

Adaptation to muscular activity: Facts and Prospects A. Solodkov

One of the major problems of modern physiology and medicine is to study the regularities of adaptation to different environmental conditions. Adapting to any human activity is a complex, multilayered process involving various functional systems of the organism (LV Kiselyov, 1986; FZ Meerson, MG Pshennikova, 1988, etc.). In physiological adaptation to muscle activity is a systemic response of the organism to achieve a high fitness and minimize physiological price for it. From this perspective, adaptation to physical exercise should be viewed as a dynamic process, which is based on the formation of a new program to respond, and the adaptive process, its dynamics and the physiological mechanisms determined by the state and the ratio of external and internal conditions of (VN Platonov, 1988; A. Solodkov, 1988).

Studies in recent years, studies on mechanisms of human adaptation to different conditions of work have led us to believe that the physiological factors for long-term adaptation necessarily accompanied by the following processes: a) the restructuring of regulatory mechanisms, b) the mobilization and utilization of physiological reserves of the body, c) the formation of a special functional system to adapt to the specific work (sport) human activity (IA Vartanyan, 1981, 1982). In fact, these three physiological reactions are the primary and main components of the adaptation process, and general biological regularity of adaptive rearrangements refers to any human activity.

The mechanism of realization of these physiological processes is as follows. To achieve sustainable and improved adaptation plays an important role restructuring of regulatory adaptive mechanisms and the mobilization of physiological reserves, as well as the sequence of their inclusion in the different functional levels. It appears that initially included the usual physiological reaction, and only then - the reaction mechanisms of stress adaptation, requiring considerable energy expenditure using the spare capacity of an organism that leads ultimately to the formation of a special system of functional adaptation, providing a specific human activity. Such a functional system in athletes is a newly formed relationship of the nerve centers, hormonal, autonomic and executive branches needed to solve the problems of adaptation of the organism to physical stress. Formation of a functional system to adapt to the engagement of various morphofunctional structures of the body is the fundamental basis of long-term adaptation to physical loads and realized efficiency of the various organs and systems in general. Knowing of the formation of a functional system can be different ways to effectively influence of its individual components, accelerating the adaptation to physical stress and increasing fitness, ie to manage the adaptation process.

Adaptive changes in the healthy organism are of two types: changes in a familiar area variations in environmental factors, when the system is functional in the usual composition, and changes under the influence of excessive factors with the inclusion of additional elements into the system and mechanisms, ie with the formation of a special system of functional adaptation. In the literature, and the first and second group of adaptive changes is often referred to as adaptation. It seems more appropriate and correct to call the first group of changes in normal physiological responses, because these advances are not associated with significant functional rearrangements in the body and usually do not extend beyond the physiological norm. The second group of adaptive changes differs significantly stress regulatory mechanisms, the use of physiological reserves and the formation of a functional system of adaptation, in connection with what they should be called adaptation shifts (AS Solodkov, 1982, 1990). Adaptive

adjustment - a dynamic process, so the dynamics of adaptive changes in athletes advisable to devote several stages. We offer four stages (physiological stress of the organism, adaptability, disadaptive and rehabilitation), each of which has its own functional and structural changes and regulatory and energy machinery. Naturally, the main having fundamental significance in the sport, should be considered as the first two stages. For the general scheme of adaptation such stages, obviously, is typical of people in the process of adapting to any business environment. This has been proved in theory we have experimentally proved and published in 1974. Athletes under stress the body is dominated by the processes of excitation in the cerebral cortex, increasing function of the adrenal cortex, increased rates of autonomic systems and the level of metabolism; athletic performance is unstable. In the endocrine background is dominated by production of catecholamines and glucocorticoids, which played a leading role in the adaptive shifts of carbohydrate metabolism. Simultaneously, these hormones increase the activity of hormone-sensitive lipase of adipose tissue.

Increased zhiromobilizuyuschy effect is preparing the next phase of the adaptive metabolic changes - the phase of increasing lipid metabolism, which corresponds to the stage of mainly adaptedness of the organism. Physiological basis of this stage is again set the level of functioning of various organs and systems to maintain homeostasis in the specific context of activity. Defined in this time, functional indices at rest and not go beyond physiological variations and the performance of athletes is stable and even increased. Consequently, in the process of long-term adaptation of athletes to physical stress hormones play a leading role in the mechanisms of switching the energy metabolism of carbohydrate type on fat. Thus, if catecholamines are preparing such switching, the glucocorticoids to implement.

