DIAGNOSING AND MANAGING FATIGUE IN ATHLETES

Presented to Sports Science and Sports Medicine professionals within the National Elite Sports Council network, October 2003

Presenters & Panel members:

- Coaches - Pierre LaFontaine, Phil Brown and Dick Telford
- Strength and Conditioning - Trent Lawton
- Medicine - Greg Lovell
- Physiotherapy - Craig Purdam
- Physiology - Allan Hahn, Dave Martin, Shona Halson and Esa Peltola
- Performance Analysis - Keith Lyons
- Psychology - Gavin Freeman
- House parent at AIS - Andrea Farrow

Session Chairs:

- Drs Dave Martin & Shona Halson

Discussion Chair:

- Prof Peter Fricker

Introduction

One of the responsibilities of the Technical Direction Division at the Australian Institute of Sport (AIS) is to conduct two professional seminars or workshops each year on issues of particular interest to those who work in the area of sport.

It is intended that a summary of proceedings of each of these activities be available to all interested parties via the internet and through peak bodies such as the National Executive Sports Council (NESC), which represents the AIS and all State Institutes and Academies of Sport in Australia.

Conducting these workshops is seen as part of the broad leadership role of the AIS.

This desire to hold this particular workshop resulted from informal discussions with a number of senior AIS Athlete and Coach Service (A&CS) providers who highlighted “athlete fatigue” a well-researched, but poorly understood topic relevant to almost all sports science/sports medicine (SSSM) disciplines. It was considered a significant opportunity to bring together professionals from across SSSM to more formally discuss issues and strategies for diagnosing and managing fatigue in athletes.

Aims

1. To learn and discuss how fatigue in athletes is diagnosed and managed
2. To discuss current techniques for diagnosing and measuring fatigue
3. To identify through discussion a process or strategy to assist all in managing and diagnosing fatigue.

The workshop was video & audio taped. Ms Naomi Datson (AIS Physiology) has kindly transcribed the presentations and discussion points raised.
Fatigue is not an easy concept to describe, as its definition may alter depending on an individual’s role. Athletes, coaches, medical doctors, psychologists, dieticians and physiologists all consider fatigue from a slightly different angle.

A broad definition is “an inability to perform at a level that was once possible in recent history”. This inability to perform must not be due to sickness, injury or detraining but must specifically be related to some aspect of fatigue.

Fatigue is not always negative. In fact it can often lead to a training adaptation and, therefore, it is not necessary to prevent fatigue entirely but to manage it.

Training itself can induce fatigue and consequently disrupt homeostasis. After training there is usually a period of recovery in which the changes from training are essentially reversed. Hopefully, if fatigue has been induced and there is also a suitable recovery, then there will be a period of supercompensation, which in turn leads to an increased capacity.

It is valuable to consider what constitutes normal and abnormal levels of fatigue. Fatigue during normal training can be used as a baseline reference and when fatigue becomes elevated above this point, particularly for a prolonged period of time, there may be cause for concern and a suitable course of action must then be considered.

Overreaching and overtraining are best defined by the overtraining continuum. If you continually train with an appropriate recovery you can have an increase in the state of fatigue and also an increase in severity of symptoms that are associated with this fatigue. On the left hand side of the continuum you have acute fatigue, which is normally experienced after 1, 2, or 3 bouts of intensified training. If you continue to intensify training without a sufficient recovery this can lead to a state of overreaching, and at the end of the continuum is overtraining. The primary difference between overreaching and overtraining is the time that it takes to recover, and it is thought that overreaching leads to overtraining. Overreaching is not necessarily a negative concept, appropriate recovery from an overreaching period where there has been intensified training, can lead to supercompensation in performance. The problems may occur if an individual is at the right hand end of the continuum and in a serious state of fatigue, as this can take months and in some cases years to alleviate.

