

Recovery Training

Workbook

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Introduction

The *Recovery Training Workbook for Coaches* is designed to provide coaches with an introduction to this important training component. The workbook may be used as a module in appropriate coaching courses towards a recognised coaching qualification. After completing this study pack coaches will be able to integrate recovery strategies into training programs and provide better management of their athletes. The majority of the reading material is provided, and there are work tasks throughout the chapters.

Learning Outcomes

After completing this workbook coaches will be able to:

- Outline the principle of recovery and its importance and role in training
- Monitor an athlete's adaptive responses and help athletes to monitor and manage this process
- Recognise and be able to use a range of recovery techniques
- Select appropriate recovery techniques to suit the requirements of training and competition, and the individual needs of athletes
- Plan recovery activities within weekly and annual training programs

Specifically, coaches will be able to:

Plan and prepare:

- plan and prepare short and long-term recovery programs that effectively integrate recovery techniques for physiological, neural and psychological stress
- individualise the recovery program to suit the needs of the athlete

Facilitate and conduct:

- facilitate a learning environment for athletes on the importance of a recovery program
- conduct effective recovery sessions that enhance the physical, neural and psychological well-being of the athlete after training sessions and performance

Monitor and review:

- assess and monitor the recovery of the athlete after training and competition
- identify signs and symptoms of non-adaptive responses in an athlete
- respond to unforeseen events in training and competition and adapt the recovery program accordingly

Evaluate:

- evaluate the short and long-term effectiveness of the program

Adapt:

- implement appropriate modifications to optimise the recovery of athletes to enhance adaptive responses to training stimuli and minimise non-adaptive responses such as training illnesses and injuries

Assessment

Competencies and knowledge will be demonstrated through completion of work sheets and tasks in the workbook.

Assessment of the marking and completed work sheets and tasks is the responsibility of the national sporting body.

Chapter 1: The Principle of Recovery

Learning Outcome

On successful completion of this chapter the coach will be able to

- outline the principle of recovery and its importance and role in training.

Background reading and references

Calder, A. (1990). Restoration and Regeneration as Essential Components within Training programs, *Excel*, 6(3): 15-19. Australian Institute of Sport.

Calder, A. (1996). "Recovery – Revive, Survive and Prosper", Ch. 7 in *Smart Sport*, RWM publishing, Canberra.

Flanagan, T, E.Merrick, M.Baum, A.Healy, M.Jones, A.Pedrana & S.Whytcross, (2000). "Kuala Lumpur Tour 2000: The Effects of Tournament Play on Elite Youth Soccer Athletes", *Success in Sport and Life*, Victorian Institute of Sport, Melbourne.

Pyne, D. (1994). "Physiological Basis of Fatigue", In *Proceedings of the Australian Coaching Council's Coaching Conference*, pp. 162-167. Canberra, Australia.

Rushall, B.S. and Pyke, F.S. (1990). *Training for Sport and Fitness*, Ch. 3 pp 27-40, and Ch5. pp. 60-72, Macmillan Australia, Melbourne.

Sayers, M. (1994). "Neuromuscular Fatigue and Recovery: a brief review" In *Proceedings of the Australian Coaching Council's Conference*, pp. 173-179. Australian Sports Commission, Canberra.

Recovery as a Training Principle

Recovery is one of the five basic training principles taught to coaches during their accreditation courses (Rushall & Pyke, 1990). These five principles are:

- **Overload**
- **Specificity**
- **Individuality**
- **Recovery**
- **Reversibility**

Unfortunately coaches tend to focus primarily on overload and to a lesser extent individuality and specificity, whilst recovery is often forgotten in the training process. This is despite the fact that it is critical for the development and performance of all athletes.

Training is designed to bring about improvements in athletic performance. This is achieved through progressively overloading the body systems and fuel stores that underpin each of the five **S**'s of training:

- **S**tamina
- **S**trength
- **S**peed
- **S**uppleness
- **S**kill

Each of these capacities is subject to all the five basic training principles. Underpinning the concept of progressive overload is an understanding that in order to develop a particular capacity or system, that capacity must first be challenged or stressed. This stress is provided by the training load that represents the stimulus for change to occur. The work undertaken results in a degree of fatigue or depletion of the physical or psychological systems involved. Adaptation to training is accelerated when residual fatigue is reduced as soon as possible after training and the challenged functions are restored quickly to normal operational levels.

Recovery training addresses this training fatigue through two primary functions – Monitoring recovery and Managing recovery. Monitoring recovery relates to assessing adaptive responses to training and stress so that appropriate recovery strategies can be identified. Managing recovery deals with the selection of specific techniques and strategies to minimise any residual fatigue from training and competing (Figure1).

