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ADAPTIVE CHANGES OF THE BLOOD SYSTEM AND FEATURES OF PHYSIOLOGICAL ADAPTATION IN ATHLETES IN CONDITIONS OF DIFFERENT MOUNTAIN HEIGHTS DURING SPORTS TRAINING

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ANNOTATION

Goal. To study the adaptive changes in the blood systems of athletes and the human motor apparatus associated with the activity of muscles, and with the functions of many other physiological systems of the body. This activity is characterized by a very high degree of diversity, which causes extremely large differences in the adaptation of various muscle groups and autonomic systems. Methods and materials of the study. In this work, blood and vestibular apparatus studies were studied and conducted in students of athletes of the 2nd and 3rd courses of the physical education faculty. The results of the study: The occurrence of a general adaptation syndrome in response to physical exertion used in training leads to the excitation of important autonomic centers and, as a result, to the excitation of the sympathetic - adrenal and pituitary-adrenal-cortical systems. In accordance with the nature and magnitude of the chosen load, a dominant system is formed in the body, the hyperfunction of which becomes responsible for the development of adaptation. The increase in the number of red blood cells and the concentration of hemoglobin occurs very slowly in the conditions of the middle mountains. At a very high altitude, the concentration of hemoglobin in the blood increases rapidly and significantly. For permanent residents of the mountains, it is more than 20%. For every 300 m of height increase, the concentration of hemoglobin in the blood increases by an average of 2.1% in men and 1.8% in women. When analyzing the changes in FRM in the groups studied by us

at an altitude of 2100 m above sea level, the rate of increase in FRM at the presentation of physical activity was taken as a basis compared to the state of rest, taken as 100%. In addition, the rate of recovery of FRM was studied, i.e. reduction to the background level of FRM in 4 minutes after the end of physical activity. Discussion and conclusions. Thus, the specificity of adaptive changes in the body that develop under the influence of training is clearly manifested in the indicators of both urgent and cumulative training effect and can be traced at all levels – from subcellular to general organizational. The adaptation of the motor apparatus to various types of muscle activity that require high degrees of coordination is primarily associated with the formation of increasingly perfect sensory and operant time connections. In some cases, the improvement of coordination occurs without a special improvement in power and speed capabilities, while in others it is necessary to simultaneously improve some motor qualities.

The purpose of the study: The content of red blood cells and hemoglobin in the blood of athletes in the first days of staying at altitude increases due to hemoconcentration caused by the loss of part of the plasma circulating in the vascular bed. Hemoconcentration ensures the maintenance of normal O2 content in arterial blood and therefore plays an important role in the rapid adaptation of the body to hypoxic conditions. The study of individual indicators and types of changes in the respiratory rate, as well as the adaptation of the body to the effects of physical exertion.

Materials and methods of research. In this work, blood and vestibular apparatus studies were studied and conducted in students of athletes of the 2nd and 3rd courses of the physical education faculty. A general blood test, the total volume of lung ventilation and the frequency of respiratory movements.

The results of the study: In the first days of the athletes ' stay in the mountains, erythropoiesis increases, leading to a true increase in the number of red blood cells in the blood. It becomes noticeable already on the 3rd-4th day of staying at an altitude of over 2000 m. The number of the total number and, accordingly, the concentration of red blood cells at an altitude of up to 2800 m increases, which is linearly dependent on the height and duration of stay in the mountains. When the height increases to 6000 m, the erythropoiesis decreases.

In climbers, after several days of staying at an altitude of more than 6000-7000 m, the content of red blood cells reaches 8.5 million/mm3; in permanent residents of the mountains, it is the greater the higher the altitude of residence

Height (m)	0	1000	1500	2500	3500	4500	5500	6500
Red blood cell content (million/mm3)	5.3	5.4	5.5	5.8	6.2	6.6	7.3	8.2

Due to an increase in the total number (mass) of red blood cells in a person acclimatized to height, the volume of circulating blood is increased.