Tim Noakes, a well-respected exercise physiologist has stated that one of the main weaknesses we have in our current thinking in exercise physiology is that we lack knowledge about the precise factors that determine fatigue and hence limit performance. We do not have a grasp on fatigue because every person that deals with an athlete only considers his or her own perspective. A combination of areas is required in order to lead to a greater understanding.

The diagnosis of an athlete, who presents to a medical clinic with a relatively short period of fatigue, usually centres around three factors:

1. Excessive training or poor response to excessive training
2. Psycho-social factors
3. Presence of infection

Significant medical or surgical illness is rare in the athletes we see. As with any general medical problem, the starting point is the individual’s history, including past medical history, recent medical conditions, past surgical history, recent injury or illness, medications, other drugs that may have been taken, supplements, smoking, alcohol, diet, allergies and, in females, menstrual history.
The duration of the individual’s tiredness and its estimated effect on training can be divided into four groups:

1. Able to cope with full training
2. 50-100% of training
3. 0-50% of training
4. No training at all

It may also be beneficial to assess the intensity of training and in particular the recent training history as often there will have been a significant increase.

Other factors that may merit investigation include psychological conditions (minor degrees of depression which are termed unhappiness and anxiety), social history (school, work, money, and relationships), sleep pattern, weight and skin fold changes. The social history is particularly important in a large number of AIS scholarship holders as they often move away from their friends and families at a young age.

Following the history, a clinical examination is conducted, and then a specific examination of areas that may have been highlighted by the history. The next and most controversial area of our evaluation is pathology testing. The evidence for the utility of blood testing in tired athletes is zero, as there have been no papers published on the topic. It is however recommended that the routine testing in such circumstances should include a full blood count and other tests can be used if clinically indicated. Consideration of all these factors will lead to a clinical diagnosis.

It may be advantageous in the future to train some of the AIS residential athletes in stress, conflict, relationships and time and money pressures, and to ascertain whether this has a significant effect on the incidences of tiredness.

Question: What percentage of tired athletes’ diagnostic work looks normal?

The majority of athletes’ blood tests are normal with minor, predominantly viral infections being common. Most cases of fatigue that we see are a combination of training load and psycho/social stress. We have just started a tired athlete study (6 week duration, n = 6) looking at the diagnosis of tired athletes. We have found that two cases are due to psycho/social stress; two are due to psycho/social stress plus overreaching, one to overreaching alone and one post viral. This distribution is representative of what we tend to see.

Key Point – the majority of tired athletes are trying to deal with training loads that are slightly more than they are used to and may also be experiencing psycho/social stresses.

Louise Burke (Nutrition) – via telephone link up

Question: What is the thought process and which factors would you consider when an athlete tells you that they are tired?

The starting point is for the athlete to try and describe the tiredness. Is it a tiredness that they wake up with or does it begin during exercise? The next issue is to consider dietary causes that could have an acute effect on fatigue such as inadequate carbohydrate intake, fuel depletion and dehydration. These can have a profound effect on fatigue in an acute manner, i.e. one training session to the next or one day to the next. Conversely, there is a new syndrome called energy drain, which is a chronically occurring nutritional inadequacy syndrome. Energy drain results when an athlete is restricting calorie intake or increasing training to a point where there is a chronic mismatch between the energy intake and the energy expenditure below a certain threshold. Effects have been found on both hormonal and metabolic systems within the body, however it is a complex area and it is hard to pinpoint at which point these effects are becoming detrimental. It is rare that deficiency of a micronutrient in the diet will cause fatigue. However, it is likely that if an individual has an inadequate intake of a micronutrient they are likely to also have an inadequate intake of a macronutrient. So, I would look at the nutrient mismatches for both sub optimal intake or expected utilisation and then examine a series of corrective tools.
**Question:** Which athletes do you have the most fatigue complaints from?

