as the main for the 50-meter pool: starting site where length (m) and speed ($m \cdot s^{-1}$) of overcoming of a piece from a starting table till appearance of the sportsman on a water surface were considered; a piece from "coming up" after start to a mark of 15 m; remote swimming on sites: 15–25 m, 25–35 m, 35–45 m; finishing site of 45–50 m. This approach allows to calculate in more detail individual values of the structure of competitive activity of sportsmen and to reveal reserves of achievement of the planned indicators of the competitive activity.

Processing of video of heats allowed obtaining data on temporary and spatial characteristics of swimmers. These data formed the basis for development of quantitative model of structure of competitive activity of highly skilled swimmers when passing a distance of 50 m butterfly (pic. 1).

The tendency of decrease in indicators of speed, speed and "step" of a cycle of rowing movements as approaching the finish is noted when forming models of the structure of competitive activity of sportsmen. The greatest indicators of rate of movements are observed in the first half of a distance (62,43 $cycle \cdot min^{-1}$) which gradually decrease under the influence of the increasing exhaustion that leads to reduction in the rate of swimming. At the same time sizes of "step" of a cycle of rowing movements of swimmers are rather stable. Therefore, the deduction of optimum sizes of frequency and power of rowing movements in the second half of a 50-meter distance can be a reserve of increase of sports results of swimmers.

The carried-out correlation analysis allowed establishing a number of the interrelations between the main components of competitive activity influencing sports result at swimming by of a 50-meter distance by using the way butterfly (tab. 1).

The highest rates of the return interrelation are established between sports result and the speed shown on remote sites: "coming up – 15 m" (r=–0,91), "15–25 m" (r=–0,86) and "35–45 meters" (r=–0,90). The average level of correlation is revealed between sports result and indicators of speed of swimming on starting (r=–0,62) and finishing (r=–0,69) pieces. High productivity at a distance of 50 m butterfly is shown by those sportsmen who carry out "coming up" more effectively and overcome with higher speed the second half of a distance.

Rather high values of frequency of strokes more influence the level of sporting achievements at a 50-meter distance. The return interrelation is established between sports result at a distance and rate of rowing movements on cyclic pieces: "15–25 m" (r=–0,76), "25–35 m" (r=–0,84), "35–45 m" (r=–0,76).

In turn swimming speed indicators on pieces "start – "coming up" and "15–25 m" correlate with rate of rowing movements on sites: "coming up – 15 m" (r=0,96 and 0,74), "15–25 m" (r=0,95 and 0,97), "25–35 m" (r=0,83 and 0,99), "35–45 m" (r=0,78 and 0,97), "45–50 m" (r=0,89 and 0,76 respectively). Average degree of interrelation is established between swimming speed on a piece of "35–45 m" and rate of movements on a site of "25–35 m" (r=0,70).

On a site "coming up – 15 m" indicators of speed of swimming and "step" of a cycle of rowing movements have the sufficient degree of interrelation (r=0,82). Besides, speed indicators on sites of "35–45 m" and "45–50 m" correlate with the size of "step" on a piece "coming up – 15 m" (r=0,77 and 0,96 respectively). Between speed on a site of "45–50 m" and length of a stroke by a hand on a piece of "15–25 m" the sufficient interrelation (r=0,71) is noted.

Thr comparison of specific features of sportsmen to model technical and tactical characteristics allows to predetermine the content of the training process, especially at the final stages of long-term training of swimmers.

It is known that characteristics of a constitution significantly influence physical working capacity and have the high hereditary conditionality that allows to define prospects of swimmers. Therefore in the course of definition of remote specialization of swimmers the account their individual morhofunctional features is necessary [1; 2; 7].

