



Stages of adaptation as an important factor in the ability of the athletes' body to adapt to the action of loads of increasing power

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Abstract

Objective of the study was to identify the stages of adaptation of the cardiorespiratory system of athletes of different sports, age and gender to the action of an increasing testing load.

Methods and structure of the study. Athletes of different sports, age and gender took part in the scientific work. Based on age, the athletes were divided into groups. Athletes of all groups worked on a bicycle ergometer with a power of 50 to 200 W with a pedaling frequency of 60-70 rpm, the duration of each load step was 3 minutes, the method of tetrapolar chest rheography according to Kubizek was also used, modified by Yu.S. Vanyushin.

Results and conclusions. Three stages of adaptation of the cardiorespiratory system of athletes, specializing in different sports, age and gender, with increasing power load on a bicycle ergometer, were revealed. It turned out that the existing first or lower stage of adaptation is associated with the function of respiration. The next stage of adaptation is manifested as a result of the activity of the circulatory system and is aimed at increasing the indicators of the chronotropic reaction and inotropic function of the heart. It can be classified as an intermediate level of adaptation of the body of athletes. And the highest stage of adaptation is aimed at increasing the characteristics of the body of athletes associated with gas exchange, and is manifested in the growth of the oxygen utilization factor.

Keywords: adaptation, cardiorespiratory system, athletes, increasing power loads.

Introduction. Adaptation is considered to be a process of adaptation to various conditions of the external world. More I.P. Pavlov [6] believed: "Human life is an eternal and infinite adaptation", inherent in all living beings, including humans. Therefore, those reactions of the body that underlie its adaptation to the environment and are aimed at maintaining homeostasis are associated with adaptation.

The problem of adaptation has attracted the minds of domestic and foreign scientists for many decades, being the leading one for the physiology of labor and sports [1, 5, 7]. As a result, a theory of adaptation appeared, acting as a leading factor in updating theoretical knowledge related to the methodology of development and improvement of physical qualities, increasing the functionality of various physiological systems of the body, and optimizing the structural ele-

ments of the process of training athletes. At the same time, the empirical basis of the theory of adaptation itself is expanding and deepening, which develops and improves in the process of adapting the body of athletes to various conditions of training and competitive influences. The result of such an adaptation is the adaptation of the organism to various physical loads, which should be attributed to environmental factors. At the same time, it is necessary to pay attention to the fact that the ability to adapt is not unlimited and it is largely influenced by hereditary factors.

The training process affects the adaptation of each individual gradually, improving it, by dialectically negating the previously achieved level of adaptive transformations. Therefore, any preparation for subsequent competitions with appropriate sports training to achieve a higher level of adaptation processes is built



as a negation of the previous lower level of adaptation [7]. It is expedient to consider this process from the point of view of the theory of physical education, which should take place constantly, provided that the athlete sets high goals for himself, which he strives to achieve under the guidance of a coach.

Objective of the study was to identify the stages of adaptation of the cardiorespiratory system of athletes of different sports, age and gender to the action of an increasing testing load.

Methods and structure of the study. Athletes of different sports, age and gender took part in the scientific work, which made up several groups of subjects. Focusing on age, the groups were divided as follows: teenagers 15-16 years old, youths 17-21 years old, adult athletes 22-35 years old and another group of athletes of the second period of adulthood - 36-60 years old. All of them specialized in endurance sports and belonged to men by gender. Other groups of subjects trained for endurance and were engaged in speed-strength sports. They were divided into males and females. Athletes of all groups worked on a bicycle ergometer with a power of 50 to 200 W with a pedaling frequency of 60-70 rpm, the duration of each load step was 3 minutes. Using the method of tetrapolar thoracic rheography according to Kubitschek [9], as modified by Yu.S. Vanyushin [2], determined the chronotropic response of the heart in terms of heart rate, inotropic capabilities of the myocardium in terms of blood ejection and minute volume of blood circulation. Respiratory rate, tidal volume and minute respiratory volume were found using a pneumotachograph device. Recording the indicators of the cardiorespiratory system was necessary to judge the multi-stage adaptation process during bicycle testing.