The athletes that undergo a heavy training programme with respect to both volume and intensity, such as rowing, cycling, triathlon and distance running have a high incidence of fatigue. Fatigue complaints are also common in individuals who have a concern with their body fat and/or body weight. Particular care must be taken with athletes who are training hard and who are also trying to decrease their calorie intake to maintain or reduce body fat. Decreasing energy intake reduces the opportunity to consume all the required nutrients.

Being fatigued is a side effect of being an athlete and it is often hard to differentiate between the fatigue that you can live with, train through and adapt to, versus abnormal fatigue. This is particularly relevant when athletes are new to a programme and there is often a substantial increase in training volume. They sometimes consider any type of fatigue to be abnormal but with experience they learn that they can train through it and can complete the training block. It is then important to judge at what point management is required.

**Question:** Is chronic or acute dehydration a problem with AIS athletes? Can it be identified as the mechanism of fatigue or is too much emphasis placed on it?

Some groups have excellent hydration status whereas others can be quite complacent. So it is up to us to educate them as to how dehydration can affect their performance and also their overall level of fatigue.

**Key Point** – When athletes reduce their energy intake they are also compromising the opportunity to consume all the necessary macro and micronutrients. Body composition conscious individuals and those with an energy mismatch are more likely to report feelings of fatigue.

**Pierre LaFontaine (Swimming Coach)**

**Question:** What are the most common types of fatigue that you see in your athletic group and how do they present themselves?

Fatigue often occurs in athletes that are trying to lose weight that they may have gained during time away from training and competition. Fatigue is also common in those who have a number of social stressors such as the pressure of children, work or school.

It can be hard for coaches to judge fatigue especially at an institution such as the AIS where there is a large support network. Consequently, fatigue may not be detected until relatively late, to the point where an athlete may need to take a break from swimming in order to recuperate.

It is worthwhile to observe the athletes, to see how they look and how they carry themselves down the pool deck in the morning. In the past I have had three sessions scheduled for a day and then seen them in the morning and decided that the lunchtime session was off.

Some athletes are good at communicating their state of mind and some either because they are scared to show any weakness, or because they are used to having a dictator style coach, breakdown because they won’t come and talk to you. In the past I have had swimmers who have had a week of unbelievable training and as a coach you have to be smart enough not to get excited because they can not keep going at that pace otherwise they will blow out. A coach needs to be able to judge when this is the case.

Incidences of fatigue are often related to poor management skills or changes in circumstances for the athlete. All athletes have individual tolerance levels and will experience different levels of fatigue after the same workload. The hardest aspect for the coach is to understand how best to manage fatigue.

**Dick Telford (Track and Field Coach)**

In terms of the biochemistry of fatigue, iron and magnesium are common problems. In one particular case an individual was recognised as being magnesium deficient and won a
gold medal within four to five weeks of being treated for magnesium deficiency. When individuals try to decrease their fat intake they are at risk of reducing their intake of essential fatty acids.

Thyroxine is another issue that has caused problems in runners in the past. Thyroxine levels are partially influenced by hereditary factors but I have a feeling that hard training and nutritional issues may also affect them.

Blood pressure and electrocardiograms can be examined to assess the operation of the cardiovascular system under a sense of fatigue.

Eccentric type exercises can be observed and creatine kinase leakage out of muscle membrane monitored to give a good idea about fatigue.

Immunology and particularly neutrophils are a very good indicator of fatigue as they are impinged upon by hard training. In the last five to ten years I have seen a number of cases of glandular fever in 17 to 19 year olds.

**Case study:** a female runner who was the quiet achieving type and whose parents had just divorced, was trying to adapt to a new training system, a new coach, whilst studying at university and trying to maintain an AIS scholarship was not surprisingly found to be overreaching. Recently, three 10km runners are now ranked 4th, 7th and 8th in the all-time Australian list and two of those actually lost their scholarships because they were not fast enough.

**Phil Brown (Women’s Basketball Coach)**

Our athletes are 15-18 years of age and during the two-year period that they are at the institute they undergo a huge transition period. They move away from home to live at residences, they have to adapt to a new school, a new basketball programme and new coaching staff. These issues present challenges to both the coaching staff and the athletes.

