

OVERTRAINING SYNDROME IN AQUATIC SPORTS

Babak Shadgan MD., MSc. Sports Medicine, Orthopaedic Fellow, Dip. FA

**Director, Sports Medicine Centre, National Olympic Academy of I.R.Iran
Chief Medical Officer, Canoe, Kayak & Water Ski Federation of I.R.Iran
Medical Committee Member, International Canoe Federation**

E-mail: b.shadgan@qmul.ac.uk

SUMMARY

It is no secret among athletes that in order to improve performance they should work hard. Some athletes fail to recover from training, become progressively fatigued, and suffer from prolonged underperformance. They may also suffer from frequent minor infections particularly respiratory infections. This condition is called the over-training syndrome. There are some other names for similar conditions like burnout, staleness or sports fatigue syndrome. There is an idea that in the absence of any medical cause, overtraining is more accurately called the Unexplained Underperformance Syndrome (UPS). This definition is the result of several years of research and studies by Dr. Richard Budgett and his colleagues in the British Olympic Medical Centre (BOMC).

“The condition is normally secondary to the stress of training and immune system impairment but the exact cause is not known, and many factors other than hard training and competition may lead to failure to recover from training or competition. The diagnosis is made if an athlete fails to recover despite two weeks of relative rest in the absence of a medical cause. UPS is most common in endurance athletes such as swimmers, cyclists, middle and long distance runners, kayakers and rowers. It is extremely rare in pure sprint and power athletes. Changes in psychological, hormonal and immune parameters have been shown in these under-performing athletes some of which may be useful as markers when used on an individual basis. Monitoring mood state, performance and heart rate may be helpful in some athletes. However the importance of any of these changes, many of which are seen in athletes without UPS when training very hard, is not fully understood.

Athletes normally recover in 6 to 12 weeks with regeneration strategies and a programme of gentle exercise far below their normal intensity. Once 20 minutes is easily tolerated then short sprints can be introduced” (Budgett et al).

INTRODUCTION

At some point during their career, a number of endurance athletes report experiencing a suppressed athletic performance, often in conjunction with one or more other physiological and/or psychological symptoms. Among others, these symptoms may include chronic fatigue, disturbed mood states, increased susceptibility to upper respiratory tract infections, changes in resting heart rate and disturbances in sleep patterns. Athletes experiencing such symptoms may be suffering from, or are at increased risk of developing, the overtraining syndrome.

In fact overtraining can best be defined as the state where the athlete has been repeatedly stressed by training to the point where rest is no longer adequate to allow for recovery. The "overtraining syndrome" is the name given to the collection of emotional, behavioural, and physical symptoms due to overtraining that has persisted for weeks to months. This is different from the day to day variation in performance and post exercise tiredness that is common in conditioned athletes. Overtraining is marked by cumulative exhaustion that persists even after recovery periods.

There are lots of terms used for Over training syndrome including unexplained underperformance syndrome (UPS), burn out, under recovery, chronic fatigue, sports fatigue syndrome, all of which are terms for the same thing.

Overtraining may be in training, in competition, on an appropriate ergometer or in the laboratory.

The incidence of overtraining in females is higher.

Symptoms

The most common symptom in athletes is fatigue and an increased sense of effort. There is often a history of particularly heavy training and competition. This may limit workouts and may be present at rest. The athlete may also become moody, easily irritated, have altered sleep patterns, become depressed, or lose the competitive desire and enthusiasm for the sport. Some will report decreased appetite and weight loss. Physical symptoms include persistent muscular soreness, increased frequency of viral illnesses, and increased incidence of injuries.

