Swimmers' Training Process Control Taking into Consideration Typology of Bioenergetics

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Abstract: The research deals with the specific characteristics of swimmers' training management taking into account typologies of bioenergetics. For an effective and quick functional state and reserve capacities of athletes' organism diagnostics we held the test according to "D&K – TEST" express-diagnostics methodology created by Karlenko V.D. We created a block system of swimmers' sports training control. The block system includes the stages and the main components of management structure, where great attention is paid to information gathering concerning swimmers' functional training taking into account their typology of bioenergetics. We studied the ratio of swimmers' bioenergetics typology at the training stage according to the years of study. We estimated the level of functional state and swimmers' organism reserve capacities depending on their bioenergetics type. Specially selected training means and methods for swimmers were used in accordance with their typology of bioenergetics and it provided their physical readiness improvement, characterizing the effectiveness of competitive activity. We received the results of swimmers' functional state and reserve capacities of their organism, combined according to three types: aerobic, mixed and anaerobic.

1 INTRODUCTION

It is supposed that at a current stage of swimming development progressive changes of achievements in competitive activity should be connected with timely methods, means and methodical approaches change in training in macro-, meso-, microstructures. New methodologies and approaches effective introduction into swimmers' training process at a training stage can be provided by objective information about the level of their functional readiness and taking into account their typology of bioenergetics. This approach influences directly the effectiveness of competitive activity and a progress of functional readiness increase in swimmers in dynamics.

2 ORGANIZATION AND RESEARCH METHODS

The research was held on the basis of the specialized sports swimming school of the Olympic reserve in Izhevsk (Republic of Udmurtia, Russia). The swimmers of the initial training group and the training group according to the years of studying took part in the research. For an effective and quick functional state and athletes' reserve capacities diagnostics we used "D&K – TEST" express-diagnostics. Karlenko V.P. (Vanyushin Yu.S. and Sitdikov F.G., 2001, Karlenko V.P. and Karlenko N.V., 2003) offers to use the method of bioenergetic monitoring. It is based on the analysis of electrocardiogram of R and S waves.

This method helps to estimate the most important parameters of aerobic and anaerobic energetic metabolism without any load tests and get information about an athlete's state and his functional and reserve capacities (Karlenko V.P. and Karlenko N.V., 2003, Karlenko V.P. and Karlenko N.V., 2008)

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2.1 Participants

76 swimmers of the initial and training stage sports training (initial training of the 1st and the 2nd year of study n=30 people; the training group according to the years of training TG-1 n=10 people; TG-2 n= 12 people; TG-3 n =12 people; TG-4 n=10 people) took part in the research. All swimmers were effective and went in for swimming at a sports school. Sampling decreased during the process of study because some athletes took part in the competitions.

2.2 Instruments

For a functional state and reserve capacities of athletes' organism study we used "D&K – TEST" express-diagnostics [2.3.4]. This method helps to estimate the most important parameters of aerobic and anaerobic energetic metabolism without any load tests and get information about an athlete's state and his functional and reserve capacities (Karlenko V.P. and Karlenko N.V., 2003, Karlenko V.P. and Karlenko N.V., 2008).

2.3 Data Acquisition

The research results were received on the basis of the specialized sports swimming school of the Olympic reserve in Izhevsk (Republic of Udmurtia, Russia), during the following period: September, 2017 till May, 2018 in terms of scientific-research work of the author. Swimmers, who took part in functional state monitoring according to "D&K – TEST" express-diagnostics, were explained the procedure of the following indices study beforehand: anaerobic metabolic capacity; anaerobic utilization capacity; aerobic metabolic capacity; aerobic utilization capacity; general metabolic capacity; power of creatine phosphate source of energy-supply; power of glycolytic source of energy-supply; power of aerobic source of energy-supply; anaerobic metabolism threshold; heart rate at anaerobic metabolism threshold; general energetic stock.