As we are a developmental programme, and underpin the National Leagues and the National Programmes, we are creating an environment where fatigue is to be expected. They are experiencing what is required to tour with the National Team, play at World Championships and Olympic games. In tournaments they may play eight games in ten days, so they need to learn how to play when they are tired.

The athletes undergo an adaptation process whilst they are here; it is vital that they remain on the edge the whole time, which requires periodisation of the training schedule. It took a long time to find a system that worked for our programme but it is now proving very successful. Occasionally some individuals will go over the edge, where they overtrain or they become sick.

It is vital for us to educate our young athletes and promote self-management skills. It is important they recognise that the best manager, the best coach and the best trainer that they are ever going to get is themselves. Players are given a training logbook that enables them to self-monitor on a weekly basis. We also endeavour to develop players’ communication skills by talking to the support staff (physiotherapists, coaching staff and strength and conditioning staff). They learn to communicate when they are feeling good or not so good and to address psycho/social issues in their lives.

If the players are undergoing a stressful time (for example year 12 exams) this can be seen at training, where they may struggle to focus. It is easy to determine when the group is emotionally flat, it may be necessary to do some cross training or fun drills to get them back on track.

In our situation we tend to modify training volume and not intensity. It is easy to see when players are being pushed too far, injuries happen and they may become clumsy and uncoordinated. This can happen when we lose control of our training environment.

Recovery is important, a minimum of ten girls are needed for most drills. Some individuals appear to cope better than others, and it is not always the senior girls. Some appear to be more vulnerable and susceptible to getting viruses.
**Question:** Would you say that most basketball players who present with heavy fatigue are illness and injury free?

I would say that illness plays a big part, usually viral infections. In the early 1990s we had a big problem with overuse injuries. Things have improved recently as we have increased screening and monitored training loads and intensities. We now also play over the summer months. It is important to remember that when discussing fatigue in 16 and 17 year old girls there are a number of factors to consider.

**Trent Lawton (Strength & Conditioning)**

The first point as a strength and conditioning coach is to establish differences between sports and perceived doses of activity or exercise (skills and drills) and how they impact on the athletes’ perceptions of workloads. It is important to understand the culture of a sport and how they approach work, as this will influence how I integrate strength and conditioning in the sport.

One factor to consider is how to manage the athletes. For example, if an activity is presented as a hard training session then that is going to bias how the athletes approach the training session and the effort that they exert. It is therefore sometimes a beneficial approach to disguise workloads.

One of the biggest issues as a coach is making sure priorities are balanced out for a particular training phase. For example, a cyclist told me that she needed to work on explosive power but she was going to wait for 8 weeks to introduce it into her programme, but if it is a priority that is necessary to improve performance – then you should prioritise that and subsequently adjust everything else accordingly.

Fatigue can be specific. If an athlete does a leg extension until repetition fatigue, performance is unaffected when completing a different exercise with the same muscle, for example, a leg press. Care must be taken not to use a generalised assessment of fatigue across all scenarios. Fatigue in strength training can occur due to the complexity of a movement. A snatch (whole body movement) cannot be performed if the alignment of the body is slightly out.

**Question:** Which athletes are most likely to be fatigued when they come through the gym?

Explosive athletes often suffer from fatigue particularly if you give them an explosive task. However, if you give them a different type of activity they show no signs of fatigue. Athletes will benefit from increased feedback; besides the weight lifted, number of sets and number of reps, enabling them to correct the movement and perhaps technique. Also, allowing a perception of mental and physical exertion.

**Greg Lovell (Medicine)**

Reiterate what Kieran said. Basically the role of the doctor is to discount illness.

**Craig Purdam (Physiotherapy)**

“Fatigued athletes” often present pale and gaunt; will fall asleep during treatment; they can be teary, less talkative or a bit snappy and short with people. Fatigued athletes will often say that “everything is too much” for them.