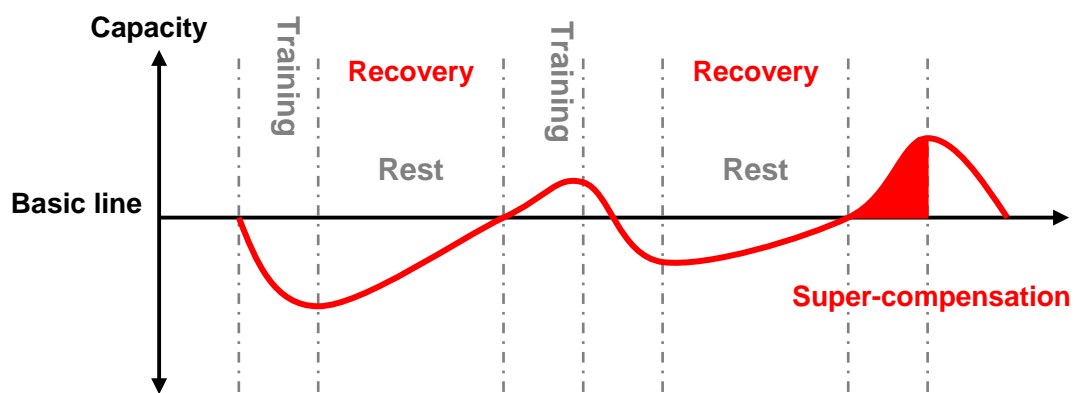
Aetiology

The reason of overtraining syndrome is still not known. There are a large number of theories and the causes could be different in different individuals.

Among the all athletes, overtraining syndrome is relatively more common in swimmers, kayakers and rowers. In these groups underperformance mostly follows a viral infection. It is assumed that higher presence of Rhino viruses (which are the most common aetiology of respiratory infections) in the aquatic environments is the main reason of the higher percentage of overtraining in the aquatic athletes. Insufficient calorie intake over many months can also lead to overtraining. The deficit may be small and subtle but must not be missed.

Diagrammatic representation of Normal training, Super compensation, Over-reaching and Over-training