2.4 Statistical Analysis

For the received results handling we used mathematical statistics on computer using SPSS-22 statistical package, Microsoft Excel electronic table.

3 RESULTS ANS DISCUSSION

In terms of global changes in the sphere of sports activity, which happen under the influence of technical progress, competitions conditions and swimmers' training change demands a long-term sports training study as the process of athletes' training and readiness control.

According to the results of preliminary research works we gathered research material, which demands to reconsider the process of swimmers' training control in the macro cycle of training.

Management process realization demands to widen the process of training and athletes' readiness control (Vanyushin Yu.S. and Sitdikov F.G., 2001, Mishchenko V.S., 2005, Moshkina N.A., 2019, Petrov R.E., Mutaeva I.S., Ionov A.A., 2018).

The base of training process planning is this process control. Management considers not only the questions of training control, but also the leverage of control improvement. It helps to introduce innovative methods of training.

3.1 Training Stage Swimmers' Training Process Control Taking into Account the Typology of Bioenergetics

The held analysis of swimmers' readiness at the initial and training stages according to the years of study, the training program and the methodical peculiarities of their realization analysis provided block-scheme of swimmers' training process control creation taking into account their typology of bioenergetics. It is a relevant adjunct to swimmers' competitive activity effectiveness increase [Machado L., Almeida M., Morais P., Faria V., Colaco P. and Ascensao A., 2006, Toubekis A., Tsami A. and Tokmakidis S, 2006)

We created a block system of swimmers' training control taking into account typology of bioenergetics in a yearly cycle.

The block-scheme included the stages and components. They characterized the level of control over swimmers' training process at a training stage. We took into account typological bioenergetics. It was mentioned that the plan of training swimmers at a training stage provides etalon competitive activity indices consideration. It shows the aim of the training process, which includes all indices and their achieved level taking into consideration typology of bioenergetics (training process and readiness monitoring).

One of the most important demands of modern system of training swimmers is all components of effective competitive activity consideration Fernandes R.J., Cardoso C.S., Soares S.M.,

Ascensao A.A., Colaco P.J. and Vilas-Boas J.P.,2011, Hay J., 1987, Heberstreit H., Beneke R., 2011). Swimmers' competitive activity studying helps to receive objective information about the degree of readiness in terms of competitions and to reveal the factors, which influence sports result. Further it helps to create the models of competitions and tactics of swimming races organization and timely correct training means.

A typical characteristic of swimmers' competitive activity is the opportunity to define strictly the number and succession, tempo of the fulfilled motor actions. It depends on sports-technical mastery of swimmers. Another important part of management block system is functional components of training and swimmers' readiness optimization (Kuznetsov A., Mutaeva I. and Kuznetsova Z., 2017, Kuznetsova Z., Kuznetsov A., Mutaeva I., Khalikov G. and Zakharova A., 2016).

Swimmers' typology of bioenergetics taking into account, especially at a practice stage of training, helps to increase the effectiveness of control over training process and swimmers' readiness.

3.2 Swimmers' Bioenergetics Typology Monitoring

To date, there are no methodical approaches of swimmers' typological bioenergetics use in training process control. In spite of the fact that many specialists study athletes' functional state, there is no methodology, which is created taking into account athletes' bioenergetic type (Karlenko V.P. and Karlenko N.V., 2008). "D&K – TEST" express-diagnostics determines program affiliation to bioenergetic groups.

The block-scheme of swimmers' training process control is presented as an integral activity. It includes the whole process of the training and competitive loads realization taking into account swimmers' typological bioenergetics.

For this purpose, it is important to realize control over functional readiness of swimmers taking into account their typology of bioenergetics.

Pictures 1,2,3,4 present percentage of different swimmers' bioenergetics typology ratio in the training groups of the 1st, 2nd, 3rd and the 4th years of study.