Travelling and basically having a very structured, fully planned life could be significantly contributing to fatigue. Hence lifestyle is an issue. Would like to suggest that AIS Residences develop a “café lifestyle” – an area for informal, unplanned living.

Overuse injuries don’t correlate with increased fatigue. Fatigue tends to be associated with clumsy injuries. It is especially important for athletes to understand training periodisation (i.e. overload periods & light sessions). Furthermore, the service provider needs to support the coach and go to them for reflection.
**Allan Hahn (Physiology)**

Increases in fatigue often correspond to a change in an individual's training programme. New athletes to the AIS are particularly susceptible, as they may experience a vast increase in training volume and intensity. An athlete may also feel fatigued if they have had a big disappointment in terms of competition or if they feel that they are putting in a lot of effort without receiving the desired result or output.

*Sleep* is a vital factor in fatigue management as it is the body’s natural recovery mechanism. In a few situations fatigue is due to central factors; in a major race a rower stopped 100m before the finish line and could not continue. Despite trying he could never push himself to that level again.

**Esa Peltola (Physiology/ Track Coach)**

*Question:* What type of fatigue do you see in the strength and power athletes and how do you handle it?

Endurance athletes usually have volume related fatigue whereas strength and power athletes have intensity related fatigue. Strength and power athletes start to decrease speed of muscle contraction, so fast force production is suppressed and a greater input is necessary to gain the same power output. I do not think that an athlete can really overtrain it is the training plus other pressures and stressors that result in overreaching.

**Keith Lyons (Performance Analysis)**

The process of observing training and fatigue has three components; the observer, the technology regarding athlete's dispositions and states, and the athlete. The athlete can either be vocal or silent, either end of the continuum does not automatically mean that things are going well or poorly.

Generally, there is insufficient knowledge regarding volume, frequency and intensity as a modulation for individuals. Typically, group norms and experiences are used to set training loads.

Kieran’s work with Greg has shown that athletes themselves have variations in their characteristics which themselves are not pathological. Sometimes we respond to metrics that aren’t a problem – but they are measurable as such – so what we want to talk about more and more is how we modulate this for individuals. Coaches therefore have to be prepared to work harder and harder at detailed quantitative observations if we are talking about individuals rather than norms. We need to work with coaches and athletes to look at the willingness to train. You can pick up body language and all these things and sometimes that athletes and coaches are so busy they don’t pick up the signals that are available early on. Also training to compete – the readiness of an athlete to compete – that for coach and athlete is a combination of science and art. Whilst we are working on the science sometimes the art is lost with individual coaches.

So getting a performance out is not simply about metrics, not simply about science, it is about being human and understanding how we energise individual difference. To me, performance is not something that is absolute, it is only a relative thing in terms of getting out what we have got from the training environment and somehow on the day turning the science in to the magic of a gold medal or Olympic success. I think that we have got to work very hard here to link the science and the art and recognise that observation is the key to all that – and that is what we are trying to do in our area.

**Gavin Freeman (Psychology)**

It is important to recognise that there are differences in individuals who are fatigued and those that are depressed even though similar symptoms are found with both conditions; sleep disturbances, loss of appetite, weight fluctuations, psychomotor retardation or agitation, feelings of sadness and flatness and even suicide.

My perspective is that the athletes here at the AIS are normal but they are living in an abnormal environment. It is worthwhile when first talking to an athlete to try and gain a
baseline and talk to them about sleeping patterns, appetite and other habits. It can then be established if incidences are a single occurrence or if they are a pattern developing over a period of time. Athletes will present in a number of ways, they may come up and say they are not sleeping, that they are tired and struggling to get on with their coach and teammates. Sometimes they may refer to performance, but this is often a bit more masked, and they may say that they are not motivated, they can’t focus or they can’t concentrate.