Results of the study and their discussion. In our previous work, we presented the types of different reactions of the cardiorespiratory system in athletes of different ages, specializing in endurance, with increasing power load [3].

As shown by the results of our further studies, the first or lowest stage of adaptation is associated with the indicators of external respiration (Fig. 1), which was determined by the indicator of the minute volume of respiration. It manifested itself in groups of adolescents aged 15-16 and veteran athletes aged 36-60 who train in endurance sports. On the part of the teenager's body, such a reaction to physical activity is natural, since at this age the body's needs for oxygen are met by the respiratory system, which is the leading and, apparently, the only one. However, this method of providing the body with oxygen is not so efficient and productive, because part of the oxygen consumed is spent on the work of the respiratory muscles. This must be taken into account when planning training sessions for adolescents during their training in new motor acts, when it is necessary to coordinate breathing with various body movements [4, 8]. It is surprising that athletes aged 36-60 showed this stage of adaptation. We assume that it is associated with an insufficiently high level of the state of fitness of the subjects.

The next stage of adaptation was noted in the group of young athletes aged 17-21 years, which was aimed at increasing blood circulation and was classified by us as intermediate.

The third or highest stage of adaptation was manifested in athletes aged 22-35 years and indicated an increase in gas exchange rates and, in particular, the oxygen utilization coefficient (UCO₂).

Consequently, the results of our research have

The highest level of adaptation _____

Gas exchange
function
(UCO₂)
Athletes aged 22-35

Intermediate stage of adaptation

Circulation
(chronotropic reaction,
inotropic function)
Boys 17-21 years old

The lowest level of adaptation

External respiration
(minute respiratory volume)
Teenagers 15-16 years old
Athletes 36-60 years old

Figure 1. Schematic representation of the multi-stage process of adaptation of the cardiorespiratory system



shown that there is a multi-stage adaptation process in athletes whose training is dominated by such a physical quality as endurance, and this multi-stage is associated with the age characteristics of the subjects.

In the future, we were interested in how the process of adaptation manifested itself depending on the type of sport and the gender characteristics of athletes? The next stage of adaptation of the cardiorespiratory system in athletes specializing in endurance and speed-strength sports, and regardless of gender, is associated with the chronotropic response of the heart to increasing physical activity (Fig. 1). This is a natural reaction of any organism to the exercise performed.

However, it should be noted that the younger the subject's body, the more pronounced this reaction was. In representatives of endurance sports, it is less pronounced than in groups of athletes developing speed-strength qualities. In groups of female athletes, regardless of the sport, such a reaction was preferable. To this stage of adaptation of the cardiorespiratory system, we include a group of young men aged 17-21, whose reaction was associated with an increase in the indicators of the circulatory system. Such a reaction is considered more appropriate, since the increase in physical performance occurred as a result of an increase in myocardial contractility, that is, the inotropic function of the heart. All of the above features of the reaction of the circulatory system we attribute to an intermediate stage, which is a link between the lower and higher levels of adaptation of the cardiorespiratory system with increasing physical activity.

Conclusions. Three stages of adaptation of the cardiorespiratory system of athletes, specializing in different sports, age and gender, with increasing power load on a bicycle ergometer, were revealed. It turned out that the existing first or lower stage of adaptation is associated with the function of respiration. The next stage of adaptation is manifested as a result of the activity of the circulatory system and is aimed at increasing the indicators of the chronotropic reaction and inotropic function of the heart. It can be classified as an intermediate level of adaptation of the body of athletes. And the highest stage of adaptation is aimed at increasing the characteristics of the body of athletes associated with gas exchange, and is manifested in the growth of the oxygen utilization coefficient.

Therefore, we can talk about the multi-stage adaptation process, which we considered against the background of studying the indicators of the cardiorespiratory system. Such variability of the adaptation process depends on the age and sex characteristics of ath-

letes and their activities in various sports. Identification of the stages of adaptation and their significance as a result of performing physical loads of increasing power is an important factor in the ability of the body of athletes to adapt to environmental conditions.

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