Causes Of Fatigue In The Body During Physical Exercise

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ABSTRACT

The article discusses the causes of fatigue of athletes during sports loads. Health is an invaluable gift that nature presents to a person. In order to preserve sports health and strengthen it, in order to improve health and prevent diseases, it is necessary to engage in physical culture intelligently. To resist adversity, you need to know your body and ensure its ability to overcome harmful influences and consequences by self-healing methods. Each of us needs to strengthen our health gradually. The article discusses the causes of fatigue of athletes during sports loads.

Keywords: Physical exertion, fatigue, overwork, strenuous work, chronic fatigue, performance, body, athletes

The main and objective sign of fatigue is a decrease in performance. During fatigue, performance temporarily declines, but it quickly recovers with regular, ordinary rest. Fatigue has its own dynamics – it intensifies during work and diminishes during rest (whether active, passive, or sleep). Fatigue should be regarded as a natural, normal functional state of the body during work.

Another important criterion for assessing fatigue is the change in bodily functions during work. Depending on the degree of fatigue, functional shifts can take on different characteristics. At the initial stage of fatigue, clinical-physiological and psychophysiological indicators are unstable and show divergent changes, although their fluctuations generally remain within physiological norms. In chronic fatigue, particularly overtraining, there is a significant one-direction deterioration of all functional indicators of the body, accompanied by a simultaneous decline in the level of professional activity.

Let's review the main theories of fatigue development. The key theories include the following:Exhaustion of energy resources in muscles, Accumulation of metabolic by-products in muscles,Poisoning by metabolites,Suffocation due to lack of oxygen.

These local-humoral versions do not fully explain the mechanisms of fatigue, as they consider changes in muscle tissue as the primary cause of fatigue.

The most widely accepted and scientifically studied theory of fatigue, formulated by I.M. Sechenov in 1903 and further developed by A.A. Ukhtomski, links the onset of fatigue exclusively to the activity of the nervous system, particularly the cerebral cortex. It was proposed that the mechanism of fatigue is based on the weakening of the main nervous processes in the brain's cortex, a disruption of their balance, with relative dominance of the excitation process over the more weakened process of internal inhibition, and the development of protective inhibition.Current electrophysiological and biochemical research methods, along with the data obtained, do not allow fatigue to be attributed solely to changes in any one organ or system, including the nervous system.

Therefore, it is incorrect to attribute the onset of primary fatigue to any one system.

The main factor causing fatigue is physical or mental stress, which affects the afferent systems during work. The relationship between the magnitude of the load and the degree of fatigue is almost always linear, meaning that the greater the load, the more pronounced and earlier the fatigue will appear. In addition to the absolute magnitude of the load, the development of fatigue is also influenced by several characteristics of the load, including its static or dynamic nature, its constant or periodic nature, as well as the intensity of the load. Along with the primary factor of workload, there are additional or contributing factors. These factors, by themselves, do not lead to fatigue, but when combined with the primary factor, they contribute to the earlier and more pronounced onset of fatigue.

The additional factors include:External environmental factors (temperature, humidity, gas composition of the air, barometric pressure, etc.Domestic factors, such as disruption of the work-rest schedule,Changes in habitual daily biorhythms and the absence of sensory stimuli,Socio-psychological factors – motivation, relationships within a team, family, etc.

The main sign of fatigue is a decrease in performance, which changes for various reasons during different physical exercises. Therefore, the physiological mechanisms of fatigue development are varied. These mechanisms are determined by the intensity of the work, its duration, the nature of the exercises, the complexity of their execution, and other factors

During high-intensity periodic work, the reason for the decline in performance and the development of fatigue is the reduction in the mobility of primary nervous processes in the central nervous system, with inhibition predominating due to the large flow of efferent impulses from the nerve centers to the muscles and afferent impulses from the working muscles to the centers. The working system of interconnected cortical neuron activity is disrupted. Additionally, the level of ATP and creatine phosphate in the neurons decreases, while the content of the inhibitory neurotransmitter gamma-aminobutyric acid increases in the brain structures. A critical factor in the development of fatigue is the change in the functional state of the muscles themselves, such as the reduction in their excitability, lability, and relaxation speed.

In cyclic work of maximum power, the leading causes of fatigue are the suppression of nerve center activity and changes in the internal environment of the body. This is caused by an acute lack of oxygen, leading to hypoxemia, a decrease in blood pH, and a 20-25 times increase in the content of lactic acid in the blood. The oxygen debt reaches its maximum values — 20-22 liters. Inadequately oxidized metabolic by-products, being absorbed into the blood, impair the activity of nerve cells. The intense activity of nerve centers occurs against the backdrop of acute oxygen deficiency, which leads to the rapid development of fatigue.