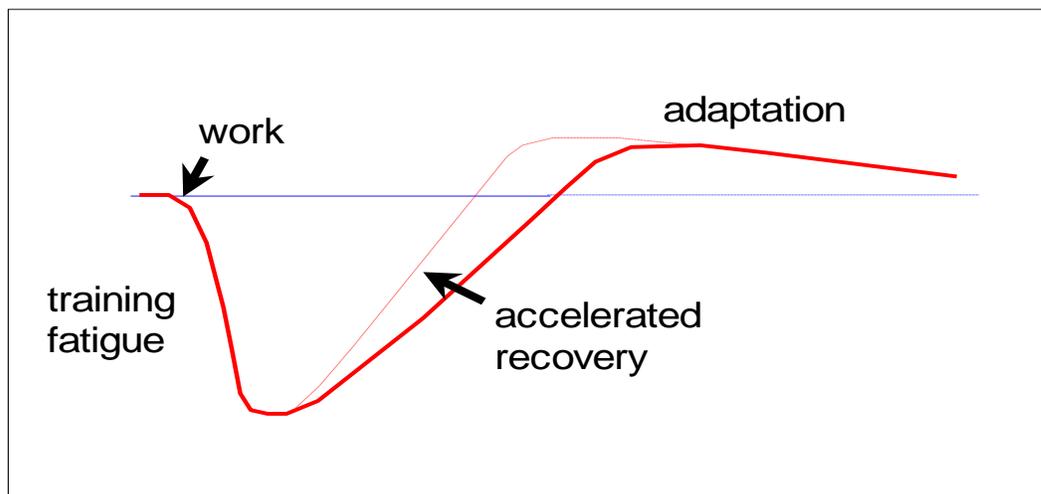


Figure 1: The principle of recovery

Overtraining, Overuse and Burnout

If positive adaptation to training results in improved performances then it is also important to recognise that negative adaptation can also occur. Essentially, the wide range of *overtraining* signs and symptoms is a reflection of the extensive influence of the athlete's immune system when it is unable to cope with excessive stress. *Overuse* problems are an indication of biomechanical problems due to excessive or inefficient mechanical loading, and *burnout* occurs when athletes are so psychologically drained they lack motivation and sometimes lose all interest in their sport.

The onset of these conditions is diverse and varied. No two athletes will respond to training loads in the same way as adaptation rates will vary from one individual to another. Consequently, it is not always appropriate to prescribe the same workloads for all athletes but **it is absolutely essential** to monitor their responses to training so that workloads can be varied to suit each individual's adaptive capabilities.

Primary Role of Recovery Training

The main rationale for recovery strategies is to enable the athlete to train with minimal fatigue and in doing so, to adapt to workloads faster (Calder, 1996). Training and performing in a fatigued state reduces the capacity to learn and perform. Functioning in a non-fatigued state provides the best opportunity for learning and adaptation to occur, whether this is within a specific training session or throughout a competition. Essentially, recovery training is about being able to train and perform optimally at every training session and event.

Coaches often assess the effectiveness of recovery strategies through the reliability and consistency of an athlete's performances. Can the athlete *bounce back* and repeat a good performance? Effective recovery strategies form the platform for the next session or event but they also have several other important benefits for the athlete.

Secondary Roles of Recovery Training

Secondary benefits from using recovery training strategies include:

- The incidence of training illnesses and injuries is reduced (Flanagan et al., 2000). Overtraining, overuse and burnout are common problems for high performance athletes and are an indication of inadequate adaptation to stress (Mackinnon & Hooper, 1994). Regular monitoring of an athlete's stress responses can help to detect problems early, thereby reducing the incidence and impact of such problems.
- Promotes natural adaptation. Provides for safer and natural performance enhancement without the use of illicit drugs and ergogenic aids.
- Improves an athlete's self management skills. Training hard and recovering well requires careful management and planning. This encourages athletes to acquire effective life skills in self-awareness, self-management and self-maintenance that can be used outside the training environment.
- Provides athletes with life skills for their post competitive careers. Athletes can continue to lead a balanced life by applying knowledge gained from their recovery experiences even after they have finished their competitive careers.

Recognising the type of fatigue

The fatigue experienced by athletes as a result of training and competing is a necessary part of the adaptive process. The astute coach will design programs specifically to expose the athlete to many varieties of fatigue in order to extend the athlete's capabilities to perform. The challenge for most coaches and athletes is to identify which specific capacities are fatigued and then select appropriate recovery strategies to restore the athlete to a normal functioning state (Calder, 1994).

There are four main types of training and competition fatigue. These are referred to as **metabolic fatigue** (energy stores); **neural fatigue** of either or both the peripheral nervous system (localised force production) and central nervous system (drive /

motivation). **psychological / emotional fatigue** (emotional and social stress factors); and **environmental / travel fatigue** (climate and travel).