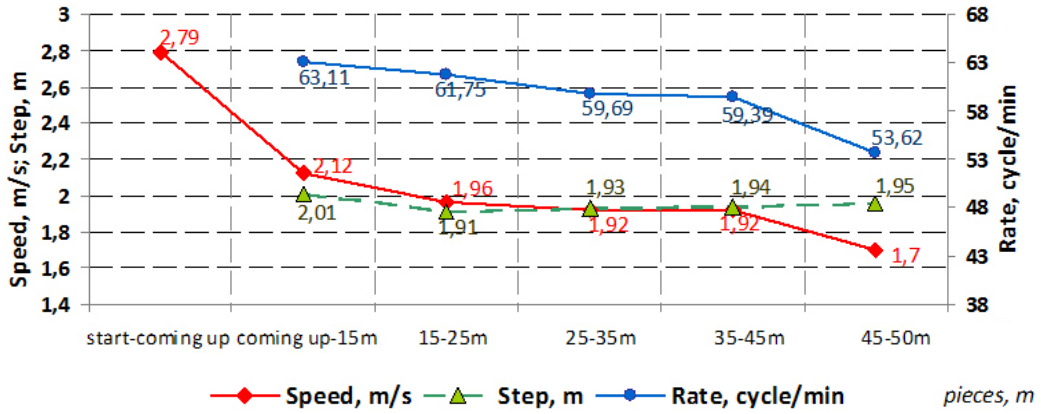
We studied the longitudinal and girth sizes of a body, body weight, LVC, indexes of physical development for the purpose of the development of morphofunctional model characteristics of the strongest swimmers specializing in a distance of 50 m butterfly. 40 parameters were analyzed in total.

The comparative analysis of swimmers sprinters with average model of other swimming specializations [7] showed that they are rather athletic and have high rates of body weight, total and girth sizes of a body, LVC that allows them to perform successfully high-speed and power work in an anaerobic zone of power supply (pic. 2).

The carried-out analysis of the obtained data allowed to define interrelation of sports result with various morphofunctional parameters of the swimmers sprinters who performed at a distance of 50 m butterfly and to allocate the most significant indicators having high coefficient of correlation (pic. 3).

So, it was established that the sports result closely correlates with an index of relative lung vital capacity (RLVC) (r=0,99), and also length of a foot (r=0,98). Average values of interrelation are revealed between time shown at a distance and body proportion indexes: "body length/length of an arm" (r=0,72) and "width of a pelvis/ body length" (r=0,73). The return interrelation of sports result is revealed with: length of a shin (r=–0,98), body length (r=–0,88), hand (r=–0,78), leg (r=–0,77), absolute surface area of a body (r=–0,86), width of shoulders (r=–0,78), girth of a wrist (r=–0,83), shin (r=–0,72), shoulder (weakened) (r=–0,70), indicator of the "width of shoulders/width of a pelvis" index (r=–0,76), and also with the flexibility test "mobility in shoulder joints" (r=–0,69).

Besides, the various degree of interrelation was established between morphofunctional parameters of swimmers and speed of swimming on various sites of a distance.

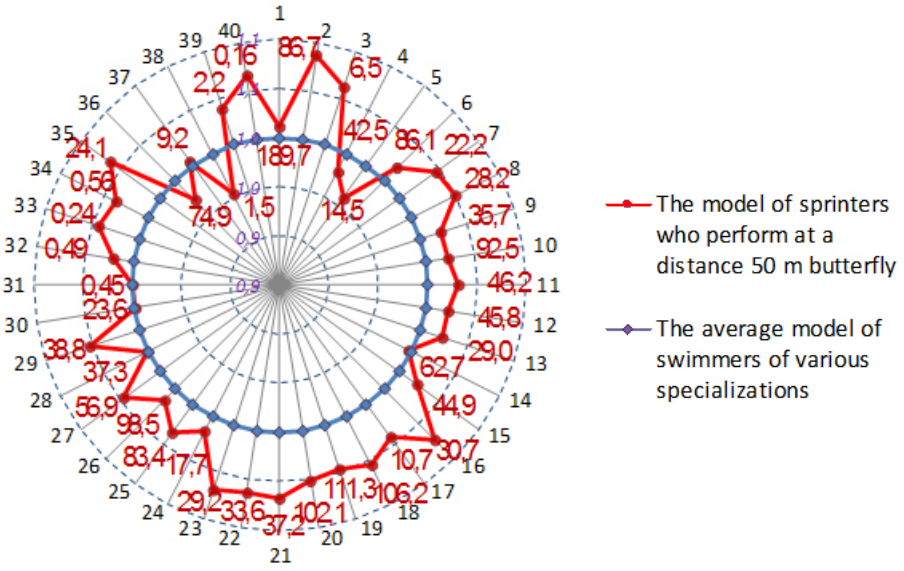


Pic. 1. **Dynamics of indicators of speed of swimming, speed and "step" of a cycle of rowing movements of sportsmen at a distance of 50 meters in swimming by using the way butterfly**