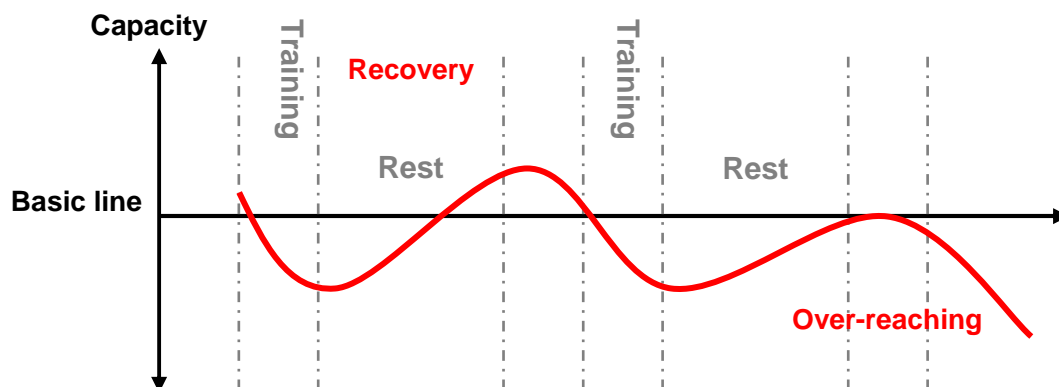
1- Normal Training & Super-compensation



Correct intensity of workout
Correct volume of workout
Enough rest periods

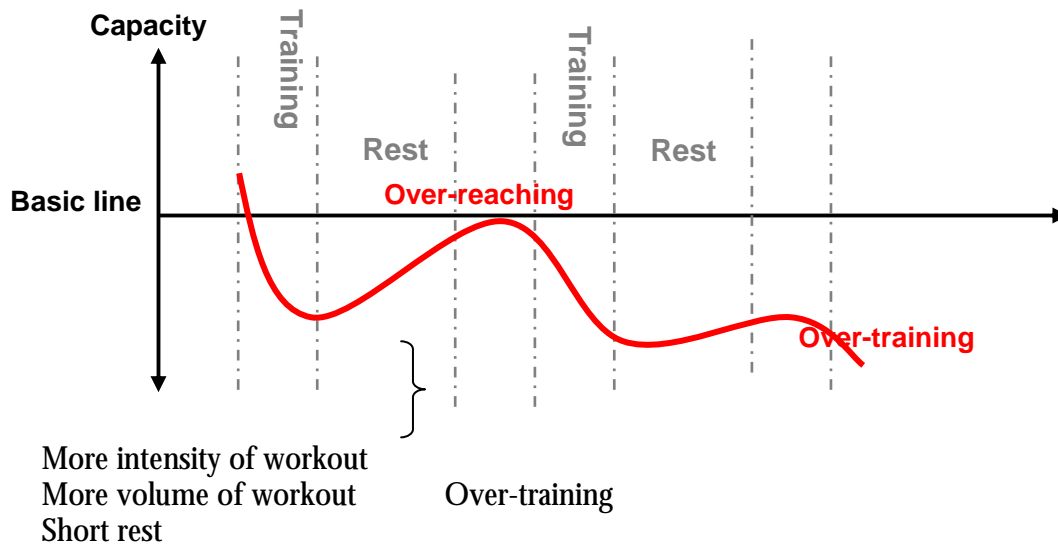
} Recovery & Super-compensation

2- More Training & Over-reaching



More intensity of workout
 More volume of workout
 Previous rest periods } Over-reaching

3- No recovery & Overtraining



DIAGNOSIS

Unlike with diagnoses of most diseases, there is not an exact criteria for the overtraining state. The diagnosis is based on three points: (1) patient history and symptoms, (2) carefully ruling out other diseases, and (3) laboratory findings.

History-taking includes a careful account of symptoms and signs. There is often a history of particularly heavy training and competition and some frequent minor respiratory infections. Overtraining symptoms are reported as: loss of energy, unexplained heavy stiff and sore muscles, mood disturbance including anxiety, depression, irritability and emotional lability, loss of competitive drive, loss of libido, loss of appetite and change in expected sleep quality.

The overtraining syndrome can only be diagnosed after clinical examination has ruled out other conditions. Diseases such as Addison's disease, anemia and other nutritional deficiencies, asthma and allergies, cardiac diseases (eg, hypertrophic cardiomyopathy), diabetes or glucose intolerance, hypo- and hyperthyroidism, infections, muscle diseases, and psychiatric disorders can mimic overtraining.

Laboratory tests for differential diagnosis and laboratory findings that can be connected to decreased performance capacity are helpful. Several laboratory parameters have been proposed to indicate an impending or actual overtraining state: a decrease in testosterone and increase in cortisol concentration, or a decrease in their ratio; decrease

in nocturnal catecholamines; changes in catecholamine concentration in blood during rest and after exercise; decrease in maximal blood lactate concentration; decrease in plasma glutamine concentration; increase in uric acid and creatine kinase concentrations (reflecting overload at the muscle level). Increase in morning heart rate and increased postural dizziness (due to a drop in blood pressure) are commonly reported.

A Sports Medicine Doctor can exclude many possible causes and diagnose UPS with a careful history and examination and clinical tests. This is an important role of an expert coach to feel this condition in the athlete and refer him or her to a Sports Medicine Doctor as soon as possible.

PREVENTION

Prevention is the best treatment for the overtraining state. Tapering the training regimen combined with rest, proper nutrition, and sleep help the body heal. A qualified coach or manager should know about overtraining and try to prevent this dangerous problem. It is important to optimise training and recovery with appropriate periodisation.

The most crucial time to take care is probably at the end of a period of recovery and tapering (has the athlete fully recovered?), and also just before the hardest training weeks (can the athlete tolerate that last hard week?).

In aquatic athletes prevention of infections is crucial. According to the new studies, it is approved that using Glutamine tablet, which is one of the sports supplements, plus vitamin C are very important to fortify the immune system and therefore prevention of infections especially in swimmers and rowers before competitions.

Another important preventive consideration is providing a good and full of carbohydrate diets. The reason is that depletion of glycogen stores in athletes make them vulnerable to fatigue and UPS.

TREATMENT

The treatment for the overtraining syndrome is rest. The longer the overtraining has occurred the more rest required. Therefore, early detection is very important. If the overtraining has only occurred for a short period of time (e.g., 3 - 4 weeks) then interrupting training for 3 - 5 days is usually sufficient rest. After this, workouts can be resumed on an alternate day basis. The intensity of the training can be maintained but the total volume must be lower. It is important that the factors that lead to overtraining be identified and corrected. As well as following a graded exercise regime they must concentrate on regeneration strategies which simply mean optimum diet, good food intake, regular sleep, reduction of stresses as much as possible and relaxation.