Metabolic Fatigue.

Metabolic fatigue generally occurs as a result of demanding training sessions or events lasting more than one hour, or as a result of several sessions a day, or training and events over a number of days (Coyle, 1995; Maughan, 2000). Metabolic fatigue can be cumulative if there are inadequate nutritional and hydration strategies in place to offset the ongoing energy demands of the work undertaken. This type of fatigue is often identified when the athlete fatigues sooner than is normal for that athlete, or struggles to complete the session or event.

Neurological Fatigue.

Fatigue of the **peripheral nervous system** can occur after short high intensity sessions or after long lasting but low intensity sessions (Sayers, 1994). High intensity workouts may be experienced through hard strength training sessions or plyometrics, whereas low intensity steady state workouts can also fatigue the peripheral nervous system. This type of fatigue is expressed by a reduction in localised force production and may occur, especially from high intensity but short duration workloads, even if there is no evidence of metabolic fatigue.

Fatigue of the **central nervous system** can occur if the athlete has an inadequate diet (low blood glucose levels), lacks motivation, or is injured. This type of fatigue is expressed by a lack of drive and motivation on the part of the athlete and may exist with or without any evidence of fatigue in the peripheral nervous system. Highly motivated athletes are less susceptible to this type of fatigue unless they are injured or psychologically stale.

Psychological / emotional fatigue.

Psychological, emotional and social factors affect all athletes at some stage. The causes for this type of fatigue are varied and may stem from within or outside the training and competition program. Competition pressures, school exams for younger athletes, home life stresses and financial difficulties are some of the most common causes. There may be a set stress pattern for some factors such as exams, so there is an opportunity to plan for, and minimise the impact of this type of stress. Athletes will express this type of fatigue through a loss in self confidence or self-esteem or a change in their attitude and behaviour towards others.

Environmental / travel fatigue

Environmental fatigue occurs as a result of travelling or through changing climatic conditions. This represents a constant challenge for the professional sport athlete and coach. Disruptions to biological (circadian) patterns result from changing time zones, inconsistent wake-up times, changing meal times and disturbed sleep patterns. Varied climatic conditions especially hot and humid environments encourage the early onset of fatigue and additional recovery strategies are needed for performances in such extreme situations.

Worksheet 1: Identifying fatigue in your athletes

Type of fatigue	Give examples of how you recognise different types of fatigue in your athletes?
Metabolic Fatigue	
Neural Fatigue	
Psychological fatigue	
Environmental	

Chapter 2: Monitoring Adaptive Responses

Learning outcomes

On successful completion of this chapter you will be able to:

- identify appropriate monitoring methods and use these to evaluate an athlete's responses to training
- assist and train your athletes to monitor their adaptive responses

Background readings and references

Hooper, S.L., MacKinnon, L.T, Howard, A., Gordon, R.D. & Bachmann, A.W. (1995). "Markers for monitoring overtraining and recovery", *Medicine and Science in Sports and Exercise*, (Vol. 27, p.106-112).

Mackinnon, L.T. & S.L.Hooper. (1994). "Training Logs: an effective method of monitoring overtraining and tapering", *Sports Coach*, (Vol. 17, No. 3, p.10-12). Australian Coaching Council, Australian Sports Commission, Canberra.

Individual responses to training fatigue

Identifying fatigue and its causes represents about half of the information that is needed to plan for specific recovery strategies. A complementary and equally important aspect for coaches and athletes to consider is how each athlete adapts to, or copes with training and competition stress. Another training principle often overlooked in the preparation and development of athletes is that of *individualisation*. Athletes will adapt to training and stress in different ways and at different rates. Consequently, in order to maximise an athlete's ability to perform, it is vital to monitor individual responses to work and stress, both within and outside the training and competition environment.

Who should do the monitoring?

There are three perspectives or levels of athlete monitoring. The athlete's view, the coach's view, and the sport scientist / sport medicine view. Each has a degree of responsibility for monitoring athlete adaptation but each has a different perspective on what is monitored and how this is done. The most important level is that of the athlete as he/she can monitor themselves on a daily basis. The coach is the next most important individual in the monitoring process as he or she is able to monitor the athlete at training, particularly from a performance and behavioural viewpoint. Sport science and sport medicine perspectives are undertaken less frequently and usually more expensive and less accessible than the more regular evaluations by athlete and coach. The latter perspectives are usually in the form of regular testing and evaluations as part of annual programming requirements to benchmark the progress of the athlete. Invariably an athlete with problems is referred to a specialist after the athlete or the coach, has reported problems with maladaptation to training stress.

What are the variables coaches should monitor?

