ISSN 2379-6391

SPORTS AND EXERCISE MEDICINE

Open Journal

Openventio PUBLISHERS

Short Communication

Diagnosis of Overtraining and Overreaching Syndrome in Athletes

Gerasimos V. Grivas, PhD*

Department of Physical Education and Sport Science, University of Thessaly, Trikala, 42100, Greece

***Corresponding author**
Gerasimos V. Grivas, PhD
Department of Physical Education and Sport Science, University of Thessaly, Trikala, 42100, Greece; Tel. +306936514049; E-mail: grivasger@hotmail.com

Article information
Received: June 1st, 2018; **Revised:** October 14th, 2018; **Accepted:** October 15th, 2018; **Published:** October 17th, 2018

Cite this article
Grivas GV. Diagnosis of overtraining and overreaching syndrome in athletes. *Sport Exerc Med Open J.* 2018; 4(3): 74-76. doi: 10.17140/SEMOJ-4-165

Overtraining (OT) is one of the most popular topics between coaches and researchers. The problem of this syndrome has been well-known for 70-years, however, the mechanism that induces OT remains unclear.[1-3] Many recent papers have referred to the work of Kreider et al[4] for the definitions of overreaching (OR) and OT.[1-3]

Overreaching: An accumulation of training and/or non-training stress resulting in short-term decrement in performance capacity with or without related physiological and psychological signs and symptoms of maladaptation in which restoration of performance capacity may take from several days to several weeks.

Overtraining: An accumulation of training and/or non-training stress resulting in long-term decrement in performance capacity with or without related physiological and psychological signs and symptoms of maladaptation in which restoration of performance capacity may take several weeks or months.

These definitions suggest that the difference between OT and OR is the time that is needed from the recovery. For example, the recovery from OT syndrome (OTS) may require weeks to months while for OR resolved within days to weeks. Several psychological disturbances such as psychosocial stressors, sleep disorders and illness, decreased vigor, increased fatigue and reduced performance and the athletes will need weeks or months to recover.[5]

Many researchers have tried to examine the effects of overtraining in athletes.[6] Although, as there is no diagnostic tool to identify an athlete with OT or OR syndrome, diagnosis can only be made by excluding all other possible influences on changes in performance and mood state.[1] So, that prevention is still the best cure, and to avoid the onset of OR or OT athletes should record daily their training load, using a daily training diary or training log.[3] Athletes, coaches and researchers need to recognize the early warning signs OR or OT. However, there are recognized physiological and biochemical parameters which are associated with overtraining, for example a low iron or testosterone-level.[7]

The OT or OR syndrome represents one of the most feared complications in competitive athletes and concern coaches and researchers,[8] because the recovery of athletes may require weeks to months. The aim of strength and conditioning is to improve performance of athletes. Nonetheless, there is a thin line between maximal performance and OT or OR. As a consequence, when an intensive, excessive and extended training are applied concurrent with inadequate recovery, many of the positive physiological alterations associated with physical training are reversed with OT or OR.[2] Overreaching is often used by athletes during a typical training cycle to improve performance. If the intensity, the load and the duration of the training are not reduced, OR leads to OT.[1] However, athletes who are diagnosed with OTS may take months or years to completely recover, this means that an athlete's career may be seriously compromised and there are many cases that athletes stopped the athletic career due to OT or OR.[1]

OT or OR is recurrent problem and is often observed in high performance athletes and in different sports. More especially, studies have reported that the symptoms of OTS appeared in >60% of distance runners during their athletic careers, >50% of professional soccer players during a 5-month competitive season, and 33% of basketball players during a 6-week training camp.[2]

DIAGNOSIS

Diagnosis of OTS and OR is not simple. Unfortunately, diagnosis of OTS cannot be made definitively with one biomarker, there are

a few markers that may be considered in the elite athlete.[3,8,9] From the literature the most used biomarkers are urea (5-7 mmol/L), uric acid (237-449 μmol/L), ammonia (70-80 μmol/L), and creatine kinase (100-250 U/L).[8] However, there are many others biomarkers that should be examined. However, one may be able to estimate training load and the body's response with the following: salivary immunoglobulin A, serum testosterone: cortisol and overnight urinary cortisol: cortisol ratio.