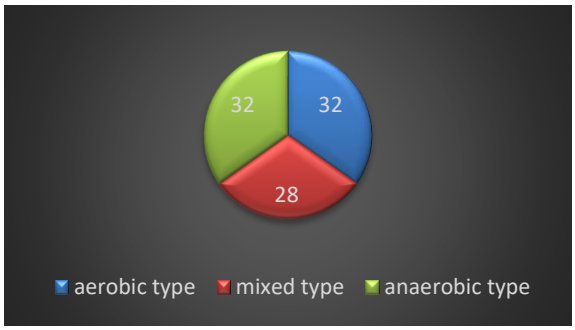

Figure 1: Percentage ratio of swimmers TG 1 bioenergy types.

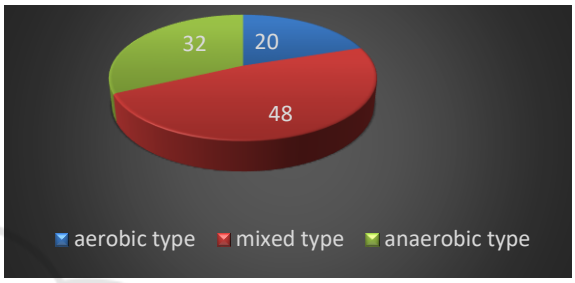

Figure 2: Percent ratio of swimmers TG 2 bioenergy types.

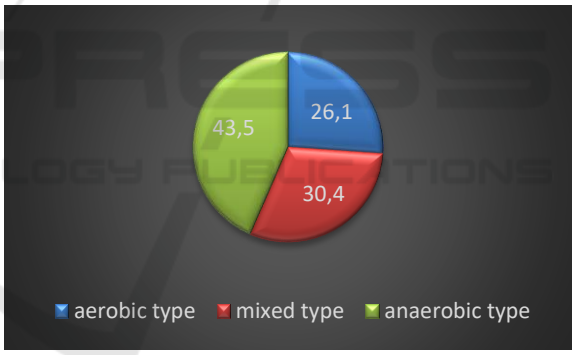

Figure 3: Percentage ratio of swimmers TG 3 bioenergy types.

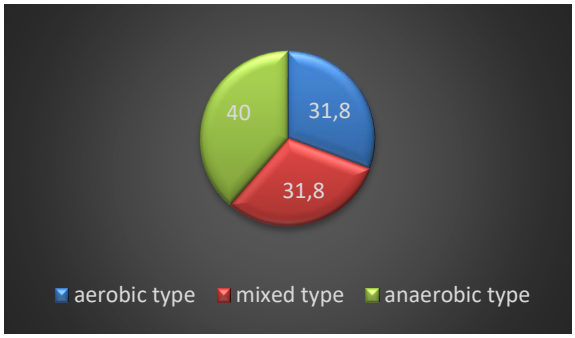

Figure 4: Percent ratio of swimmers TG 4 bioenergy types.

We defined all types of bioenergetics. Taking into account their typology, we created the training program of training swimmers. The aim of this program is to realize the training means taking into account the advantages and disadvantages of muscle activity energy-supply mechanisms. In each training group, in our example, we realized the means, directed toward the leading mechanisms of bioenergetics development.

3.3 Functional State and Reserve Capacities of an Organism among Swimmers Taking into Account Typology of Bioenergetics

The main component of the training program was swimmers' typology of bioenergetics and their functional state determination.

Table 1 shows functional state and reserve capacities indices of swimmers' organism taking into account their typology of bioenergetics.

Table 1: Functional state and reserve capacities of an organism taking into account typology of bioenergetics.

