

Differentiated Methodology of Training Long-Distance Swimmers for Competitions on Open Water Taking into Account Types of Energetic Metabolism

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Abstract—The article describes the questions of the training process quality improvement on the basis of training long-distance swimmers differentiated methodology taking into account types of athletes' energetic metabolism. As a result of the research work it was revealed that among the athletes, who have aerobic type of energetic metabolism, tempo endurance should be developed by means of standard-continuous exercise method and their speed endurance should be developed by the repetitive method of training. Athletes, who have anaerobic type of energetic metabolism, can develop their tempo endurance by means of interval exercise method and their speed endurance by means of unlimited efforts method with normative quantity of distance parts repetitions. Among the athletes, who have mixed type of energetic metabolism tempo endurance should be developed by means of alternant method of training and speed endurance by means of combining repetitive method and unlimited efforts method with the fixed quantity of distance parts repetitions.

Keywords—*swimming on open water; muscular activity energetic support; types of energetic metabolism; special-preparatory stage of swimmer's training.*

I. INTRODUCTION

Competitive activity of long-distance swimmers in open water places great demands on the level of their physical readiness [2]. The base of the specialized training for long distance swimming races forms special endurance development in overcoming the distance on water surface with high wave disturbance and not stable temperature regime [2]. The effectiveness of this physical quality development is determined by a purposeful influence on the athlete's organism by means on the basis of the energy production mechanisms type energetic metabolism [1, 3].

Sufficient amount of research works, concerning this problem, only indirectly discuss the questions of energy supply peculiarities in muscular activity of long-distance

swimmers. This contradiction doesn't let us use special endurance development means and methods differentially in long-distance swimming [4]. The methods of special endurance development among swimmers in open water are not fully used. They are differentiated relative to typology of athletes' energetic metabolism.

The aim of the research is to reveal the effectiveness of athletes' specialized training methodologies in swimming on open water taking into account the types of energetic metabolism.

II. RESEARCH METHODOLOGY

18 athletes-masters of sport, who specialize in open water swimming at 5 and 25 km distance, took part in the research. The age range of the respondents was 17-20 years old. For the created variants of training testing 4 groups of athletes were formed depending on the type of energetic metabolism: aerobic type, anaerobic type, mixed type, not taking into consideration energy supply of the work. The duration of the experiment was 6 weeks of special-preparatory period of training. Means and methods of specialized training for each group of athletes were created taking into consideration the characteristics of muscular activity energy supply mechanism. In order to substantiate the model of training swimmers comparative analysis of athletes' functional abilities was held in different groups, differentiated according to the type of energetic metabolism.

For the research objectives realization the method of functional state and athletes' reserve capacities express-diagnostics (S.A. Dushanin, 1998) D&K-Test was used. As a result of the program algorithms functioning we defined the type of each athlete energetic metabolism on the basis of the character and height of electrocardiogram R- and S-waves analysis. Electrocardiogram was made in 3 main, 3 increasing and 6 chest leads. The received results helped to calculate the following indices.

Capacity of anaerobic energy supply (CANSE) characterizes the ability to fulfill the load in the 3rd, 4th and the 5th zones of intensity.

Anaerobic recycling capacity index (ANDT) characterizes athletes' propensity for anaerobic work (in percentage).

Capacity of energy supply (CASE) aerobic source index characterizes the ability to fulfill the load in the 1st and the 2nd zones of intensity.

The index of aerobic recycling capacity (ADT) characterizes athletes' propensity for aerobic work (in percentage).

General metabolic capacity index (TMC) characterizes general working capacity of an organism.

The index of creatine phosphate energy supply power (PCPES) characterizes speed qualities of swimmers.

The index of glycolytic energy supply power (GPC) characterizes speed endurance of swimmers.

The index of aerobic energy supply power (PAE) characterizes the ability to demonstrate general endurance and also to rehabilitate oneself after anaerobic work.

The index of anaerobic metabolism threshold (AMT) characterizes the effectiveness of aerobic energy supply mechanisms use.