High-intensity periodic work leads to fatigue due to the discoordination of motor and vegetative functions. For several dozen minutes, a very intense effort must be maintained by the cardiovascular and respiratory systems to provide the working body with the necessary amount of oxygen. During this work, the oxygen demand slightly exceeds the oxygen consumption, and the oxygen debt reaches 12-15 liters. The total energy expenditure during such intense work is very high, consuming up to 200 grams of glucose, which leads to a decrease in its level in the blood. There is also a decrease in certain internal secretion gland hormones (pituitary, adrenal glands) in the blood.The duration of moderate-intensity cyclic work leads to the development of protective inhibition in the CNS, exhaustion of energy resources, tension in the oxygen transport system functions, strain on the internal secretion glands, and changes in metabolism. The body's glycogen stores decrease, which leads to a reduction in blood glucose levels. Significant loss of water and salts, changes in their quantitative ratios, and impaired thermoregulation also lead to reduced performance and the onset of fatigue in athletes.In the mechanism of fatigue development during prolonged physical

activity, changes in protein metabolism and a decrease in the functions of internal secretion glands play a certain role. The concentration of glucocorticoids, mineralocorticoids, catecholamines, and thyroid hormones decreases in the blood. As a result of these changes and the prolonged influence of monotonous afferent stimuli in the nerve centers, inhibition occurs. Suppression of these centers leads to a significant decrease in the efficiency of movement regulation and a disruption of their coordination. In different climatic conditions, during prolonged work, the development of fatigue can be accelerated by disturbances in thermoregulation.

In various types of acyclic movements, the mechanisms of fatigue development are also different. Specifically, when performing situational exercises of varying intensity, the higher parts of the brain and sensory systems experience the greatest load, as athletes constantly need to analyze the changing situation, program their actions, and switch the pace and structure of their movements. This constant mental and physical demand leads to the development of fatigue.

In different sports (e.g., football), the main factor contributing to fatigue is the insufficiency of oxygen supply and the development of oxygen debt. In gymnastics and combat sports, fatigue develops due to the deterioration of brain conductivity and the reduction in muscle function, which decreases their strength, excitability, and the speed of contraction and relaxation.In static work, the main cause of fatigue is the continuous tension of the nerve centers and muscles, the shutdown of less stable muscle fibers, and the large flow of afferent and efferent impulses between muscles and motor centers.

Fatigue, which is a normal functional state of the body during work, completely disappears during regulated rest periods. However, with prolonged, intense work and disruption of the work-rest regime, the signs of fatigue accumulate, leading to chronic fatigue and overtraining.Chronic fatigue is a borderline functional state of the body, characterized by the persistence of subjective and objective signs of fatigue from previous work at the start of the next work period, which can only be relieved with additional rest. Chronic fatigue arises from prolonged work with improper work-rest schedules. The main subjective signs are feelings of tiredness before the workday begins, quick fatigue, irritability, and unstable mood; objective signs include significant changes in bodily functions, a noticeable decrease in athletic performance, and the appearance of mistakes in actions.In chronic fatigue, the necessary level of athletic performance can only be maintained briefly by increasing the biological cost and quickly depleting the body's functional reserves. To eliminate the negative effects on the body's functions and maintain athletic performance, it is necessary to correct the disruptions in training and rest schedules and provide athletes with additional long rest. If these measures are not followed, chronic fatigue may progress to overtraining.

Overtraining is a pathological state characterized by constant feelings of tiredness, sluggishness, sleep disturbances, appetite loss, and pain in the heart and other body parts. Additional rest is insufficient to resolve these symptoms; special medical treatment is required. Objective signs of overtraining include sharp changes in body functions, some of which exceed normal levels, excessive sweating, shortness of breath, weight loss, impaired attention and memory, and atypical reactions to functional tests that are often not completed.

The main objective criterion for overtraining is a sharp decline in athletic performance and the appearance of serious errors in performing specialized physical exercises. Athletes showing signs of overtraining should be removed from various training and competition activities and undergo medical treatment.

Recent studies on the quantitative assessment of the work capacity of different specialists have shown that a decrease in direct and indirect indicators of performance by up to 15% compared to baseline values indicates fatigue, 16-19% suggests chronic fatigue, and a decrease of 20% or more signals the onset of overtraining.

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