Groups	50 m	ANAMC	AMC	GMC	PCP	PGL	MOC	HR at TANM	dGEF
Aerobic type									
IT-2	41,92	113,33	222,24	335,57	38,23	32,05	58,66	155,34	193,57
IT-1	50,34	142,45	250,14	392,59	39,54	42,78	67,16	171,11	210,64
TG-1	40,78	107,32	255,6	362,92	35,76	32,91	67,41	167,19	202,95
TG -2	37,4	120,02	208,29	329,3	41,64	36,9	56,19	153,42	194,96
TG -3	31,53	84,3	168,79	253,09	29,32	32,54	54,76	149,47	178,79
TG -4	30,24	112,04	207,78	319,82	33,17	34,44	57,46	154,88	188,04
Mixed type									
IT-1	58,19	70,49	197,96	268,45	32,2	30,85	57,77	153,81	186,01
IT-2	42,36	85,36	254,14	339,51	32,48	28,23	67,04	166,12	179,87
TG -1	38,51	94,72	257,45	352,18	32,46	32,21	67,84	167,89	200,35
TG -2	34,01	83,47	234,4	317,88	32,67	29,34	63,57	161,34	194
TG -3	31,88	79,85	215,96	295,82	30,28	32,31	58,82	155,45	185,72
TG -4	29,48	61,98	208,15	270,13	33,82	30,81	55,13	149,84	183,65
Anaerobic type									
IT-1	48,05	41,42	251,33	292,75	29,33	30,85	66,36	165,45	194,78
IT-2	41,7	42,16	224,23	266,39	31,26	29,74	62,26	159,67	190,93
TG -1	37,2	66,73	291,41	358,14	24,8	28,34	73,55	174,07	198,88
TG -2	33,29	41,27	243,75	285,01	33,58	30,44	64,45	162,74	196,32
TG -3	30,96	44,96	288,97	333,93	31,07	31,1	71,64	172,48	203,55
TG -4	28,36	34,33	256,51	290,83	30,33	32,15	65,62	164,89	195,22

Notes: IT- initial training; TG- training groups according to years of study; ANAMC – anaerobic metabolic capacity; AMC-aerobic metabolic capacity; GMC - general metabolic capacity; PCP - power of creatine phosphate source of energy-supply; PGL - power of glycolytic source of energy-supply; PASE - power of aerobic source of energy-supply; Wtanm - threshold of anaerobic

metabolism; HRtanm - heart rate at threshold of anaerobic metabolism; dGEF - general energetic fund

Table 1 shows that fundamental state and reserve capacities indices study among swimmers taking into account typology of bioenergetics helps to estimate the level of readiness. It is mentioned that 50 meters swimming results are better among swimmers of anaerobic type. It is characterized by the fact that during training at short distances we have general energy fund stabilization. During systematic means use, which are directed toward speed qualities development, there is muscle activity anaerobic energy sources of energy-supply optimization.

Special physical readiness tests analysis among swimmers helped to reveal that in 50 meters swimming the best result showed "anaerobic type" swimmers. According to the stages of training we had the following results: IT-1 - 48,05±1,66 sec.; IT-2 - 41,7±1,56 sec.; TG-1 - 37,2±1,43 sec.; TG -2 -33,29±1,42 sec. ; TG -3 - 30,96±1,67 sec.; TG-4 - 28,36±1,68 sec.. "Mixed type" type swimmers showed the following results according to the stages of training: IT-1 - 58,19±1,48 sec.; IT-2 - 42,36±1,23 sec.; TG -1 - 38,51±1,56 sec.; TG -2 -34,01±1,47 sec. ; TG -3 31,88±1,67 sec.; TG-4 - 29,48±1,70 sec..

"Aerobic type" swimmers showed the following results: IT-1 - 50,34±1,23 sec.; IT-2 - 41,92±1,56 sec.; TG -1 - 40,78±1,47 sec.; TG -2 -37,4±1,34 sec.; TG -3 - 31,53±1,69 sec.; TG-4 - 30,24±1,60 sec..

"Anaerobic type" swimmers show the best time of 400 meters distance swimming (289,1 ±4,sec.), "mixed type" swimmers and "aerobic type" swimmers show the following time: 302,3 ±13,32 sec. and 303,50 ±12,20 sec.

In 800 meters swimming the results are the following: "anaerobic type" swimmers- 600±9,14 sec., "aerobic type" swimmers- 628±29,18 sec., "mixed type" swimmers-621±22,02 sec..