The effectiveness of the training process control was achieved owing to special training methodologies differentiation among long-distance swimmers depending on the characteristics of energy supply of their muscular activity.

Tempo endurance of aerobic type swimmers developed by means of continuous long-term exercise method, speed endurance by means of repetitive method of training.

Among athletes with anaerobic type of energy metabolism tempo endurance developed by means of interval exercise method, speed endurance by means of submaximal loads with the fixed amount of the swum parts repetitions.

Swimmers with the mixed type of energetic metabolism developed their tempo endurance by means of alternating method of training and speed endurance by means of repetitive method and unlimited efforts method combination with the fixed amount of distance parts repetitions.

For the control group of long-distance swimmers standard means and methods of tempo and speed endurance development were used.

The load for long-distance swimmers was chosen taking into account current result in 400 meters swimming (table I) and 1500 meters swimming (table II). The number of repetitions of the parts that an athlete swims and weekly volume of the training load were selected taking into account the level of athletes' functional state. For special training control the system of training process control created by G.G. Turetskiy (2000) was used. It included power testing at a special bench, lactate profile determination, Skin fold test and blood profile analysis. The system was used for training

program planning among swimmers taking into account heart rate and the tempo of energetic metabolism.

TABLE I. MAIN PARAMETERS OF LONG-DISTANCE SWIMMERS' LOAD AT A SPECIAL-PREPARATORY STAGE OF TRAINING FOR COMPETITIONS (6 WEEKS)

Parameters of the load	The groups of respondents according to the type of energetic metabolism			
	Aerobic type	Anaerobic type	Mixed type	Without taking into account the type of metabolism
Daily volume of swimming, km	18-20	12-16	16-18	16-18
Weekly volume of swimming, km	116-120	72-96	96-116	96-116
Number of the training lessons a week	12	12	12	12
The main training task	6 x 800 m; 4 x 2500 m	4 x (5 x 400 m); 6 x 1000 m	3 x (2 x 800 m) 4 x 2000 m	8 x 1000 m; 2 x 5000 m
Method of training	Proportional, repeated	Interval, submaximal loads	Alternating, unlimited efforts	Proportional, repeated, interval

III. RESULTS

As a result of the research works there were revealed differences in the dynamics of specialized tests indices depending on the types of long-distance swimmers energetic metabolism (table II, III).

TABLE II. DYNAMICS OF RESULTS IN 400 METERS SWIMMING AMONG LONG-DISTANCE SWIMMERS OF DIFFERENT ENERGETIC METABOLISM TYPES (C)

Period of testing at a special-preparatory stage of training	The groups of respondents according to the type of energetic metabolism			
	Aerobic type	Anaerobic type	Mixed type	Without taking into account types of metabolism
The beginning of the stage	309,8±5,4	319,4±4,8	315,0±10,7	310,8±8,6
The end of the stage	291,8±3,5	302,8±6,3	302,4±12,3	296,1±5,8

In 400 meters swimming athletes of aerobic type energetic metabolism showed time results improvement for 17,9 seconds, the results increase was 5,8 % ($P < 0,05$). Long-distance swimmers with the mixed type of energetic metabolism improved their result for 12,6 seconds, the increase was 4,0 % ($P < 0,05$). The groups of anaerobic energetic metabolism type showed time index improvement for 16,6 seconds, the increase was 5,2 % ($P < 0,05$). The average time improvement in this test among the group of swimmers without taking into account type of energetic

metabolism was 10,8 seconds. It corresponds with the increase for 3,5 % ($P < 0,01$).