The study of Barron and Noakes,[10] was one of the first studies that investigate the possible mechanisms of overtraining. Four overtrained athletes were investigated in total, with only two subjects given actrapid insulin alone. The prolactin responses of the subjects to this challenge ranged from <1 to 98 ng/min/mL. Additionally, subjects were reported to be recovered after a 4-week rest period. This suggests that the athletes were, indeed overtrained; however, performance was not measured in this study. In the study of Rowbottom et al.[11] examined a combination of parameters in ten athletes who were diagnosed as overtrained. Athletes reported difficulty maintaining their training program and fatigue. Resting hematological, biochemical, and immunological measures were made and compared with established normal ranges. The only measured parameter that was significantly different to normal ranges was glutamine, indicating that in most haematological, biochemical and immunological aspects, these athletes were not different from normal controls.

In the study of Hedelin et al.[12] examined overtrained athletes and found a decrease resting heart rate (-4.8%). The athletes reported accumulated fatigue and reduced performance, however, the change in performance was not reported and the type of exercise test was unclear. Compared with normally subjects, the overtrained subjects had an increase in high-frequency and total power in the lying position during intensified training, which decreased after recovery.

Koutedakis and Sharp[13] examined 257 elite athletes who were members of British National Teams in a variety of sports over a 12-month training season. They found that 15% of athletes were classified as overtrained and in 50% of these cases a state of overtraining was said to have developed in the 3-month competition phase.

Meeusen et al[5] published a test protocol with two consecutive maximal exercise tests separated by four hours. With this protocol they found that in order to detect signs of OTS and distinguish from normal training responses or functional OR, this method may be a good indicator not only ofthe recovery capacity of the athlete but also of the ability to normally perform the second bout of exercise. The use of two bouts of incremental exercise to volitional exhaustion to study neuroendocrine variations identified an exercise-induced increase of adrenocorticotrophic hormone, prolactin, and growth hormone.[8] The test could be therefore used as an indirect measure of hypothalamic-pituitary capacity. In a functional-OR stage a less pronounced neuroendocrine response to a second bout of exercise on the same day is found,[14,15] while in a non-functional OR stage the hormonal response to a two-bout exercise protocols hows an extreme increased release after the second exercise trigger.[10] With the same protocol it has been shown that athletes suffering from OTS have an extremely large increase in hormonal release in the first exercise bout, followed by a complete suppression in the second exercise bout.[5] This could indicate a hypersensitivity of the pituitary followed by an insensitivity or exhaustion afterwards. Previous reports that used a single exercise protocol found similar effects.[5] It appears that the use of two exercise bouts is more useful in detecting OR for preventing OT. Early detection of OR may be very important in the prevention of OT.

On the other hand, there are many studies that report diagnosis of OR. Numerous studies have reported changes in a variety of physiological and biochemical responses to intensified training. In a study of Hooper et al reported a 2.4% increase in performance times in swimmers who were overreached compared with 1.1% decrease in well trained swimmers. Both Jeukendrup et al[16] and Snyder et al[17] reported a decrease in maximal aerobic power achieved during a graded incremental cycle test to exhaustion of approximately 3-4% as a result of 2-weeks of intensified cycling training. Jeukendrup et al[16] reported a slightly larger decline in performance (5%) when the same subjects completed a time-trial test with an approximate duration of 15-minutes. When researchers incorporate time to fatigue assessments, a larger decline in endurance capacity is evident. Fry et al[18] and Urhausenet al[19] reported a 29% and 27% decline in performance, respectively, when using a time to fatigue protocol.

PREVENTION

Diagnosis of OT or OR is difficult, authors agree that is important to prevent them.[6] Moreover, one proposed method it is of utmost importance that athletes record daily their training load, using a daily training diary or training log.[9,20]

In the studies of Meeusen et al[3] reported four methods most frequently used to monitor training and prevent OT or OR are as follows: retrospective questionnaires, training diaries, physiological screening, and the direct observational method. Also, the psychological screening of athletes and the Borg Rating of Perceived Exertion (RPE) have received more and more attention now-a-days.