Table 1

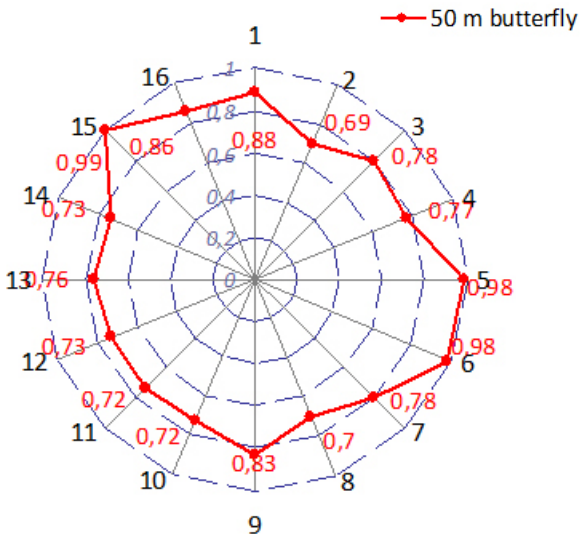
Correlation indicators between sports result and components of competitive activity of swimmers at a distance of 50 m butterfly

Pieces of distance	Speed, m·s^{-1}	Rate, cycle·min^{-1}	Step, m
Starting piece	–0,62	–	–
Outlet– 15 m	–0,91	–0,4	–0,52
15–25 m	–0,86	–0,76	0,01
25–35 m	–0,21	–0,84	0,71
35–45 m	–0,9	–0,76	0,63
45–50 m	–0,69	–0,36	0,09



Pic. 2. **Model morphofunctional characteristics of the high-class swimmers specializing in a distance of 50 m butterfly:**

1 – body length, sm; 2 – body weight, kg; 3 – LVC, l; 4 – mobility in humeral joints, sm; 5 – inclination down, sm; 6 – length of an arm, sm; 7 – length of a hand, sm; 8 - length of a forearm, sm; 9 – length of a shoulder, sm; 10 – length of a leg, sm; 11 – length of a hip, sm; 12 – length of a shin, sm; 13 – length of foot, sm; 14 – length of a trunk, sm; 15 – width of shoulders, sm; 16 – width of a pelvis, sm; 17 – width of a hand, sm; 18 – OT at rest, sm; 19 – OT on a breath, sm; 20 – OT on an exhalation, sm; 21 – girth of a shoulder (intense.), sm; 22 – girth of a shoulder (weakened.) sm; 23 – girth of a forearm, sm; 24 – firth of a wrist, sm; 25 – girth of a waist, sm; 26 – girth of buttocks, sm; 27 – girth of a hip, sm; 28 – girth of a knee, sm; 29 – girth of a shin, sm; 30 – girth of an anklebone, sm; 31 – length of an arm/ body length, sm; 32 – length of a leg/length of a body, sm; 33 – width of shoulders/body length, c.u. 34 – OT/body length, c.u.; 35 – Kettle's index, kg·m^{-1}l; 36 – RLVC, ml·kg^{-1}; 37 – excursion of a thorax, sm; 38 – width of shoulders/width of a pelvis, c.u.; 39 – absolute surface area of a body, ml; 40 – width of a pelvis/ body length, c.u.



Pic. 3. Structure of interrelation of sports result and morphofunctional characteristics of the swimmers specializing in a distance of 50 meters by using the way butterfly:

1. – body length; 2. – mobility in shoulder joints; 3. – length of a hand; 4. – length of a leg; 5. – length of a shin; 6. – length of a foot; 7. – width of shoulders; 8. – girth of a shoulder (weakened); 9. – girth of a wrist; 10. – girth of a shin; 11. – body length/length of an arm; 12. – width of shoulders/body length; 13. – width of shoulders; 14. – width of a pelvis/body length; 15. – RLVC; 16. – Absol. sq.

