



## FORMS OF FATIGUE - PHYSIOLOGICAL FATIGUE

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**Abstract:** After efforts which are not beyond the functionality of the body, physiological fatigue installs manifested at both peripheral and central level.

**Keywords:** acute peripheral fatigue; acute central fatigue.

Fatigue is estimated based on some quantitative and qualitative aspects of its manifestation.

Bugard quoted Bota, C. (2000) presents the stages which are installed in a tired body, as follows:

- Stage I - fatigue with harmonious response - is specific to athletes;
- Stage II - fatigue with oscillating response - occurs when recovery is incomplete;
- Stage III - fatigue with discordant response when to the physical state of fatigue is added a mental fatigue and sometimes a disease state;
- Stage IV – with exhaustion - pathological condition, including besides scope of the muscular system, the neuro- vegetative, metabolic and endocrine.

Between fatigue and exhaustion there is a quantitative difference, in which the phenomena of fatigue disappears within 24 hours while recovering from depletion processes require a minimum of 4-7 days with a complementary medical therapy.

If fatigue is installed after a sporting effort which does not exceed the functional capacity of the body, it is estimated that fatigue is a physiological form, its manifestation is in muscles (peripheral) or at neuro-psychological level (central).

Weineck, J., (1995) orders manifested forms of fatigue in acute fatigue (peripheral and central) and chronic fatigue (local and general).

Brătilă, F., (2002) quoting Stegemann,

classified fatigue in: acute fatigue (peripheral and central), local and general fatigue (associated with overtraining) and neuro-muscular fatigue.

Drăgan, I., (2002) systematizes fatigue as physiological form and pathological form.

### PHYSIOLOGICAL FATIGUE

Physiological fatigue manifests as:

- Acute peripheral – muscle fatigue;
- Acute central – neuro-psychological fatigue.

#### Acute peripheral fatigue (muscle fatigue)

Muscle fatigue is caused by repeated muscle contractions, which consume energy reserves, disrupting homeostasis (physicochemical balance) of the body. Fatigue accumulates gradually, depending on the duration and intensity of exercise, reaching a point when exercise can no longer be continued, which causes termination of execution.

According to Drăgan, I., (2002), muscle fatigue can be caused by the following energy order reasons:

- Depletion of muscle creatine phosphate reserves, in the case of anaerobic efforts (0-45 sec);
- Depletion of muscle creatine phosphate reserves and increasing the concentration of lactic acid in the case of short endurance exercise (45 seconds - 2 minutes);
- Increasing muscle lactic acid, accompanied by increasing hepatic ammonia, in the case of medium level of endurance efforts (2-10 min);
- Depletion of muscle glycogen in the case of long endurance type I and type II (10-35-90 min);
- Depletion of muscle glycogen, accompanied

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by the accumulation of lipid peroxides in the case of long endurance efforts type III - IV (90 min – 6 hours – over 6 hours).

In addition to the limits of the energy order, fatigue may be induced by other causes, such as:

- Intramuscular ionic imbalance; contractions with long duration and frequency cause loss of potassium and calcium, which has the effect of further reducing of muscle contraction ability;
- Fatigue at the neuromuscular synapse level, which disrupts sending of command from motor level to the muscles;
- Type of fiber, white fibers (phasic) get tired more easily than red fibers (slow), considered resistant to fatigue;
- Lack of oxygen caused by insufficient blood supply to the muscles.

Muscle fatigue can be recognized by a series of clues, signs, subjective and objective aspects, such as:

*Subjective aspects:*

- Feeling drowsy throughout the body;
- Feeling of heaviness in the muscles and movement;
- Feeling pain in pressure of muscle mass;
- Desiring to reduce or terminate the effort and need for rest.

*Objective aspects:*

- Reducing work capacity, physical efficiency;
- Increasing of muscle tone in rest;
- Decreasing of muscle tone in effort;
- Impairing coordination and muscle control;
- Decreasing of neuromuscular excitability;
- Decreasing of strength, range of motion;
- Decreasing of appetite, sleep disorders.

*The mechanism of fatigue in muscle fiber*

During muscle contraction, due to increased internal pressure, the capillaries are compressed and blood exhausted. During state of relaxation, muscle tension decreases, blood capillaries dilate and blood enters into the vessels.

When the contraction follow each other rapidly, the capillaries are compressed again, and in the interval between contractions, arterial blood does not enter in sufficient amounts, with oxygen and supporting substances for effort, thus reducing the capacity of the removal of toxins .

