SECTION III. BIOLOGY

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The efficiency evaluation of the endurance development methodology for middle-distance and long-distance runners with account of lactate level monitoring

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Abstract

The article deals with implementation phases and the content of methodology of combining aerobic and anaerobic-oriented means at the training exercises of track and field athletics. The findings of the time indices of covering the fractions of distance in the training days during the whole preparation period with loads at the aerobic threshold level have been presented. The feasibility of the tested methodology of using aerobic running loads in the training process of track athletes with account of monitoring the lactate level has been demonstrated.

Key words: training process, endurance, running, lactate, capacity, physical qualities, body, sports result.

Introduction. Athletic training is a long process, one of the most important purposes of which is achieving the high level of physical training and fitness and developing motional qualities of the athletes. Depending on sports specialization the training process can be focused on developing the physical qualities, on which the sports result depends most of all. For example, in such sports as skiing, middle-distance and long-distance running, the most important physical quality is endurance. In sprint races, jumping, throwing it is a combination of strength and speed qualities. The up-to-date athletic training implies the integration of general and specialized physical conditioning. Its efficiency depends to a great extent on the correlation of volumes, means and methods of general and specialized physical training with account of individual differences of athletes. In this regard the issues of interrelation between physical qualities and control of their development are especially important. Besides, it is essential to know how the increase of one motional quality level influences the others [1].

Endurance in sports means the ability of the body to resist fatigue during the long performance of sports exercises. The level of endurance development is determined, first of all, by the functional capacity of heart-vascular and nervous systems, the level of metabolic processes and the coordination of various organs and systems functioning [9]. An essential role is played by the economization of the body's functions. The endurance is also influenced by the coordination of motion and the strength of mental and volitional processes of an athlete. Endurance can be also defined as the ability to perform a specified type of work as long as possible. One of the main criteria of endurance is the time period, during which a person can maintain the specified intensity of work.

The biological basis of the general endurance is the aerobic capacities of the athlete's body. The key indicator of utilizing the aerobic capacities is the maximal oxygen consumption (MOC) in liters per minute and the anaerobic exchange threshold (ANET) [6].

In the training of athletes, specializing in middle-distance and long-distance running, there is rather a wide range of different types of exercise loads, which cause various adaptive shifts in body functioning; the main criterion for classifying training loads in running is the speed of running [3].

The specifics of each method of running training consist, first of all, in the running speed, which reflects the correlation of anaerobic and aerobic systems of energy supply. This correlation determines the direction and quantitative characteristics of physiological changes in the body. Each of the training methods (continuous, repetitive and intervallic), in spite of their successfulness in a certain period, is only a prevailing paradigm in the training process, and the physical preparation of each athlete must include not only the implementation of this or that method of training, but its adaptation to each one's peculiarities [8].

The purpose of research is studying the functional fitness and the aerobic endurance level of athletes with high-level functional vigor by the repetitive training method.

Methods. On the basis of analyzing literature sources, to achieve the stated objective, in the preparation period of 2016 a research was carried out, in which 3 masters of sports of Russia in track and field athletics in middle-distance and long-distance running took part. The volume and intensity of the running work was adjusted with account of lactate indices. The main criterion of evaluating the qualitative and quantitative changes of the athletes' functional fitness was the speed of running, which was expressed in the time of covering a certain distance.

Results and discussion. The theoretical analysis of the professional literature has shown that to organize the training process different types of training loads are used, which can simulate and exceed the effect of competitions in order to realize the potential. There are loads, which develop and maintain the performance of this or that system, and the loads, which help recovering after the intensive competitive and training activity. On the basis of this approach to running loads distribution a modern classification has been developed, which has become widely used in the training practice of many cyclic kinds of sports: swimming, running, speed skating, rowing. It includes 5 areas, segregated according to the principle of intensity, volume and physiological orientation of exercises [10]. These areas have the following characteristics:

1 area – «aerobic-recovery». The main physiological parameters of this area: HR 120-145 bpm. Lactate in the blood stream is up to 2 mmol/l. (normally has recovering effect).