So, speed on a starting site closely correlates with girth sizes of a body: wrist (r=0,91), knee (r=0,90), shin (r=0,98), and also with length of a shin (r=0,76), indicator of excursion of thorax (r=0,81) and the test "mobility in shoulder joints" (r=0,98). The interrelation is traced between a swimming speed indicator on a site "coming up – 15 m» and body length (r=0,77), length of a hand (r=0,91), leg (r=0,95), shin (r=0,82), width of shoulders (r=0,91), indicator of absolute surface area of a body (r=0,81), the index "width of shoulders/width of a pelvis" (r=0,72) and the test "inclination forward from a standing position" (r=0,70). Swimming speed on a piece of "15–25 m» correlates with a length of a shin (r=0,95), girth of a shin (r=0,94) and wrist (r=0,84), mobility in shoulder joints (r=0,82), the index "width of shoulders/width of a pelvis" (r =0,84). On a piece of "25–35 m» speed of swimming is interconnected with indicators of body weight (r=0,84), length of a forearm (r=0,90), length of a hip (r=0,77), width of a hand (r=0,78), girth of a knee (r=0,90), girth of a thorax (r=0,78), a shoulder (r=0,79), a forearm (r=0,87), buttocks (r=0,78) and mobility in shoulder joints (r=0,73). High degree of correlation is established between swimming speed on a site of "35–45 m» and indicators of length of a hand (r=0,80), length of a leg (r=0,96), length of a shin (r=0,83), width of shoulders (r=0,80), the index "width of shoulders/width of a pelvis" (r=0,85). Swimming speed on a finishing piece has high degree of interrelation with length of a leg (r=0,99), length of a hand (r=0,85), width of shoulders (r=0,85), and also the test "inclination forward from a standing position" (r=0,74).

High degree of interrelation between a mobility indicator in shoulder joints and rate of rowing movements on sites is recorded: "coming up – 15 m" (r=0,90), "15–25 m" (r=0,91), "25–35 m" (r=0,79), "35–45 m" (r=0,71) and "45–50 m" (r=0,78). The indicator of length of a shin correlates with speed on pieces of "15–25 m" (r=0,88), "25–35 m" (r=0,93) and "35–45 m" (r=0,86). Between indicators of girth of a shin and frequency of movements on all sites of a distance high degree of correlation is noted: "coming up – 15 m" (r=0,92), "15–25 m" (r=0,99), "25–35 m" (r=0,93), "35–45 m" (r=0,89) and "45–50 m" (r=0,89). The indicator of excursion of a thorax is interconnected with speed on pieces: "coming up – 15 m" (r=0,92), "15–25 m" (r=0,77), "25–35 m" (r=0,66), "35–45 m" (r=0,70) and "45–50 m" (r=0,98). The "width of shoulders/ width of a pelvis" index correlates with speed on sites of "15–25 m" (r=0,70), "25–35 m" (r=0,86) and "35–45 m" (r=0,90).

The return correlation interrelation is established between indicators of the index "width of shoulders/body length " and frequency of rowing movements on sites: "coming up –15 m" (r=–0,94), "15–25 m" (r=–0,91), "25–35 m" (r=–0,84), "35–45 m" (r=–0,86) and "45–50 m" (r=–0,99). Also the index "width of a pelvis/length body" is connected with speed on pieces: "15–25 m" (r=–0,84), "25–35 m" (r=–0,94), "35–45 m" (r=–0,98) and "45–50 m" (r=–0,70). The index "length of a hand/ body length" correlates with rate of rowing movements on sites: "15–25 m" (r=–0,76), "25–35 m" (r=–0,90) and "35–45 m" (r=–0,94). The girth of a waist has the average level of interrelation with rate of rowing movements on sites: "25–35 m" (r=–0,70), "35–45 m" (r=–0,81) and "45–50 m" (r=–0,73).