In the reviews of Kreherand Schwartz[9] and Kreher[20] reported that major components of prevention are screening and education. One should educate athletes at risk for overtraining that one ofthe initial signs of overreaching is increased rating of perceived exertion for a given workload. In addition, sports medicine providers may consider preemptively asking if training has increased to compensate for decreases in performance. History of athletes should include inquiry about training (monotony, excessive load, sudden increase, caloric/hydration needs in relation to load) and personal stressors (interpersonal, family, sleep, travel).

REFERENCES

1. Halson S, Jeukendrup A. Does overtraining exist? An analysis of overreaching and overtraining research. *Sports Med.* 2004; 34(14): 967-981.

2. Armstrong L, VanHeest, J. The unknown mechanisms of the overtraining syndrome: Clues from depression and psychoneuroimmunology. *Sports Med.* 2002; 32(3): 185-209.

3. Meeusen R, Duclos M, Foster C, et al. Prevention, diagnosis, and treatment of the overtraining syndrome: Joint consensus statement of the European College of Sport Science and the American College of Sports Medicine. *Med Sci Sports Exerc.* 2013; 45(1): 186-205. doi: 10.1249/MSS.0b013e318279a10a

4. Kreider R, Fry AC, O'Toole M. *Overtraining in Sport.* Champaign, Illinois, USA: Human Kinetics. 1998.

5. Meeusen R, Piacentini MF, Busschaert B, et al. Hormonal responses in athletes: The use of a two bout exercise protocol to detect subtle differences in (over) training status. *Eur J Appl Physiol.* 2004; 91(2-3): 140-146. doi: 10.1007/s00421-003-0940-1

6. Uusitalo A. Overtraining: Making a difficult diagnosis and implementing targeted treatment. *Phys Sports Med.* 2001; 29(5): 35-50. doi: 10.3810/psm.2001.05.774

7. Lehmann M, Foster C, Keul J. Overtraining in endurance athletes: A brief review. *Med Sci Sports Exerc.* 1993; 25(7): 854-862.

8. Urhausen A, Kindermann W. Diagnosis of overtraining: What tools do we have? *Sports Med.* 2002; 32(2): 95-102.

9. Kreher JB, Schwartz JB. Overtraining syndrome: A practical guide. *Sports Health.* 2012; 4(2): 128-138. doi: 10.1177/1941738111434406

10. Barron JL, Noakes TD, Levy W, et al. Hypothalamic dysfunction in overtrained athletes. *J Clin Endocrinol Metab.* 1985; 60(4): 803-806. doi: 10.1210/jcem-60-4-803

11. Rowbottom DG, Keast D, Morton AR. The emerging role ofglutamine as an indicator of exercise stress and overtraining. *Sports Med.* 1996; 21(2): 80-97.

12. Hedelin R, Wiklund U, Bjerle P, et al. Cardiac autonomicimbalance in an overtrained athlete. *Med Sci Sports Exerc.* 2000; 32(9):1531-1533.

13. Koutedakis Y, Sharp NC. Seasonal variations of injury andovertraining in elite athletes. *Clin J Sport Med.* 1998; 8(1): 18-21.

14. De Schutter, Buyse L, Meeusen R, Roelands B. Hormonal responses to a high-intensity training period in Army recruits. *Med Sci Sports Exerc.* 2004; 36: S295.

15. Meeusen R. Overtraining and the neuroendocrine system. *Med Sci Sports Exerc.* 2004; 36: S45.

16. Jeukendrup AE, Hesselink MK, Snyder AC, et al. Physiological changes in male competitive cyclists after two weeks of intensified training. *Int J Sports Med.* 1992; 13(7): 534-541.

17. Snyder AC, Kuipers H, Cheng B, et al. Overtraining following intensified training with normal muscle glycogen. *Med Sci Sports Exerc.* 1995; 27(7): 1063-1070.

18. Fry RW, Grove JR, Morton AR, et al. Psychological and immunological correlates of acute overtraining. *Br J Sports Med.* 1994; 28(4): 241-246.

19. Urhausen A, Gabriel HH, Weiler B, et al. Ergometricand psychological findings during overtraining: A long-term follow-up study in endurance athletes. *Int J Sports Med.* 1998; 19(2): 114-120. doi: 10.1055/s-2007-971892

20. Kreher JB. Diagnosis and prevention of overtraining syndrome: An opinion on education strategies. *Open Access J Sports Med.* 2016; 8(7): 115-122. doi: 10.2147/OAJSM.S91657