With long-term effects on the body of intense and high-volume training and competitive pressures may occur violation of neuroendocrine regulation, a decrease in catecholamine and glucocorticoids and reduced energy metabolism, resulting in the body of athletes can result in various disorders that characterize the onset of the third period of adaptation changes - stage disadaptive. At this time there are unfavorable direction changes in the functions of the organism, a significant reduction of general and special performance athlete, its adaptive capacity, and can develop premorbid conditions and professionally due to illness.

After a long break in the systematic training or stop them altogether arises rehabilitation phase, which is characterized by the acquisition of other properties and qualities of the organism The physiological significance of this stage - the reduction of fitness and the return of some indicators of body functions to the original values. It is believed that athletes who had exercised regularly for many years and leaving a big sport, requires specific, evidence-based recreational activities for the return of the body to a normal life.

It should be borne in mind that arose in the process of prolonged and intense exercise structural changes in the myocardium, bones and skeletal muscles, abnormal levels of metabolic, hormonal and enzymatic adjustment is usually not returned. For systematic excessive exercise, and then for their termination body athletes pay a biological price, which may manifest itself atherosclerosis development, obesity, reduced resistance of cells and tissues to adverse impacts and enhance the level of general morbidity.

On the systemic mechanisms of adaptation to physical loads can only be judged on the basis of full consideration of population responses of the entire organism, including the response from

the central nervous system, hormonal and locomotor apparatus, movement of organs and circulatory system, blood analyzers, metabolism, etc. Therefore, no may be some - that one indicator that reflects adaptive changes in the body, and for this purpose may be suitable only set of indicators characterizing the activity of various functional systems. It should also be emphasized that the severity of changes of body functions in response to physical activity depends, above all, from individual to individual and the level of his trenirovannosti.

The adaptation process associated with uneven biological significance of various functional systems of the body. At the extreme of human exposure are altered in different ways depending on the role of each of them in the general adaptive response. The adaptation is based on the integrated responses of individual organs and systems, which vary though unevenly, but generally provide the optimal functioning of the whole organism. This, for example, due to the inhibition of activity of the digestive system and the allocation of the athletes under intense physical work, resulting in a saved backup capabilities of the organism to enhance the functions of respiration and circulation, directly providing the body with oxygen (IA Vartanyan, 1988).

Very interesting, as demonstrated in our study was the dependence of adaptive capacity of the organism from a baseline value of its functions and their fluctuations in the course of employment. For example, people who are faster and better adapted to adverse conditions noted, tend to be relatively low initial content of erythrocytes in the peripheral blood (4,0 - 4,5. 10¹² / liter), and their variations during the work were not credible. In others, the adaptive process which proceeded slowly and was unstable, the initial number of red blood cells often is 4,5 - 5,0. 10¹² / l and more, and during the duration of the activity of their number was reduced to 1,0 - 1,5. 10¹² / liter. In addition, the first group of the examined indicators of autonomic functions (heart rate, blood pressure, shock value, minute volume and blood velocity krovoottoka) fluctuated within \pm 10-20% from baseline, while those of the second group, they go beyond the boundaries mentioned. The submissions suggest that the relatively stable baseline indicators of body functions and their insignificant fluctuations in the process of adaptation showed a higher functional stability of various organs and systems. These data can and should be used in terms of selecting professional athletes, predicting their performance and health.

In recent years, drawn attention to the fact that the physiological mechanisms of adaptation to the action on the rights of various extreme factors are the starting point. At the same time a leading position among these are nonspecific reactions, resulting in the maintenance of homeostasis and the development of increased resistance to any single environmental factors, entail a simultaneous increase in resistance to certain other adverse effects. In other words, the adaptation of the organism occurs, to a large extent, identical functional changes. Established, for example, that the physiological changes that are very similar in the hypoxic training, physical stress, hardening, and in other cases. With all these effects occur in the body adaptive response, aimed primarily at increasing its non-specific resistance (AS Solodkov, 1990, 1998).