Otherwise, the overtraining syndrome is likely to recur. The alternate day recovery period is continued for a few weeks and then an increase in volume is permitted. In more severe cases, the training program may have to be interrupted for weeks, and it may take months to recover. An alternate form of exercise can be substituted to help prevent the exercise withdrawal syndrome.

In a similar way, Budgett (2000) suggests that the exercise programme should start with a small volume at low intensity (heart rate approximately 120 bpm). This may only be tolerated for 5 to 10 minutes but should be built up to 20 minutes as quickly as possible. Once 20 minute of gentle exercise has been reached then short sprints can be started to three times per week. The sprints must be less than 10 seconds with at least 3 minutes of complete rest between each effort and a maximum of 10 intense sprints in one session. The gentle endurance exercise like mild swimming or paddling of 20 minutes can be split into 10 minutes before as warm up and 10 minutes after as wind down. Recognition and treatment of depression is important. Therapies such as massage and sauna baths can speed recovery.

CASE STUDY

Marta was a 25 years old competitive kayaker. She doubled her training when she joined the National squad. Her job and social life had to fit in with her training. She was not very ambitious at work and her social life was minimal. Marta had been in the same job for three years. She was promoted at work about six months prior to his symptoms presenting. Her responsibilities shifted from being a duty manager to being manager. Her performance was improving but then she became increasingly fatigued with heavy legs, loss of motivation and a raised resting pulse rate.

In addition to her suppressed performances, additional symptoms that Marta experienced included chronic fatigue, exercise-induced asthma, delayed recovery from training and competition, loss of enjoyment in running, muscle pain, muscle weakness, headaches, sleep disturbance and cognitive complaints. Marta's experiences of the overtraining syndrome were rather detrimental to her life as an athlete. As a result of her symptoms, Marta had not been able to achieve the goals that she had set at the beginning of the season. Referring to her expert coach she followed a recovery programme over the next 6 weeks and was subsequently selected for the Commonwealth Games.

CONCLUSION

The diagnosis of unexplained underperformance syndrome is difficult. The prevailing wisdom is that it is better to be under-trained than over-trained. Rest is a vital part of any athlete's training. There is considerable evidence that reduced training (same intensity, lower volume) for up to 21 days will not decrease performance. A well-planned training program involves as much art as science and should allow for flexibility. Early warning signs of overtraining should be heeded and schedule adjustments made accordingly. Smart training is the path to faster times and good health.

When planning an athlete's training regimen and competitive season, a coach should consider all aspects of the athlete's life. In terms of non-training stress, it is imperative that coaches consider modifying their athletes' training loads when they are experiencing periods of non-training stress (eg, examinations, relationship difficulties). Modifying the training load may enable an athlete to accommodate the accumulation of

stress that he/she is experiencing, ensuring that their ability to adapt is not compromised in any way and thus possibly preventing the development of the overtraining syndrome. Professional athletes should be under supervision of an experienced multi-disciplinary team including their team doctor, psychologist, sports dietician, physiotherapist and coach.

References

1. Budgett R. The overtraining syndrome. *Coaching Focus* 1995; 28: 4-6.
2. Budgett R. Fatigue and underperformance in athletes: The overtraining syndrome. *BMJ* 1998; 32: 107-110
3. Budgett R, Newsholme E, Lehmann M, Sharp C et al Redefining the overtraining syndrome as the unexplained underperformance syndrome. *Br J Sports Med* 2000;34:67-68
4. Fry RW, Morton AR, Keast D: Overtraining in athletes. An update. *Sports Med* 1991;12(1):32-65
5. Houmard JA: Impact of reduced training on performance in endurance athletes. *Sports Med* 1991;12(6):380-393
6. Lehmann M, Foster C, Keul J: Overtraining in endurance athletes: a brief review. *Med Sci Sports Exerc* 1993;25(7):854-862
7. Uusitalo AL, Uusitalo AJ, Rusko HK: Heart rate and blood pressure variability during heavy training and overtraining in the female athlete. *Int J Sport Med* 2000;21(1):45-53
8. Seals DR, Chase PB: Influence of physical training on heart rate variability and baroreflex circulatory control. *J Appl Physiol* 1989;66(4):1886-1895
9. Budgett R. The overtraining syndrome. *British Medical Journal* 1994; 309: 4465-8.
10. Essau CA, Jamieson JL: Heart rate perception in type A personality. *Health Psychol* 1987;6(1):43-54
11. Koutedakis Y and Sharp CC: Seasonal variations of injury and overtraining in elite athletes. *Clin J Sport Med* 1998;8(1):18-21
12. O'Connor PJ, Morgan WP, Raglin JS: Psychobiological effects of 3 d of increased training in female and male swimmers. *Med Sci Sports Exerc* 1991;23(9):1055-1061
13. Lehmann MJ, Lormes W, Opitz-Gress A, et al: Training and overtraining: an overview and experimental results in endurance sports. *J Sports Med Phys Fitness* 1997;37(1):7-17