If an individual says that they are having difficulties sleeping, it needs to be determined whether they are having trouble getting to sleep, if they are waking in the night and if so if they have difficulty getting back to sleep. Importantly how refreshed they feel when they wake. The most common social factors leading to fatigue that athletes undergo are related to relationships- boyfriends, girlfriends or lack thereof.

**Andrea Farrow (AIS House Parent)**

My role when the athletes are fatigued is primarily to listen to them and give them someone that they can bounce ideas off and also sound off to. I try to be supportive and ask them about their training and reaffirm to them that what they are feeling is actually normal.

A situation that I commonly observe is an athlete that goes to the doctor when they are feeling slightly fatigued, they then rest from training and school, but feel well enough to go out at the weekend. The following week they may feel fatigued again. The question is whether they would be feeling fatigued if they had not gone out at the weekend. So, in some cases the athletes may not be necessarily making the most appropriate decisions. As house parents we try to liaise with the coaching staff fairly regularly, in order to try and get the best out of the athletes. I have noticed that the athletes appear to be less tired when they are in competition. With the basketball girls it seems that it is actually injuries and illnesses that are preventing them competing and not necessarily tiredness.

A common problem is the athlete’s inability to sleep. I do not know if it is worth contacting a specialist to discuss ways to improve the time it takes for athletes to get sleep and also stay asleep.

**Question:** Is there a certain group of athletes that have more problems sleeping or does it appear to be a widespread problem?

There do not seem to be any differences between athletes but it is a very common problem. It may be related to the fact that the athletes have such a busy schedule and that they get very little down time.

Another issue is that it is important for the athletes to be aware of are their training phases, particularly tapering and recovery phases. For example, recently the rowers have been undergoing a very hard phase of training and they do not even know when their next day off will be.

**Session 2 – Diagnosing & Measuring Fatigue (current techniques)**

**Dave Martin**

- Diagnosing/Categorising Fatigue: Anatomical Location vs. Time Course Approaches.
- What part of the system fails? Central vs. peripheral processes.
- How does fatigue present itself? – illness vs. injury; short-term fatigue (<24hrs) vs. long term fatigue (>24hrs)
- When is the training load right? Need to consider intensity, duration, type & frequency.
Shona Halson
- Central Fatigue: Definitions & Mechanisms
- Measuring central fatigue – drug challenges which act on specific receptors; hormones; neurotransmitters; cytokines; BCAA:f-TRP concentrations in plasma; plasma ammonia concentrations.

Greg Lovell
- Blood tests in tired athletes: Lessons for general medicine
- Medical model – history, examination & tests. Tests typically include – FBC, ESR/CRP, biochemical profile, iron studies, TSH.
- Majority of general medicine evidence shows that blood tests are not contributory to clinical diagnosis of fatigue. Studies show that typically <5% tests result in a significant clinical diagnosis.
- AIS in the first year of a 3-year prospective study of the “tired athlete”.

Gavin Freeman
- Psychological markers of fatigue
  - Important to differentiate between thoughts and feelings. “Thoughts” are factual interpretations, versus “feelings” which are emotional responses to an incidence/event.

David Pyne
- Muscle damage & soreness
  - Mechanistic models of damage (mechanical stress, metabolic stress, cytokine induction, heat shock protein)
  - Mechanisms of DOMS – lactic acid theory, muscle spasm theory, connective tissue damage, muscle damage, inflammation, enzyme efflux theory, genetic predisposition. Commonly accepted to be an integrated mechanistic model.
  - DOMS & muscle damage can impact athletic performance in a number of ways (i.e. decreased strength, power, joint kinematics; altered recruitment patterns).
  - Increased injury risk factors – reduced shock absorption; alterations in muscle sequencing; compensatory recruitment; impaired perception of impairment; changes in agonist:antagonist muscle ratio.
  - Treatment & Management Strategies – i.e. cryotherapy, stretching, massage, anti-inflammatory drugs, compression, ultrasound, electrical stimulation, exercise.