2 area – «aerobic developing». HR 145-160 bpm. Lactate in the blood stream is up to 4 mmol/l (the index, codenamed «aerobic threshold» in literature).

3 area – «mixed» of aerobic-anaerobic energy supply - extensive. HR 160-175 bpm. A considerable volume of specific loads is performed in this area. The main purpose of the exercises is increasing the aerobic capacity (the critical speed of running).

4 area – «anaerobic-glycolytic» - intensive. HR 170-185 bpm. The volume of specific loads, performed in this area, is small. The main purpose of the exercises is developing and maintaining at the achieved level the anaerobic (glycolytic) mechanisms of energy supply, improving the technique, strengthening the musculo-skeletal system.

5 area – «anaerobic alactic» - maximal. HR 180-195 bpm. The main purpose is increasing the speed and strength qualities, as the speed margin is an important indicator of a runner's fitness for a specified distance. Nowadays, due to the increase of the role of training methodology, the application and understanding of load areas is particularly topical in training middle-distance and long-distance runners [4].

Anaerobic threshold is the most well-known indicator of the runners' fitness for endurance. It characterizes the performance of oxygen transport and utilization with muscle tissues and is represented with the running speed, above which the sharp increase of lactic acid (lactate) content in muscles and blood stream is observed. The higher is the fitness, the higher is the body's anaerobic threshold level, and the better is the sports result which an athlete can achieve at the competition. If we compare two athletes, which have different anaerobic threshold level (fitness), the athlete with the higher level can gain the higher speed and keep it for a longer time when covering the competition distance. For an athlete with lower fitness the anaerobic threshold occurs at the lower HR values, which indicates the insufficient capacity of his aerobic systems of energy supply [7].

Anaerobic threshold is an essential physiological parameter, which reflects the level of fitness of the body and the interaction between aerobic and anaerobic ways of energy supply, as well as between the HR value and the intensity of physical exertion. The higher is the anaerobic threshold, the more developed aerobic energy supply system an athlete possesses, the performance of which can amount to 80-90 % of the maximal oxygen consumption (MOC). The anaerobic threshold in this case takes place at the higher level of HR [5].

The optimal intensity of training load, which has the maximum effect for increasing the aerobic energy supply, is the anaerobic exchange threshold rate border (AnT). It is the optimum intensity of physical activity, which corresponds to the lactate concentration within 3-4 mmol/l (2nd area).

The work at the AnT allows increasing the maximum aerobic capacity at the long physical performance. An important factor of the training efficiency is the scrupulous individual selection of the intensity of exercises at the AnT border. Even for the athletes of the same level of training fitness the AnT index can be of the different levels. For the highly-qualified athletes it can be observed at the HR 170- 180 bpm. Such approach to the training process of highly-qualified runners can provide the success in the training of leading athletes and the growth of world records in middle-distance and long-distance running [2].

Based on the above stated, a training program for athletes with account of the necessary data has been developed and tested, presented in Table 1.

Table 1.

The implementation phases and the methodology of combining aerobic and anaerobic-oriented means at the training exercises of track and field athletics

Lactate index	The distribution of types of loads about the training days (6 sessions a week)																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
< 3 mmol/l	+		+		+		+		+		+		+		+		+	
= 4 mmol/l		+		+				+		+				+		+		
> 5 mmol/l						+						+						+

As a result of training exercises according to the program presented in Tab. 1 the time shifts at performing one and the same exercise were observed, with account of the constant monitoring of lactate level.

The findings of the time indices of covering the fractions of distance in the days of training during the whole preparation period with loads at the aerobic threshold level and lactate 4 mmol/l are presented in Fig. 1.

Fig. 1. The time indices of covering fractions of distance in training days at the aerobic threshold level and lactate 4 mmol/l

As we can see from the picture of the training process data of professional middle-distance and long-distance runners, the parameters, aimed at developing aerobic capacity and endurance, are constantly growing.

Conclusion. The findings of the research have shown the viability of using the designed methodology of developing endurance of long-distance and middle-distance runners with account of lactate level monitoring. The obtained data are useful for evaluating the prospects of the sports results growth of qualified long-distance and middle-distance runners.

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