In turn, the size of "step" of a cycle of rowing movements on a piece "coming up –15 m" correlate with indicators: length of a leg (r=0,90), length of a hand (r=0,85) and width of shoulders (r=0,85). Indicators of LVC and girth of a waist are interconnected with a length of a stroke on sites of "25–35 m" (r=0,86 and 0,85) and "35–45 m" (r=0,72 and 0,84 respectively). Indicators of the "body length / length of hand "and "girth of a thorax/ body length" index correlate with "step" of a cycle of fungal movements on pieces of "25–35 m" (r=0,99 and 0,95) and "35–45 m" (r=0,88 and 0,75 respectively). Length of rowing movements on a piece of "35–45 m" (r=0,95) and "45–50 m" (r=0,90) has close interrelation with an indicator of the index "width of shoulders/ body length". Besides, sizes the girth sizes of a body of a knee, shin and anklebone have the return degree of interrelation with length of a stroke on various sites of a distance.

Conclusions

1. Model characteristics of technical and tactical and morphofunctional indicators of the swimmers sprinters of high qualification, specializing in a distance of 50 m butterfly were developed and the most significant factors influencing sports result were allocated during the research.

2. Identification and assessment of the level of development of the most significant for successful sports improvement of a circle of indicators will allow making the conclusion about correctness of creation of the training process, about degree of compliance of readiness of the sportsman to requirements of swimming specialization.

Prospects of further researches are connected with the development of model technical and tactical and morphofunctional characteristics of highly skilled swimmers, representatives of other swimming specializations.

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References

1. Bulgakova, N. Zh. 1986, *Otbor i podgotovka yunykh plovtsov* [Selection and preparation of young swimmers], Moscow: Fizkultura i sport, 191 p. (in Russ.)
2. Zakolodnaya, Ye. Ye. 1997, [Type constitution as a factor of specialization and high sports achievements in swimming], *Uchenyye zapiski* [Scientific notes], Minsk: Chetyre chetverti, Vol. 1, pp. 117–126. (in Russ.)
3. Kleshnev, V. V. 2005, [Speed ratio analysis method, tempo and pitch when the locomotion in water], *Plavaniye* [Swimming], SPb.: Plavin, T. 3, pp. 74–78. (in Russ.)
4. Komotskiy, V. M. *Vzaimosvyaz struktury sorevnovatelnoy deyatelnosti i podgotovlennosti vysokokvalifitsirovannykh plovtsov-sprinterov*: avtoref. dis. na soiskaniye nauch. stepeni kand. ped. nauk [The relationship structure of competitive activity and readiness of highly skilled swimmers-sprinters: PhD thesis], Kyiv: KGIFK, 1986, 24 p. (in Russ.)
5. Platonov, V. N. 2011, *Sportivnoye plavaniye: put k uspekhu* [Sport swimming: the path to success], Kiyev: Olimpiyskaya literatura, pp. 452–467. (in Russ.)
6. Politko, Ye. V. 2014, [Modelling of competitive activity as the basis of individualization preparation of sportsmen-swimmers], *Fizichna kultura, sport ta zdorov'ya : materiali XIV Mizhnarodnoi naukovo-praktichnoi konferentsii «Fizichna kultura, sport ta zdorov'ya», (Kharkiv, 10–12 grudnya 2014 r.)* [Physical education, sports and health materials XIV International Scientific Conference ["Physical education, sport and health"] (Kharkiv, 10–12 December 2014)], Kharkiv: KhDAFK, 127–130 p. (in Russ.)
7. Politko, Ye. V. 2013, [Modern trends in the model of morpho-functional characteristics of elite athletes-swimmers], *Visnik Chernigivskogo natsionalnogo pedagogichnogo universitetu im. T. G. Shevchenka* [Bulletin of the Chernihiv National Pedagogical University Taras Shevchenko], Chernigiv: ChNPU, No 112, T. 4, pp. 84–188. (in Russ.)
8. Popov, O. & Partyka, L. 2001, [The evolution of technology training, morphological profile of the strongest swimmers and world records in sports swimming during the XX century], *Nauka v olimpiyskom sporte* [Science in the Olympic sport], Kyiv: Olimpiyskaya literatura, No 1, pp. 43–48. (in Russ.)
9. Sanosyan, Kh. A. 2009, [On the question of improvement of methodology of technical and tactical training swimmer], *Plavaniye* [Swimming], SPb.: Plavin, T. 5, pp. 43–46. (in Russ.)

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