From this theoretical position to be practically important conclusion that, in accelerating the adaptation of athletes to physical activity, achieving higher sporting skills and prevent them dizadaptatsionnyh disorders leading role belongs to the methods and means of improving the general non-specific reactivity. These activities primarily include the rational mode of exercise and rest, balanced diet, central analgesia, hyperbaric oxygenation, tempering, hypoxic training, ultraviolet irradiation, biological stimulants, not related to doping, and others There are already

proven highly effective series of events, and they should be more widely implemented in the practice of sport. The doctrine of human adaptation to physical exercise is one of the most important methodological foundations of the theory and practice of sport. It is in them the key to solving the specific biomedical and pedagogical problems associated with maintaining the health and increase efficiency in the process of systematic physical exercise. In considering adaptation as a physiological basis *trenirovannosti* must emphasize a number of practically important provisions that are essential for the physiology of sport: the establishment of quantitative criteria of body functions for different stages of adaptation, identification of indicators of the functional state of the organism in the process of adaptation, in combination with indicators of mental activity, immunological resistance and physical performance of athletes, identifying the importance of afferent systems in the development of new adaptive motor skills, taking into account the universality of adaptation influences the nervous system in the process of adaptation to physical loads. Solution of these problems, which already are highly relevant practical problem would greatly contribute to maintaining the health and high performance athletes in various conditions of their work.

Greatly increased the practice of physical culture and sport requires rapid implementation of applied physiological problems. However, once again it should be recalled well-known position that, without developing a deep theoretical problems and conducting fundamental research, we're always going to lag behind in practice. Therefore I would like to finish this article with the words of the famous Italian physicist and physiologist, Alessandro Volta, spoken by him in 1815: "There is nothing more practical than a good theory." LITERATURE REFERENCES

1. Kiselev LV Kiselev LV systems approach to the assessment of adaptation in sport. Systematic approach to the assessment of adaptation in sport. Krasnoyarsk. Krasnoyarsk. - 1986. - 1986. - 176 pp. - 176 pp.
2. Meerson FZ, Pshennikova MG Meerson FZ, Pshennikova MG Adaptation to stress and physical strain. Adaptation to stress and physical strain. Moscow: Medicine. Moscow: Medicine. - 1988. - 1988. - 254 pp. - 254 pp.
3. Platonov VN Platonov VN Adaptation in sports. Adaptation in the sport. Kiev. Kiev. - Zdorovya.-1988 .- 216 pp. - Zdorovya.-1988 .- 216 pp.
4. Solodkov AS Solodkov AS Changes in body functions and adapt to the conditions of seafarers sailing / Military. Changes in body functions and adapt to the conditions of seafarers sailing / Military. honey. honey. Zh., 1974, № 4. Zh., 1974, № 4. - P.61-63. - P.61-63.
5. Solodkov AS Solodkov AS Physiological aspects of adaptation of sailors. Physiological aspects of adaptation of sailors. L., WMA. L., WMA. - 1981. - 1981. - 46 pp. - 46 pp.
6. Solodkov AS Solodkov AS Adaptive abilities of the person / / Human Physiology. Adaptive abilities of the person / / Human Physiology. - 1982. - 1982. - № 3. - № 3. - Vol.8. - Vol.8. - S. 445 - 449. - S. 445 - 449.
7. Solodkov AS Solodkov AS The physiological basis of adaptation to physical loads / / L., GDOIFK them. The physiological basis of adaptation to physical loads / / L., GDOIFK them. PF PF Lesgafta. Lesgafta. - 1988. - 1988. - 38 pp. - 38 pp.
8. Solodkov AS Solodkov AS Adaptation in sport: theoretical and applied aspects / / TiPFK. Adaptation in sport: theoretical and applied aspects / / TiPFK. - 1990. - 1990. - № 5. - № 5. - P.3-6. - P.3-6.
9. Solodkov AS Solodkov AS Adaptation to muscular activity - mechanisms and laws / physiology in higher educational institutions of Russia and the CIS / SPb., LGU them. Adaptation

to muscular activity - mechanisms and laws / physiology in higher educational institutions of
Russia and the CIS / SPb., LGU them. Pavlova. Pavlova. - 1998. - 1998. - P.75-77. - P.75-77.