Michelle Cort
- Dietary factors implicated in fatigue
  - Factors include – inadequate carbohydrate intake, dehydration, energy drain, iron deficiency, other micronutrient deficiencies (rare).
  - All of the above factors are looked at in an assessment of nutritional status (assessment of dietary intake). But there are inherent problems with this kind of surveying.
  - Other means of assessment include – assessment of changes in body mass over a workout (hydration status); urine monitoring (colour, specific gravity & osmolality); muscle biopsy (measure glycogen stores); substrate utilisation (pulmonary gases, tracer technology); blood monitoring (status of iron, vitamins & minerals).
  - Conclusion – hard to find valid & reliable biomarkers of inadequate nutritional status or poor nutrition patterns.

Angus Ross
- Potential roles for the use of electrical muscle stimulation (EMS) in the assessment of fatigue.
  - Hoffman reflex (H-reflex) – artificially elicited monosynaptic reflex; H/M ratio can be used to assess motoneuron excitability.
  - Twitch torque/force measures – fatigue state of a muscle can be examined by the response to a single electrical twitch pulse (i.e. the peak torque generated & the rate of torque development)
Interpolated muscle twitch response – the addition of an electrical stimulation twitch on top of a maximal voluntary contraction. Potentially could be used to examine central fatigue vs. peripheral fatigue.

Inigo Mujika
- Monitoring tapers: minimising fatigue
- What is a taper? - “A progressive, non-linear reduction of the training load during a variable period of time, in an attempt to reduce the physiological and psychological stress of daily training and optimise sports performance.”
- Can a taper minimise fatigue/optimise recovery? – Evidence suggests ‘yes’.
- Biological indices of reduced stress/↑recovery:
  - Positive balance hemolysis/erythropoiesis (ie ↑RBC volume, ↑Hcrt/Hb, ↑Haptoglobin, ↑Reticulocytes)
  - ↓Creatine kinase
- Psychological indices of reduced stress/↑recovery:
  - ↓Perception of effort
  - ↓Global mood disturbance
  - ↓Perception of fatigue
  - ↑Vigor
  - ↑Quality of sleep
- Summary of optimal tapering strategies
  - Minimise fatigue without compromising fitness
  - Maintain training intensity
  - Reduce training volume by 60-90%
  - Maintain training frequency at >80%
  - Individualise taper duration between 4 & 28 days
  - Use progressive, nonlinear tapering designs
  - Expect performance improvement of ~3% (range 0.5 - 6.0%)

James Victor (National Women’s Road Cycling Coach)
- Fatigue – “The decreased capacity or complete inability of an organism, an organ, or a part to function normally because of excessive stimulation or prolonged exertion”.
- Managing fatigue – issue for athlete, coach & team staff.
- Education, Awareness & Preparedness are fundamental to effective fatigue management.
- Key elements for good management include – nutrition, massage, sleep/rest, establishing a ‘home away from home environment’, family/partners/team staff, rotating team staff, general happiness/contentment (athletes & team staff!).
- James’ advice – don’t try to hide from the inevitable, prepare physically & psychologically, engender & encourage (self-awareness, self-motivation, self-esteem), and finally, promote the benefits of fatigue.

Session 3 - Discussion

Peter Fricker
In summary, it is quite clear that fatigue comes in two forms. Performance related fatigue, with which there are obvious management issues, and dare I say that some of those are more easily managed than others. And the other is more the issue of research and management strategies based on chronic fatigue that seems to come from accumulated bouts of training.

It would be interesting to ask people what tests they would do now as a result of today, to see whether their practice or opinion has actually changed?

How would you screen an athlete for a predisposition to fatigue? Is there a way for looking at the “at risk” athlete? With some of these profiles are there any screening tests that we might be able to use? The big question is when does fatigue become
pathological? When does it become a disease or a condition that needs to be treated and how do you recognise it? Where is the line that separates being okay and simply self-managing your fatigue and needing structured intervention? Is there a way that an athlete can be taught to recognise the difference between potentially destructive fatigue and normal adaptations/training effects? Can we teach athletes that? Finally, which one research question regarding fatigue would you like to be answered?