Hemoconcentration, which occurs at the beginning of high-altitude acclimatization, and later the true increase in the number of red blood cells in the circulating blood leads to an increase

in hematocrit and blood viscosity, which in turn leads to an increase in peripheral vascular resistance and thereby affects hemodynamics. Small changes in the content of red blood cells (hematocrit) do not have a noticeable effect on blood viscosity. Only a significant increase in their concentration, which is observed, for example, in residents of high-altitude areas, can have a certain effect on blood circulation.

The increase in the number of red blood cells and the concentration of hemoglobin occurs very slowly in the conditions of the middle mountains. It is the greater, the greater the height and the longer the stay on it. At a very high altitude, the concentration of hemoglobin in the blood increases rapidly and significantly. For permanent residents of the mountains, it is more than 20%. For every 300 m of height increase, the concentration of hemoglobin in the blood increases by an average of 2.1% in men and 1.8% in women.

There are positive reviews of athletes about the effectiveness of training in the mountains, but most athletes believe that training in the mountains is ineffective for high-class athletes. Since the working capacity is significantly reduced in the first days of life in the mountains, training loads during this period should be 60-70% of the usual ones.

It is known that up to a height of 1500 m, there are no visible changes in the functioning of the body. Starting from this height, there are increasing changes in the body. To denote heights that are not indifferent to a person (starting from 1500 m), the concept of middle mountains is used.

Special observations to study the influence of the highlands in one group of athletes were carried out in the Aksai Mountains for 7 days at an altitude of 2100 m above sea level.

The results of our observations showed that at an altitude of 2100 m above sea level ("Chetanzor"), an increase in the frequency of respiratory movements (FRM) is observed on the 1st and 3rd days of adaptation. In the next 7-15 days of the athletes ' stay at this altitude, the BDD stabilized in 1 min and slightly differed from the background (Samarkand, altitude 665 m above sea level).

The study of individual indicators revealed that the subjects had extremely different types of changes in the respiratory rate. So, in an athlete F-eva, you can see a constant rate of decrease in FRM (from 27 to 21 respiratory movements), while in another athlete-A-va, after reducing the respiratory rate at rest for 3 days, its sharp increase was noted-up to 58.6 (7th day) and 67.7 (15th day) of staying at altitude.

When analyzing the changes in FRM in the groups studied by us at an altitude of 2100 m above sea level, the rate of increase in BPD at the presentation of physical activity was taken as a basis compared to the state of rest, taken as 100%. In addition, the rates of recovery of BDD, i.e. a decrease to the background level of FRM in 4 minutes after the end of physical activity, were studied.

A comparison of these indicators in each period of stay at altitude with similar shifts in the city of Samarkand (background) characterizes a certain value that reflects the effect of dosed physical activity on the change in FRM in 1 min. relative to the original numbers. We observed a more pronounced rate of increase in the respiratory rate at altitude, in the remaining periods there was a decrease in the rate of increase in the respiratory rate with metered loads. As for the recovery period, we did not find any significant differences during it compared to the

background indicators. Moreover, on the 15th day of observation, the respiratory rate at the 4th minute after exposure to the load reached lower figures than in the background.

Sports training from a biological point of view should be considered as a process of directed adaptation (adaptation) of the body to the effects of physical exertion. Physical activities used in the training process serve as the main stimulus (stimulus) that excites adaptive changes in the body. The direction and magnitude of the physiological changes that occur in response to the applied physical activity determine the training effect.

The degree of impact of physical activity on the body depends on the chosen dosage of its main characteristics: the intensity and duration of the exercise performed, the number of repetitions of exercises, the amount of rest pauses between them, the nature of rest and the type of exercises used. A change in each of the listed characteristics of physical activity causes strictly defined physiological and biochemical shifts in the body, and the combined effect leads to significant changes in metabolism, which is expressed in a change in the so-called metabolic states of the body.

