**Overtraining versus Over-reaching.**

*( I wish to thank Dr. Liam Hennessy ,MSc., PhD. for this article. Liam is an Exercise Physiologist and* *Sport Scientist who for many years worked with Bayern Munich , the Irish International Rugby team,* *and was national Coach for Coach Education and Sport Science in Ireland . He was a consultant in the* *Blackrock Clinic and is now the Director of Setanta College . The following is the text of a key-note* *lecture which he delivered at the National Coaching Conference in the University of Limerick a* *number of years ago ).*

**Overtraining can be defined as an imbalance between training and recovery.**  Training is a process of overloading the body’s fitness capacities producing temporary breakdown . However, with sufficient recovery, growth or adaptation occurs. Training , therefore, temporarily disrupts the body’s normal homeostasis or state of balance .  **If sufficient recovery does not follow a training stress, then the body does not make positive** **adaptations.** Thus, in order to benefit from training , overload and recovery strategies must be carefully combined. When recovery is compromised on a regular basis , then the athlete is exposed to chronic overwork or overtraining.

**Over-reaching , on the other hand, is a training process whereby overload temporarily outbalances** **recovery .** It can be a useful method of stimulating the body to greater levels of adaption . Caution, however, should be exerted when using over-reaching periods because **there is a fine line between over-reaching and overtraining.**

The two processes are defined by Sport Scientists as follows :

Overtraining ( O/T ) or Staleness is an accumulation of training or non-training stress , resulting in a long-term decrement in performance capacity with or without related physiological and psychological signs and symptoms of O/T . **Restoration of performance capacity may take several weeks or months.**

Over-reaching ( O/R) is an accumulation of training or non-training stress resulting in a short -term decrement in performance capacity with or without related physiological and psychological signs and symptoms of overtraining . **Restoration of performance capacity may take from some days to some weeks .**

While it can be difficult to diagnose overtraining, numerous symptoms are associated with its onset – the obvious signs being a plateauing or reduction in performance despite continued overload . The other usual signs of overtraining are as follows ( with quotes from athletes suffering from the condition : Fatigue : “getting out of bed is hard”. Emotionality : “snappiness at work”. Lack of Concentration: “ Concentration -out the window”. Physical Complaints e.g. diarrhoea. Sleep problems : “ I have trouble getting to sleep”. Appetite changes : “ Not able to eat well”. Mood swings , increased irritability , sleeping disturbances ,loss of appetite , anorexia or semi-anorexia, anger and depression are all symptoms of overtraining .A lack of enthusiasm or motivation for training and /or competition is frequently reported as a subjective marker of overtraining. While most coaches appreciate the importance of regular communication with athletes, it is important that details regarding the athlete’s psychological response to training are recorded . **Maintaining a detailed record of the athlete’s mood, enthusiasm and sleeping patterns may help to** **prevent the athlete entering into a state of overtraining.**

**General Adaption Syndrome ( GAS ) :** at this point let us pause for a moment and refresh our memory of how a positive training effect occurs. The general adaption syndrome as described by Selye in the 1970s is still the classic template for improved performance in athletic performance. Selye suggests that all physical and ,indeed , environmental /psychological stressors produce general responses. There are 3 phases to Selye’s General Adaption Syndrome: (a) During and following a stressor ( i.e. a hard session/workout ) the human body recognises and reacts to the stressor (s). The response or reaction includes several general changes such as an increase in heart rate , blood pressure and hormone concentration , just to name a few. Breakdown follows as a direct consequence of training. The most obvious example of breakdown being a reduction in fuel stores. For example muscle glycogen is significantly reduced following prolonged exercise at submaximal pace.  **Therefore ,careful attention to good nutritional habits is one essential factor in the recovery process.**  Breakdown, in the form of structural damage within the muscle cell, also occurs . During recovery new proteins are built into new tissue to restore and improve muscle architecture. (b) A resistance stage follows the training stressor with the body adapting through a process of repair and recovery and then , if the recovery proves successful , **overcompensation.** (c) The body’s defence mechanisms are overwhelmed and positive adaptation is no longer possible. This stage, (c) , corresponds to a state of overtraining which requires an extensive recovery period. The duration required to recover previous performance capacities may range from some weeks to several months.

It has been argued that the more the athlete trains , the more the athlete responds or gains. Inaddition, phrases such as “No pain , no gain” have become common place in training jargon. Whilethere will always be an element of truth in this phrase, it is the chronic use of pain without **sufficient recovery and regeneration ,** that creates a problem for the athlete . Therefore it seems logical that if the athlete constantly trains through the pain barrier then over-reaching and possibly overtraining will occur. A number of experts have suggested that highly motivated female athletes are the most predisposed to overtraining .