14. Opstad K, Aakvaag A: The effect of a high caloric diet on hormonal changes in young men during prolonged physical strain and sleep deprivation. *Eur J Appl Physiol Occup Physiol* 1981;46(1):31-39
15. Koutedakis Y, Budgett R, Faulmann L. Rest in underperforming elite competitors. *British Journal of Sports Medicine* 1990; 24: 248-52.
16. Spiegel K, Leproult R, Van Cauter E: Impact of sleep debt on metabolic and endocrine function. *Lancet* 1999;354(9188):1435-1439
17. Urhausen A, Gabriel HH, Kindermann W: Impaired pituitary hormonal response to exhaustive exercise in overtrained endurance athletes. *Med Sci Sports Exerc* 1998;30(3):407-414
18. Häkkinen K, Pakarinen A, Alen M, et al: Relationships between training volume, physical performance capacity, and serum hormone concentrations during prolonged training in elite weight lifters. *Int J Sports Med* 1987;8(Suppl):61-65
19. Duclos M, Corcuff JB, Arsac L, et al: Corticotroph axis sensitivity after exercise in endurance-trained athletes. *Clin Endocrinol (Oxf)* 1998;48(4):493-501
20. Koutedakis Y, Frischknecht R, Vrbova G, et al: Maximal voluntary quadriceps strength patterns in Olympic overtrained athletes. *Med Sci Sports Exerc* 1995;27(4):566-572
21. Lehmann M, Schnee W, Scheu R, et al: Decreased nocturnal catecholamine excretion: parameter for an overtraining syndrome in athletes? *Int J Sport Med* 1992;13(3):236-242
22. Dishmann RK: Brain monoamines, exercise, and behavioral stress: animal models. *Med Sci Sports Exerc* 1997;29(1):63-74
23. Heyes MP, Garnett ES, Coates G: Central dopaminergic activity influences rats ability to exercise. *Life Sci* 1985;36(7):671-677
24. Wittert GA, Livesey JH, Espiner EA, et al: Adaptation of the hypothalamopituitary adrenal axis to chronic exercise stress in humans. *Med Sci Sports Exerc* 1996;28(8):1015-1019
25. Furlan R, Piazza S, Dell'Orto S, et al: Early and late effects of exercise and athletic training on neural mechanisms controlling heart rate. *Cardiovasc Res* 1993;27(3):482-488
26. Lehmann M, Knizia K, Gastmann U, et al: Influence of 6-week, 6 days per week, training on pituitary function in recreational athletes. *Br J Sports Med* 1993;27(3):186-192
27. Lehmann M, Baumgartl P, Wiesenack C, et al: Training-overtraining: influence of a defined increase in training volume vs training intensity on performance, catecholamines and some metabolic parameters in experienced middle- and long-distance runners. *Eur J Appl Physiol Occup Physiol* 1992;64(2):169-177
28. Uusitalo AL, Huttunen P, Hanin Y, et al: Hormonal responses to endurance training and overtraining in female athletes. *Clin J Sport Med* 1998;8(3):178-186