The adaptation of the body to the effects of physical exertion, as well as to any other stimulus, is of a phase nature. Depending on the nature and time of the implementation of adaptive changes in the body and in the metabolism, two stages of adaptation are distinguished – the stage of urgent and the stage of long-term chronic adaptation. The stage of urgent adaptation is a direct response of the body to a single exposure to physical activity. It is implemented on the basis of ready-made, previously formed biochemical mechanisms and is reduced mainly to changes in energy metabolism and related functions of vegetative maintenance. The stage of long-term adaptation covers a large period of time. It develops gradually (on the basis of repeated implementation of urgent adaptation), as a result of summing up traces of repeated loads and is associated with the occurrence of structural and functional changes in the body that significantly increase its adaptive capabilities.

The occurrence of a general adaptation syndrome in response to physical exertion used in training leads to the excitation of important autonomic centers and, as a result, to the excitation of the sympathetic - adrenal and pituitary-adrenal-cortical systems. Therefore, it can be argued that the most pronounced adaptive changes under the influence of training occur in those organs and functional systems on which the main physical load falls. In accordance with the nature and magnitude of the chosen load, a dominant system is formed in the body, the hyperfunction of which becomes responsible for the development of adaptation.

It is known that the human motor apparatus, as a rule, is associated not only with the activity of muscles, but also with the functions of many other physiological systems of the body. This activity is characterized by a very high degree of diversity, which causes exceptionally large differences in the adaptation of various muscle groups and autonomic systems.

The adaptation of the motor apparatus to power stresses is characterized by the fact that without special training, the central nervous system cannot mobilize a significant number of motor units in the corresponding muscles. Observations show that no more than 50% of motor units can be arbitrarily mobilized in insufficiently exercised muscles under power stresses, but after systematic training, the central nervous system acquires the ability to increase the degree of mobilization of these units and their number can increase to 80-90% or even more.

After prolonged training and the development of adaptation of morphological, biochemical and physiological components of motor activity, muscle strength (without taking into account age-related shifts) can increase up to 2-4 times.

Adaptation to high-speed actions is associated with accelerated processing of information entering the central nervous system and the use of more rapidly shrinking motor units. The more complex the stimulus, the longer the processing of information. This is evidenced by a significant increase in the latent period of a complex motor reaction, compared with a simple reaction. As a result of adaptation during training, the latent period is reduced, and more with complex stimuli that require differentiation of stimuli.

Adaptation in order to increase the duration of motor activity, i.e. increase endurance, has a completely different character with different degrees of muscle tension and different pace of movements. The longer the duration of the work, the less the pace of movements. The tension of the vegetative functions (frequency of respiratory movements, heart rate, hemodynamics) is relatively insignificant even with extreme power and tempo stresses lasting 20-30 seconds. and increases sharply with similar motor activity lasting from 40-60 seconds. Up to 5-6 minutes.

DISCUSSION AND CONCLUSIONS

Thus, the experimental material obtained in this series indicates that at an altitude of 2100 m above sea level (Aksai Mountains), the increase in FRM is noted for 2-3 days of adaptation, whereas in the next 7-15 days of athletes ' stay at this height, the FRM practically did not differ from the background values (Samarkand). At the same time, it was found that athletes had extremely different types of respiratory changes, which probably depend on the typological features of the nervous system and on the functional state of the body. The specificity of adaptive changes in the body that develop under the influence of training is clearly manifested in the indicators of both urgent and cumulative training effect and can be traced at all levels – from subcellular to general organizational. The adaptation of the motor apparatus to various types of muscle activity that require high degrees of coordination is primarily associated with the formation of increasingly perfect sensory and operant time connections. In some cases, the improvement of coordination occurs without a special improvement in power and speed capabilities, while in others it is necessary to simultaneously improve some motor qualities. Thus, improving the work of acrobats requires increasing the strength capabilities of a number of muscles, the activity of a pianist, typist, telegraph operator, etc. - improving speed qualities.

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