The last comment I will make is that we have to recognise that we have a very special group of athletes here at the AIS. They are teenagers and if they want to eat toasted sandwiches, if they want to take a week off training, and if they don’t want to go to school and they would rather train – they are the issues we deal with. We do have to tailor what we do and how much we can control them – as they are young adults.

**Question:** Has today’s workshop changed the approach you would take with an athlete who is presenting as tired?

**Greg Lovell**

Probably not. I guess my primary job is to look at the illness, so do the screening, do a blood picture, biochemical profile, iron studies and thyroid testing. That would be the screen that I would use straight off. In the history examination I would be teasing out nutritional issues, psychological issues and if I had those three covered – I would be thinking more in the overreaching area and would take advice from the other departments.

**Peter Fricker**

Do you think there is any value at all in the cortisol:testosterone ratio or creatine kinase or any of the muscle physiology based material?

**Greg Lovell**

Well I think there is, but I would place it after I have worked my way down the list. So I would go through the top three (illness, nutrition, psychology – from my medical perspective) and then start to look at the next group. I guess one of the things that we do not want to do is get in to overreaching type testing and find out that they had glandular fever for the last two weeks or low ferritin, or a relationship related problem that was actually causing the whole thing.

**Dave Martin**

The first thing that I think all of us do is, if athletes are sick, injured or tired, we ask is it because of the training? How is your training? The biggest influence in their life is usually their training – we ask them how it’s going? Is it more than you have ever done? Less than you have ever done? The same as you have always done? You try and see if an athlete is bored, if they have been bored or if they are going to be bored. What you start to see is that if you do an assessment and it is not taken in conjunction with the training loads, it is almost impossible to evaluate the “appropriateness of fatigue” for that individual, unless it is pathological, in which case there would be a medical assessment. In assessing fatigue levels, training loads & time courses need to be considered. If somebody goes through a 3-week brutal training load and CK is through the roof and they are really tired and they are really tight in their muscles, have oedema, and they have got no fast twitch force production. That is normal – well-done – good training block. We did bloods through the tour of Tasmania and the winners had high CKs and the losers had normal CKs – because the winners were gauged, overloaded and racing hard. I bet the winners were the ones that adapt under that racing and the losers probably get nothing from it. It all has to be in the context of the training. I like that very simple paradigm, load, test, recover, assess.
Dave Martin

(Audience question) Is fatigue normal or not?

In the really severe cases, as Allan has seen, I’ve seen and Shona has seen, athletes are experiencing a really severe lifestyle stress or change in conjunction with incredible physical stress. The two combined have a double effect and the athlete may be falling apart as a result of that. I guess from a management point of view, which is what this session is talking about, most fatigue fixes itself. We do not need to get all freaked out and monitor hydration, nutrition, psycho-social stresses, training to the nth degree, viral infections on every athlete all of the time, with increased vigour of surveillance – we do not need that. Most fatigue deals with itself just fine. What we are trying to do is pick up those individuals that are moving into a mode of fatigue where nothing productive is going to come out of it and try to rechannel and reshape that.

Shaun D’Auria (QAS)

Tim Noakes’ says that the reason we do not understand fatigue is that we do not consider all the factors. We have got a lot of tools already and some magical blood test that is going to point us in the right direction is a long way off. I think we have tried to do too many different things with too many different people and when trying to monitor fatigue we need to look at all those different things all of the time, not just when things go wrong and the athlete comes back.

Randy Hill (WAIS)

One thing that I actually thought about is trying to figure out responders and non-responders to training. Can they stand the training load? Or maybe what we need to look at is how fast they recover? Try and highlight the different people that may need more time. Is that a responder or a non-responder? There are however a couple of problems that come with that line of investigation.

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