In one particular study , decreased endurance running performances were reported after deliberate intensive interval training for 10 days. The time taken to reach exhaustion at 18Km./hour decreased by 29% from Day 1 to Day 11. Decreases in VO2 max. have also been reported as a result of excessive prolonged exercise in endurance athletes. In David Costill’s 1970 classic study three successive days of running 16.1Km. ( or 10 miles) at 80% of VO2 max. resulted in significant decreases in peak oxygen uptake. Regular performance tests ( conducted on a treadmill in a lab. )can help to plot progress and particularly help chart a plateau in performance.

The same decreases or a plateau in strength performances have also been associated with the overtrained sprint and strength/power athlete . When experienced weight-trained athletes performed 10 repetitions of maximum effort on 6 days per week , symptoms of overtraining were reported during the second week of training. The system of “training to failure” (i.e. to exhaustion ) for muscle mass and strength was shown to produce inferior results and overtraining symptoms compared to more varied training programmes. It is clear that that both aerobic and anaerobic sport athletes are susceptible to persistent muscle breakdown with excessive training.

**Complexities of Overtraining.** Two types, and causes, of overtraining have been identified : 1. Monotonous programme overtraining , where a plateau or decrease in performance occurs due to a constant use of the same type of exercise during training.

 This is frequently accompanied by decreased motivation in the athlete. Some experts , such as Hakkinen and Komi in Finland ,suggest that monotonous overtraining may also result in in a maladaption in the central nervous system giving rise to a distorted motor pathway .Chronic fuel depletion in the active muscles is also a possibility resulting in a decreased exercise capacity. 2. Overwork is the second type of overtraining which in almost all athletes is accompanied by fatigue and a variety of psychological changes and measurable physiological changes which occur in tandem with performance deterioration.

**Good Nutrition Strategies are important in Promoting Recovery.**

 Ensuring a plentiful intake of both carbohydrates and protein is important for all athletes . Nieman recently showed how athletes who consumed carbohydrates during training had lower stress responses compared to those who did not consume carbohydrates. In other words , there was a greater capacity to restore muscle fuel and to repair tissue damage as a consequence of ingesting carbohydrates during exercise. It is important to note that less than adequate glycogen stores prior to training can result in an increased demand on protein as fuel . Research conducted in the University of Memphis in 1995 outlined how athletes who consumed additional protein were less likely to develop overtraining symptoms compared to athletes who completed the same training but did not ingest additional protein . Also, recent evidence supports the ingestion of **both** carbohydrates and protein immediately post-exercise. The addition of protein to the post -exercise beverage or meal speeds up the refuelling process. Another recent study from Peters and colleagues showed how athletes who consumed 500mg. of Vitamin C daily had less risk of incurring an infection compared to those who did not take Vitamin C but who had similar training routines . Therefore , it is clear that nutritional strategies enhance the recovery process.

**Variety enhances Performance.**

Webber and colleagues, also from the University of Memphis, showed how three sessions per week of exhaustive strength training brought diminished performances in strength and power compared to a periodised programme where intensity was varied over the three sessions . While not all studies report greater performance gains as a result of periodised programmes , there is good evidence to show that periodisation of training\* helps to reduce the risk of overtraining especially in elite athletes.

*\* The whole topic of periodisation will be discussed in a future article.*

**Moderate vs. Intense Exercise .**

It is well appreciated that regular moderate -intensity exercise confers beneficial effects on health and fitness . When athletes are well trained,  **but not overtrained, a stable immune and hormonal profile seems to exist between different types of athletes.** There is sufficient evidence to suggest that long-term aerobic training has beneficial effects on the immune system .This is one reason why regular aerobic exercise is associated with positive health benefits, The relative intensity of training seems to be a key factor in promoting either normal/beneficial or adverse effects. It is not clear if anaerobic training confers the same positive immune adaptations. Further research is needed within this area before more definitive conclusions can be made.

**Overreaching : a feature of Advanced training programmes.**

In athletic training , overreaching is frequently used for inducing delayed improvements in performance especially in elite athletes. This strategy involves an increase in training volume or intensity for a short period producing a ***decrease***  in performance.  **Subsequent rest ,detraining or tapering brings performance to a higher than previous level.** This increased level of fitness has also been termed **superovercompensation .** Training camps ,usually held for some days or some weeks , are typically overreaching experiences .  ***( The Kenyan athletes go into such a camp for up to six weeks prior to the World Cross -Country*** ***Championships ; the Spanish and Portugese used to do the same . In those camps they train three*** ***times per day with at least four high quality sessions per week ) .*** An overload of training like this , if done properly and very carefully , produces this desired super-overcompensation effect if followed by a taper lasting from 10 days to 3 weeks.

When training camps are conducted , it is recommended that they be planned with great care especially if they precede competition. A similar period/duration of recovery or light training should occur following the training camp. This then may allow an element of super-overcompensation to take place before competition .  **Performances will most certainly be decreased if competition occurs immediately following a** **training camp where an increased volume/intensity of training has been completed.** Also there are periods during an athlete’s training year where intense periods of training ( i.e. peak in mileage ) are planned . For example , a 1500m.runner may have a reduction in race performance as a result of overdistance /cross-country training early in the season when trying to increase the aerobic base or VO2 max. Overreaching can occur in this period and a subsequent period of reduced training volume can lead to a higher performance level.