TABLE III. THE RESULTS DYNAMICS IN 1500 METERS SWIMMING AMONG LONG-DISTANCE SWIMMERS OF DIFFERENT ENERGETIC METABOLISM TYPES (SECONDS)

Period of testing at a special-preparatory stage of training	The groups of respondents according to the type of energetic metabolism			
	Aerobic type	Anaerobic type	Mixed type	Without taking into account type of metabolism
The beginning of the stage	1155,4±18,4	1214,6±11,8	1203,3±16,8	1157,7±20,2
The end of the stage	1098,4±11,6	1156,9±22,2	1148,8±14,5	1118,8±21,4

In 1500 meters swimming the athletes with aerobic type of energetic metabolism improved the average time of distance overcoming for 56,6 seconds, the increase was 4,9 % ($P < 0,05$). The swimmers with the mixed type of energetic metabolism showed time indices decrease for 54,1 seconds, the increase was 4,5 % ($P < 0,05$). The respondents with anaerobic type of energetic metabolism improved the average result for 58,6 seconds, the increase was 4,7 %. The average time decrease in this test among the athletes from the group without taking into account the type of energetic metabolism was 38,5 seconds, which corresponds with 3,3 % ($P < 0,01$) increase.

Table 4 presents the results of estimating functional and reserve capacities of athletes' organism before and after special-preparatory stage of training long-distance swimmers.

TABLE IV. FUNCTIONAL AND RESERVE CAPACITIES DYNAMICS OF LONG-DISTANCE SWIMMERS AS A RESULT OF SPECIAL-PREPARATORY STAGE OF TRAINING

Period of testing	The groups of respondents according to the type of energetic metabolism			
	Aerobic type	Mixed type	Anaerobic type	Without taking into account type of metabolism
<i>Anaerobic metabolic capacity (CANSE), c.u.</i>				
before	45,42±13,68	71,07±6,9	124,65±8,96	76,12±34,63
after	48,96±11,23	76,9±4,89	136,1±11,32	82,52±9,15
t	0,62	2,19*	2,44*	0,84
<i>Aerobic metabolic capacity (CASE), c.u.</i>				
before	240,1±21,36	229,5±17,63	204,41±21,69	226,65±29,49
after	260±18,13	249,5±13,68	218,92±18,67	244,85±16,83
t	2,22*	2,89*	1,38	2,50*
<i>General metabolic capacity (TMC), c.u.</i>				
before	285,5±12,3	300,6±21,42	329,06±22,18	302,78±34,07
after	308,52±14,38	326,4±19,22	355±23,01	327,65±18,87
t	4,10**	2,98**	2,34*	2,98**
<i>Power of creatine phosphate energy supply (PCPES), c.u.</i>				
before	31,54±2,35	29,55±1,95	38,75±2,26	32,64±5,93
after	34,79±2,167	32,03±2,19	41,93±2,12	35,57±2,16
t	3,23**	2,96**	2,86*	2,17*
<i>Power of glycolytic source of energy supply (GPS), c.u.</i>				

before	31,60±2,65	29,52±2,47	33,5±2,03	31,28±3,19
after	34,35±2,76	31,94±2,03	35,77±1,58	33,75±2,12
t	2,35*	2,47*	2,35*	3,00**
<i>Power of aerobic source of energy supply (PAE), c.u.</i>				
before	57,48±4,43	52,12±5,80	46,39±4,03	51,62±10,60
after	62,25±3,22	56,03±6,13	51,63±4,34	56,28±8,96
t	2,63*	1,60	2,57*	1,56

Notes: **- $P < 0,01$; *- $P < 0,05$

Thus, as a result of the differentiated methodology of training use among long-distance swimmers we revealed valid increase of the organism functional and reserve capacities. It also should be noted that in terms of no valid CANSE and PAE indices increase in the group of athletes without taking into account type of energetic metabolism, there was valid increase of these indices in the groups of the mixed and anaerobic types of energetic metabolism. The received results help to come to understand the effectiveness of the differentiated methodology of training long-distance swimmers for swimming on open water taking into account the types of energetic metabolism.

IV. CONCLUSION

As a result of special-preparatory stage of training realization for the competitions among long-distance swimmers with different types of energetic metabolism different reaction of an organism to the training load was stated. The athletes with anaerobic and mixed type of energetic metabolism quicker adapt to speed-power work and swimmers with aerobic type of energetic metabolism – to a long-term work for endurance. It proves that taking into account the typology of long-distance swimmers energetic metabolism can be the base for means and methods of training determination among athletes in swimming on open water.

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