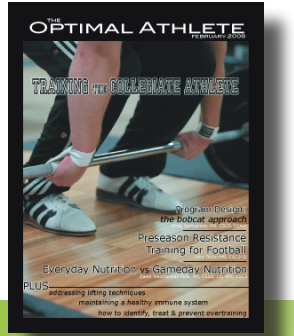

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Idenitifying, Treating & Preventing Overtraining in Athletes

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Overtraining syndrome (OTS), also known as "staleness" or "burnout", is a condition that affects many athletes, both recreational and elite. OTS can be defined as deterioration in performance, resulting from a chronic imbalance between stress and recovery (1,3). This decrease in performance is regarded as the gold-standard sign of OTS and may extend over a period of weeks or months (1,2).

There are a number of signs and symptoms associated with OTS (Table 1) that can be divided into six categories: performance, psychological, physiological, biochemical, immunological and information processing. While there are no definitive signs and symptoms, an athlete suffering from OTS may suffer from different combinations of the signs and symptoms listed in Table 1. At this time, there does not appear to be specific patterns of signs and symptoms associated with specific sporting events; however, it has been suggested that there may be distinct differences between sports, with regards to which signs and symptoms may be predominant (4). As a rule of thumb, the first indication of impending OTS is a change of mood (1,4), although it is typically the decline in performance that catches the eye of the athlete and the coach.

Categories	Signs and Symptoms of OTS
Performance	Decreased performance; inability to meet previous standards; prolonged recovery; reduced toleration of loading; decreased muscular strength; decreased maximum work capacity
Psychological	Constant fatigue; reduced appetite; change in sleep pattern (hyper- or hyposomnia); depression; general apathy; decreased self-esteem; emotional instability; fear of competition; easily distracted; gives up when the going gets tough
Physiological	Changes in blood pressure; changes in heart rate at rest, during exercise, and during recovery; increased frequency of respiration; increased oxygen consumption at sub-maximal exercise intensities; decreased body fat; decreased lean body mass; elevated basal metabolic rate
Biochemical	Rhabdomyolysis; elevated c-reactive protein; elevated creatine kinase; negative nitrogen balance; increased urea concentration; increased uric acid production; hypothalamic dysfunction; depressed muscle glycogen levels; decreased hemoglobin; decreased free testosterone; increased serum cortisol; decreased serum iron and ferritin
Immunological	Constant fatigue; complaints of muscle and joint aches and pains; headaches; nausea; gastrointestinal disturbances; increased aches and pains; muscle soreness/tenderness; increased susceptibility to and severity of illness, colds, and allergies; reactivation of herpes viral infection; bacterial infections; one-day colds; swelling of lymph glands
Information Processing	Loss of coordination; reappearance of previously corrected mistakes; difficulty in concentrating; decreased capability to deal with large amounts of information; reduced capacity to correct technical faults

Based on (2, 3, 4)

What Causes OTS?

Even though the seriousness of OTS has been recognized, the underlying causes of OTS remain unclear. A number of different ideas and hypotheses have been proposed to address causes of OTS; a consensus has yet to be reached. For example, the glycogen hypothesis suggests that a lack of glycogen present in the musculature may explain the presence of OTS; while the central fatigue hypothesis suggests that fatigue within the central nervous system due to an abundance of tryptophan in the central nervous system may be used identify OTS.

Presently, it seems that the only thing that most experts in the field agree upon is that OTS is related to an increase in volume and/or intensity of training, or a consistently high volume of training over an extended period of time, with insufficient time for recovery (2). Therefore, it can be implied that it is the dedicated, hard working athlete who suffers from OTS, and not the athlete who is casual about his or her training regiment.

Overreaching vs. Overtraining

As previously discussed, OTS is a chronic syndrome in which an imbalance between training and recovery occurs. Overreaching, on the other hand, is an acute phenomenon in which there is an imbalance between training and recovery. Overreaching is typically short in nature and can be seen as a normal part of training; however, if an athlete overreaches for an extended period of time, OTS may set in.

Treatment of OTS

In order to treat OTS, one must regain the balance between training and recovery. Physiological recovery is an important piece to this puzzle because various training and recovery variables can be controlled and accurately monitored. For example, since the athlete likely developed OTS because he or she failed to recover from the workload placed upon his or her body, a decrease in both the volume and the intensity of the training must be reduced.

Prevention

Proper periodization of the athlete's training program will play an important role in the prevention of OTS. Properly designed training programs, whether it is resistant training, conditioning, etc., should alternate high-volume and high-intensity training days within the normal training regiment. This course of action has been shown to achieve optimal results, with a decreased risk of developing OTS, when compared to training programs that only target high-volume and/or high intensity.

Regeneration strategies have been widely utilized by the Eastern Block Countries in order to improve recovery. Common regeneration strategies include meditation,

message, hydrotherapy, nutritional analysis, and psychotherapy. While most regeneration strategies have yet to be proven as a method of enhancing recovery, they have gained popularity within most elite training facilities.

OTS is a syndrome that can affect any athlete and is characterized by chronic fatigue and under-performance. It is the result of either too much training or too little recovery, or a combination of both. Factors including psychological, biochemical, physiological and immunological are reported to be responsible for the observed signs and symptoms, all resulting in a failure to recover adequately from exercise. Careful monitoring of the athletes' response to training may help prevent, or at least recognize the early signs of overtraining.

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