In extreme fatigue, relaxation time is small, which leads to a state of permanent contracture of the muscle, which results in a reduction of physical

yield. In this situation, muscle excitability exceeds the one of corresponding nerve, which produces a state of permanent contracture of muscle, thus, cramps appearing. In a muscle area so contracted, with insufficient irrigation, substances intake recovery is reduced, requiring neurological and muscle recovery measures.

Therefore, muscle fatigue is a physiological reversible, which installs normally due to exceeding the limits of the functionality of neurologic and muscle system, as a result of considerable work. Muscle activity is conditioned by the energetic effort: the more demanding of muscle performance (in terms of volume, intensity, complexity), the sooner fatigue installs.

In sports training, in physical education lessons, the occurrence of muscle fatigue can be delayed by using rational exercise or by the optimal use of effort and breaks.

Muscle fatigue as a physiological form occurs as a result of an effort within the functional limits of the body, in this case becoming a contributing factor of adaptation.

In sports training or physical education activities, repeated efforts produce a degree of physiological fatigue (within functional limits) lead to higher biological processes of adaptation and improvement of training status and getting sports form.

If the fatigue is installed after overcoming the body's functional capacity, it is estimated that fatigue occurs in pathological form.

**Acute central fatigue (neuro-psychological fatigue)**

The concept of central acute fatigue or Neuro-psychological fatigue is defined as «diminished ability to perform coordinated action with the same precision as in rest» (Stegeman quoted Weineck, J., 1995).

Central fatigue has close connections with peripheral fatigue, because related information issued by the muscle (the periphery) has inhibitory impulses response, leading to discontinuation of effort.

Triggering causes of muscle fatigue attract the same functional and biochemical parameters changes in other vital systems, such as cardio-respiratory, central nervous, peripheral and autonomic system. Information about muscle fatigue (peripheral) affects nervous system and all body functions.



*Physiological mechanisms*, which result in the installation of central fatigue (neuro-psychological) are:

- Decreasing of blood glucose that has an effect on the brain, which is extremely sensitive to low blood sugar (eg. long endurance efforts III-IV - 90 minutes).

- Accumulation of essential amino acids in the brain disrupts neurons (force efforts); amino acids that are not metabolized (consumed) are accumulating in the brain, hence inducing neuronal disorders (eg. hyper protein food rations uncovered by appropriate effort).

- Neuro-psychological stress to athletes from disciplines such as: shooting, fencing, goalkeepers, high jump and pole vault, sprinters.

According to domain experts, central fatigue is recognized by the following *aspects*:

- Reducing of coordination capacity, cooperation between central nervous system and muscular system is disturbed, where one of the components of the control and regulation of movement is affected; muscle fatigue (peripheral) has the effect of reducing motor acts coordination, precision and economy of movement. Electrical activity of muscles increases with progressive installing of fatigue, which induces central fatigue manifested in the reduction of the coordination.

- Reducing of sensory performance capacity makes central fatigue to reduce functional status of component analyzers (peripheral segment of the receptor, leading segment, the central segment of the analysis and synthesis of information), the effect manifested in changing of optical, auditory, tactile sensitivity threshold.

- Disorders in mental phenomena regulatory function, because central fatigue reduce intake of psychological and nervous energy in sensory and cognitive processes. The mental process regulator – attention, loses the essential qualities of concentration and mobility (distributive). Installing of mental fatigue has the effect of reduction of intrinsic motivation for athlete activity.

- Disorders of higher knowledge processes are observed, because psycho- physical fatigue alters

the ability of thought, the accurate assessment of information. Individual athlete mentally tired has difficulty assessing the distance, its own actions and reduced capacity of decision and motor reaction.

- Increasing of reaction time is found in physical fatigue, because it increases latency for simple motor response, but especially complex reaction, which is determined by: increasing of processing time information at central level or reducing of neurons and synapses functional status. However, physiological fatigue should be assessed as a *general mechanism for protection* against excessive stresses which occurs through:

- Sparing (protecting) of nerve structures whose neurons pass into a state of inhibition due to excessive stimulation or its prolonged action;

- Sparing of the cardiovascular system, the energy reserves of the heart muscle;

- Preventing of complete depletion of energy reserves, called "autonomous protected reserves".

Physiological fatigue is a favorable state in sports training, by installing the phenomenon of overcompensation, a phenomenon which improves body exercise capacity.

Preventing the installation of neuro-psychological fatigue is performed through management of sports training and compliance with measures and means of neuro-psychological and metabolic recovery.

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