Abstract
Overtraining is a syndrome that athletes exhibit when they are subject to high intensity of training without observing the balance between training and resting, which leads to chronic fatigue and cortisol level increase. Although experts tried to identify the cause of fatigue, the opinions are still controversial. Fatigue is strictly related to the type of muscle fiber (rapid firing). The higher percentage rate of rapid firing in the body, the faster rate of muscle fatigue. The direct cause of decrease is not necessarily the lactic acid level increase. Overtraining can be very difficult to detect in an athlete, and thorough clinical examination is required to reach proper diagnosis.

Keywords: overtraining, fatigue, recovery.

JEL classification: I20, I23

1. Introduction

Overtraining is also known as chronic fatigue. It is an excessive intensity of training, triggering a consistent stimulus – hard training, professional or individual over exercise, lack of sleep, imbalanced diet, as well as other factors. Overtraining occurs when the volume and intensity of an individual's exercise exceeds the capacity of recovery which, in turn, leads to decreases in performance, stagnation and cortisol level raise.

Some authors estimated that overtraining represents a “professional disease” specific to high performance sportsmen, and, if not treated in time, it could have negative repercussions equally on the performance capacity and the further life of sportsmen, producing functional and psychical disorders. (Dragnea, Mate-Teodorescu, 2002)

2. Contents

Subjective and objective symptoms to be met in overtraining:

2.1 General subjective symptoms
- Mood changes;
- Insomnia;
- Headache;

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- Neurotic behaviour;
- Unusual behaviour to stimuli.

2.2. Local subjective symptoms
- Muscle soreness;
- Heartburn;
- Loss of appetite.

2.3. General objective symptoms
- Skin changes during effort;
- Excessive perspiration;
- Imbalance of mineral and water levels.

2.4. Local objective symptoms
- Irregular responses;
- Decreased muscular strength;
- Breath difficulty;
- Heart rate dysfunction
- Endocrine and digestive disorder;
- Disorder of transaminase enzymes;
- Weight loss.

Athletes can experience two types of overtraining:
- Basedowian overtraining (sympathetic training)
- Addisonian overtraining (parasympathetic training).

Basedowian overtraining may result when high intensities are employed in training, namely when sympathetic processes dominate. The recovery is difficult to be attained and mostly delayed. Basedowian overtraining is relatively easily diagnosed, given the many indicative symptoms the athlete manifests.

Addisonian overtraining is typically the result of high training volume when parasympathetic processes are dominant, including weakness state and hormone imbalance. The athlete fails to perform in competitions. Such a condition is insidious and hard to be diagnosed, because of the lack of clinical symptoms while resting.

Usually, in Basedowian overtraining full recovery may be reached in 1 or 2 weeks of adequate treatment. On resumption of regular training it is necessary to raise the intensity of exercise very gradually, once the recovery is complete and the symptoms ceased.

The treatment of Addisonian overtraining requires a longer period of time (weeks or months) for the body to restore. The initial intensity of exercise attained before the break should not be approached sooner than 6 weeks after emphasizing on
specific training. As for the causes that induce fatigue, certain speculations have been disseminated in time, but some of them were not relevant, focusing strictly on local reactions.

Research in the area of fatigue considers the phenomenon as transferred to the central nervous system, implying that tiredness primarily effects in nervous system (CNS), but not in the muscles, while the other symptoms are only secondary and strictly depend on proper balance between training and resting phase (Smith & Norris, 2000).

Experts in field define overtraining according to two theories:

**Chemical theory** – depletion of energy stores and increase of food waste (lactic acid);

**Central nervous system theory** – muscle fatigue is felt by the nervous system as a specific sensation inducing a lower pace and frequency of motor neurons.

Clinically, overtraining may result in:

- Muscle fatigue (peripheral fatigue)
- Central nervous system fatigue.

**Muscle fatigue** is also called muscle pain syndrome. Such a condition is symptomised by persistent muscle pain after demanding exercise or training the athlete was not used before. Athletes usually experience muscle contraction and fatigue.

**Central nervous system fatigue** occurs when the brain activates its inhibiting motor neurons that trigger decrease of muscle performance.

Although experts tried to identify the cause of fatigue, the opinions are still controversial. Fatigue is strictly related to the type of muscle fiber (rapid firing). The higher percentage rate of rapid firing in the body, the faster rate of muscle fatigue. The direct cause of decrease it is not necessarily the lactic acid level increase, but the pH level decrease. Such a factor leads to lower levels of serum calcium and troponin proteins. Moreover, the increased concentration of hydrogen ions in blood inhibits the activity of phosphokinase, one of the most significant enzymes in anaerobic glycolysis. Such an inhabitation may result in lower level of glycolysis, inherently diminishing the release of ATP – type energy to the cells. (Portier H, Louisy F, Laude D, et al, 2001)

Depletion of ATP-CP stores may cause tiredness, yet research in field estimates the largest reduction of ATP and CP levels occurs after 2 minutes of contraction before the decline of the full force is reached. When a muscle is fully tired after 15 minutes of exercise, 76% of ATP concentration is still available. Additionally, the ATP and CP levels significantly increase during the first couple minutes of recovery, though the muscle strength slightly improves. Nevertheless, during a contraction, the ATP concentration could trigger significant decrease of myofibril protein level than the muscle itself. On the other hand, the muscle contraction is
rather limited by the energy release induced by ATP depletion than by the availability of ATP stores. The depletion of glycogen muscle level is almost complete at the end of prolonged exercise (from 30 minutes to 4 hours), even if the AGL and glycogen levels in liver are still available (Dragan - 2002).

3. Conclusions

A number of three theories attempted to define the stages of fatigue:

1. **The energy depletion theory**, according to which exhaustion of ATP-CP and glycogen stores is the basic cause of fatigue;
2. **The self intoxication theory** (muscle self intoxication) – muscle contraction is inhibited by intermediate metabolic products (lactic acid);
3. **Heterochronic theory** – fatigue is defined by inhibition of neuromuscular and synaptic transmission, blocking the innervations of muscle by nerve.

4. Recommendations

In order to overcome chronic fatigue, the advice is to cease effort, replace with jogging, and a lot of stretching, time for recovery, relaxation, active rest and diet change (vitamins, minerals, milk products, fruits). It is advisable to leave the town for a while, and spend time in a mountain training camp. In case of professional athletes, doctors could prescribe proper medication (Vitamin E, C, B, oligo elements, amino acids – arginine, glycocoll, selenium, cysteine).

Psychologically, it is recommended as a treatment:

- Avoid mood disturbance;
- Attending concerts, listening to music, entertainment and increasing sleep time;
- Avoid any excess and sunbaths;
- Auto suggestion.

**BIBLIOGRAPHY**

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