In 3000 meters swimming the results were the following: the best results among "anaerobic type" swimmers - 2400 ±71,94 sec., "aerobic type" swimmers - 2458 ±51,37 sec., "mixed type" swimmers - 2463 ±99,24 sec.. During special physical readiness testing "anaerobic type" swimmers overcome the distances quicker, than "aerobic type" and "mixed type" swimmers.

A purposeful use of the training means, directed toward swimmers' endurance development, provide indices improvement in test exercises among anaerobic type swimmers. It means that training process management owing to functional state and reserve capacities level diagnostics provides an effective adaptation of muscle activity and physical working capacity change during after activity period (Karlenko V.P. and Karlenko N.V., 2003).

General metabolic capacity (GMC) indices use defines the volume of aerobic (AMC) and anaerobic (ANAMC) metabolic changes during muscle work among swimmers with the intensity at the level of aerobic productivity. This index characterizes the definite level of working capacity among athletes during the training lessons, directed toward endurance development. The indices, which reflect the level of general metabolic capacity, increase by 220%, which is the important index during swimmers' training process planning. A positive and a long-term dynamics increase of general metabolic capacity index among swimmers in all bioenergetic types shows considerable effectiveness of training and competitive means planning and use.

Power of creatine phosphate source of energy-supply (PCP) is the quickest source of energy, used by muscle cells from muscular contractions beginning. This source of energy-supply is characterized by maximum possible movements frequency. In terms of this power work total oxygen demand is not big, but oxygen demand within the time unit is considerably bigger. That is why the work in this power is also called anaerobic, because oxygen is not used in adenosine triphosphate (ATP) resynthesis and laclate is not produced. These indices of power of creatine phosphate source of energy-supply show the effectiveness of means and methods use in the training process during power, plosive and speed-power abilities development (Karlenko V.P. and Karlenko N.V., 2003, Karlenko V.P. and Karlenko N.V., 2008). With the help of this index we estimate the effectiveness of means and methods use during the definite period of training while speed endurance developing.

The effectiveness and efficiency of aerobic source of energy-supply use is determined by the following indices: threshold of anaerobic metabolism (Wtanm) and heart rate at threshold of anaerobic metabolism (HRtanm). Anaerobic threshold characterizes the training level of an organism and interaction between aerobic and anaerobic ways of physical load energy-supply. Anaerobic threshold defines the quality and effectiveness of aerobic system use. The higher anaerobic threshold is the higher is an athlete's training level.

The most informative character of anaerobic threshold determination is HR TANM. Heart rate at

TANM level shows athletes, who go in for cyclic kinds of sport, the level of their aerobic abilities. Most authors call HR TANM the most effective estimation during training loads intensity planning, as according to HR TANM we can define the limit of transfer between aerobic and anaerobic processes. The higher HR TANM is, the higher training intensity can be kept by the definite athlete. In this connection if we know HR TANM we can distribute more effectively intensity zones of the training loads.

4 CONCLUSIONS

Functional readiness of an organism mainly depends on the ability to mobilize, realize effectiveness and the ability of energy systems to recover. However, one of the main indices of an athlete's functional readiness is the character of rehabilitation processes. According to the research works based on this methodology (Karlenko V.P. and Karlenko N.V., 2003, Karlenko V.P. and Karlenko N.V., 2008) we made the following conclusions: aerobic and anaerobic genotype of athletes' organism of different age groups and specializations do not change during a long-term period and are determined by a metabolic genotype.

In terms of this training and competitive training means planning in swimmers, taking into account their typology of bioenergetics would provide competitive activity effectiveness increase. In our example we showed the effectiveness of taking into account swimmers' typology, where anaerobic type during training tasks planning and control, taking into consideration their typology and functional state and reserve capacities, would provide functional readiness optimization and different sources of energy-supply realization during training. Training means distribution taking into account 5 zones of intensity provide swimmers' health strengthening and preservation.

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