**To Sum Up : When using overreaching strategies , it is vitally important that the duration of overwork is carefully monitored and deliberate recovery strategies follow . Otherwise a drift into overtraining can easily occur.**

**Non-Training stressors compromise the recovery process .**

Emotional stress or stress occurring in work situations impose an additional burden on the athlete. When additional non-training stressors are superimposed on intense training , the end result may be a rapid deterioration into an overtrained state . Increased levels of stress hormones adversely affect the body’s ability to replace muscle fuel. With constant exposure to stress, the capacity to refuel and repair is hampered . The combined effects of environmental and training stressors are therefore cumulative and can lead to psychological symptoms of apathy and excessive fatigue. Thus , a cocktail of debilitating events can accumulate in a relatively short period of time which may necessitate a prolonged period off training, or very light training, in order to recover psychologically and physiologically . Fry and his colleagues noted that this recovery period varied from 2 weeks to 2 months in subjects who were deliberately overtrained .

 *(A classic example would be Sonia O’Sullivan who took a long time to recover from having overtrained before the Atlanta Olympics . The trauma of what happened to her in those Games , combined with other emotional stressors , resulted in Sonia being a pale shadow of her true self throughout the rest of that year and ,indeed , all of the following year also . But she bounced back better than ever in 1998 with her two remarkable victories in the World Cross in Marrakech followed by a 5000/10000m. double in the European Championships in Budapest. P.McD..)*

Limiting an athlete’s exposure to external stressors is therefore advised during periods of intensetraining and competition . This may mean having controlled rest periods between stressors so thatthe athlete’s exposure to any stress is limited . A good coach plays a key role in controlling and monitoring the stressors imposed upon an athlete .

**The Open Window Theory :** Mackinnon ( 1996 ) has proposed the Open Window model to explain why athletes may besusceptible to post-exercise illness. With chronic hard training this “open window” period becomes extended .What happens in the immediate aftermath of hard training ?

A transient suppression of several immune indices ( natural killer cells , T-cells, helper:suppressor ratio ) and immune nutrients ( glutamine ) occurs after prolonged endurance training/competition. With overtraining this “open window” becomes extended i.e. the duration of immune-suppression extends for a longer period.  **The Importance of Sleep.** During sleep , growth hormone is released into the system . Growth hormone is central in repairing and building . Thus the body works during sleep to repair and build . Athletes who take daily siestas have an advantage over athletes who spend morning to night awake . The peak in growth hormone occurs during the first few hours of sleep . Afternoon naps not only allow the body to recover but also limit the athlete to other stressors which may hinder recovery and adaptation . The message for all athletes is to exploit this hormonal peak by getting regular siestas in addition to a good night’s sleep so that maximal recovery and growth can take place .

**How to Avoid Overtraining.**

**1. Adhere to the Principles of Training: \* Overload gradually -** avoid sudden increases in training volume and/or intensity.

**\* Avoid long Overreaching periods**

**\* Use variation in volume and intensity of training.**

**\* Use variety of exercise type and training location to avoid monotonous overtraining.**

**\* Use adequate recovery , during sessions and between sessions , remembering that it is during the recovery stage that the body adapts . Sleep is an important component of the recovery process.**

**\* Ensure good nutrition habits : many athletes may not be ingesting enough carbohydrate and protein to fuel exercise and to promote recovery and growth.**

**2. Monitor the Athlete .**

**\* Weigh the athlete regularly.**

**\* Record sleeping Heart Rate, waking H/R and exercise H/R.**

**\* Record details of athlete’s sleep patterns , mood changes and enthusiasm.**

**\* Perform regular physiological and performance tests ( i.e. blood pressure , power tests ( aerobic , anaerobic , and repetition max.tests ) , blood lactate measurement , nitrogen excretion if possible and where appropriate.**

**\* Complete regular blood and urine tests .( regular iron status monitoring for female athletes is highly recommended ). Other more sophisticated tests such as catecholamines, hormone levels and immune cell markers can be helpful but may be impractical.**

**\* Monitor appetite and occasional dietary records.**

**\* Use a training diary to record all above details.**

**3. In the Open Window Phase. \* Allow sufficient recovery . \* Ensure good nutrient intake . \* Limit exposure to other stressors and avoid places/contact with potential infection.**

So, there you have it. My thanks again to Dr. Liam Hennessy for this very erudite article . You can see why he so strongly emphasises the following

(a) **gradual increases in training,** not sudden increases in either quantity or quality . (b)  **sufficient recovery** between hard work-outs. (c) **the importance of hydration and nutrition**  (d) **the importance of sleep and rest.** ( e)  **regular monitoring of the athlete including weighing and blood testing.**

**He is also at pains to point out that “Overreaching” is largely for elite athletes and has to be monitored very carefully indeed or it can easily descend into over-training.**

***\*The next article, appropriately enough, will deal with nutrition and hydration .***