29. Costill DL, Flynn MG, Kirwan JP, et al: Effects of repeated days of intensified training on muscle glycogen and swimming performance. *Med Sci Sports Exerc* 1988;20(3):249-254
30. Keast D, Arstein D, Harper W, et al: Depression of plasma glutamine concentration after exercise stress and its possible influence on the immune system. *Med J Aust* 1995;162(1):15-18
31. Shephard RJ, Shek PN: Acute and chronic over-exertion: do depressed immune responses provide useful markers? *Int J Sports Med* 1998;19(3):159-171
32. Snyder AC, Jeukendrup AE, Hasselink MK et al: A physiological/psychological indicator of over-reaching during intensive training. *Int J Sports Med* 1993;14(1):9-32
33. Morgan WP, Costill DL, Flynn MG, et al: Mood disturbance following increased training in swimmers. *Med Sci Sports Exerc* 1988;20(4):408-414
34. O'Connor PJ, Morgan WP, Raglin JS, et al: Mood state and salivary cortisol levels following overtraining in female swimmers. *Psychoneuroendocrinology* 1989;14(4):303-310
35. Tremblay MS, Chu SY, Mureika R: Methodological and statistical considerations for exercise-related hormone evaluations. *Sports Med* 1995;20(2):90-108
36. Kirwan JP, Costill DL, Flynn MG, et al: Physiological responses to successive days of intense training in competitive swimmers. *Med Sci Sports Exerc* 1988;20(3):255-259
37. Barbeau P, Serresse O, Boulay MR: Using maximal and submaximal aerobic variables to monitor elite cyclists during a season. *Med Sci Sports Exerc* 1993;25(9):1062-1069
38. Costill DL, Bowers R, Branam G, et al: Muscle glycogen utilization during prolonged exercise on successive days. *J Appl Physiol* 1971;31(6):834-838
39. Vervoorn C, Vermulst LJ, Boelens-Quist AM, et al: Seasonal changes in performance and free testosterone: cortisol ratio of elite female rowers. *Eur J Appl Physiol Occup Physiol* 1992;64(1):14-21
40. Banfi G, Marinelli M, Roi GS, et al: Usefulness of free testosterone/cortisol ratio during a season of elite speed skating athletes. *Int J Sports Med* 1993;14(7):373-379
41. Hoogeveen AR, Zonderland ML: Relationships between testosterone, cortisol and performance in professional cyclists. *Int J Sports Med* 1996;17(6):423-428
42. Hackney AC, Fahrner CL, Gullledge TP: Basal reproductive hormonal profiles are altered in endurance trained men. *J Sports Med Phys Fitness* 1998;38(2):138-141
43. Fry AC, Kraemer WJ, Ramsey LT: Pituitary-adrenal-gonadal responses to high-intensity resistance exercise overtraining. *J Appl Physiol* 1998;85(2):2352-2359

44. Rowbottom DG, Keast D, Garcia-Webb P, et al: Training adaptation and biological changes among well-trained male triathletes. *Med Sci Sports Exerc* 1997;29(9):1233-1239
45. Fry RW, Morton AR, Keast D: Periodisation and prevention of overtraining. *Can J Sport Sci* 1992;17(3):241-248
46. Trine MR, Morgan WP: Influence of time of day on psychological responses to exercise. *Sports Med* 1995;20(5):328-337

More study

1. JH Williams, JF Signorile, WS Barnes and TW Henrich , Caffeine, maximal power output and fatigue, *British Journal of Sports Medicine*, Vol 22, Issue 4 132-134
2. R Budgett , Overtraining syndrome, *British Journal of Sports Medicine*, Vol 24, Issue 4 231-236
3. T Verde, S Thomas and RJ Shephard , Potential markers of heavy training in highly trained distance runners, *British Journal of Sports Medicine*, Vol 26, Issue 3 167-175, Copyright
4. RW Fry, JR Grove, AR Morton, PM Zeroni, S Gaudieri and D Keast , Psychological and immunological correlates of acute overtraining, *British Journal of Sports Medicine*, Vol 28, Issue 4 241-246
5. R Mullis, IT Campbell, AJ Wearden, RK Morriss and DJ Pearson , Prediction of peak oxygen uptake in chronic fatigue syndrome, *British Journal of Sports Medicine*, Vol 33, Issue 5 352-356
6. R Budgett , Fatigue and underperformance in athletes: the overtraining syndrome, *British Journal of Sports Medicine*, Vol 32, Issue 2 107-110
7. KJ Kingsbury, L Kay and M Hjelm , Contrasting plasma free amino acid patterns in elite athletes: association with fatigue and infection, *British Journal of Sports Medicine*, Vol 32, Issue 1 25-32