Each coach has a wealth of observational information about the indicators of poor adaptation and excessive fatigue. Often these are mental notes rather than formalised recorded criteria. It is important for each coach to identify what it is that they observe that is indicative of excessive stress and fatigue. The criteria identified can be categorised into signs and symptoms about physical appearance, behavioural actions and interactions, performance measures and the coach's *gut feeling* or *sixth sense*. A quick assessment of these criteria at every coaching session enables the coach to identify non-adaptive stress responses at an early stage and address them before they become a major issue for the athlete (Table 1).

Table 1. An example of a coach's checklist for monitoring an athlete

Coaching Observations	Signs & Symptoms of non-adaptive responses
Direct Communication	Athletes tells me he has: Heavy legs Doesn't feel good Legs are sore Feels tired.
Body Language	Facial expression and colour Posture Signs of frustration, etc
Performance	Poor skill execution Slow acceleration off the mark Heavy feet Poor or slow decision making / response time
Psychological	Low motivation Low concentration Aggressiveness No self confidence
Others	Poor eating habits Poor diet Poor sleep patterns External stresses

What are the variables an athlete should monitor?

The responsible athlete will also monitor training adaptations through regular recordings in a training diary or log book. Maintaining a daily record is an essential training tool for all athletes as it enables them to learn how to *evaluate* their stress levels and adaptation. Learning to recognise "*how they feel*" is one of the most important skills any athlete can acquire. Recordings of the quality of sleep, morning resting heart rate and morning body weight, and a daily rating of fatigue levels are four critical markers that should be recorded daily by athletes (Appendix 1). These four variables take two minutes a day to record and may be the first warning that the athlete is not adapting well to training and other stresses.

Feeling tired after a training session or game is a normal response but feeling fatigued all the time is a sign that the body has not adapted to its stressors. Also, an elevated

resting heart rate, recorded first thing in the morning (i.e. 10 beats above the normal reading), is an indication that any training undertaken should be minimal, if at all. Body weight is best recorded each morning before eating and after going to the toilet. This is **not** a measure of fat stores but may be an indication of poor hydration. Rapid weight loss or rapid weight gain is not advisable, and unexplained weight loss may also be indicative of overstress.

Realistically most athletes are likely to be inconsistent with recording morning resting heart rates. Research about athlete's training diaries as effective indicators of possible illness onset have indicated that a comprehensive set of variables, not just resting heart rate, should be monitored (Mackinnon & Hooper, 1994; Hooper et al., 1995). An example of a monitoring sheet including many of these variables has been in use by high performance athletes at the Australian Institute of Sport since 1996 (Appendix 2), while elite Australian rugby teams use a modified version of this sheet when attending their strength training sessions. Daily checks take 15 - 30 seconds and responses can be reviewed by the coach on a daily or weekly basis.

The frustration for many coaches is the lack of consistency with which many athletes record these variables. Some choose to ignore recordings of any kind and others are unreliable at maintaining records of any kind. There is an alternative for the reluctant athlete. A simple and quick self-assessment method for the coach is to present a monitoring sheet to the athlete when they arrive at training. Smiley Faces (Table 2) have been used effectively by numerous Olympic athletes as well as junior and developing athletes. These sheets take about five seconds to complete and the variables selected can be adapted to suit different circumstances. The aim is for athletes to be able to assess their response to training stress and external stress on a regular basis. Regular monitoring will help athletes recognise when something is outside their normal response range and encourage them to be proactive by contacting their coach, or physiotherapist, or medical specialist for help.

Table 2: Smiley faces evaluation sheet

How do you feel?			
Physically			
Psychologically			
Emotionally			

Worksheet 2. List the signs and symptoms that you notice in your athletes when they are not adapting to training stress.

Coaching Observations	Signs & Symptoms of non-adaptive responses
Direct Communication	
Body Language	
Performance	
Psychological	
Other	

Worksheet 3: List the signs and symptoms that you believe are essential for your athletes to record on a daily basis

What to monitor	What response, range, sign or symptom is indicative of a non-adaptive response

Chapter 3: Rest and Recovery Training

Learning outcomes

On successful completion of this chapter you will be able to:

- understand the role of passive and active rest as forms of recovery
- be able to educate your athletes about the importance of sleep for training and recovery

Background readings and references

Calder, A. (1996). "Recovery – Revive, Survive and Prosper", Ch. 7 in *Smart Sport*, RWM publishing, Canberra.

Gunning, L. (2001). "Enhancing Recovery: - impact of sleep on performance", *Sports Coach*, 23(4):33-25. Australian Sports Commission, Canberra.

Rest: Passive Rest

There are two major ways of resting – passively and actively. Passive rest, particularly in the form of sleep, is an area that is not well understood by either coaches or athletes. Sleep is probably **the** most important form of recovery an athlete can have. A good night's sleep of seven to nine hours provides invaluable adaptation time for adult individuals to adjust to the physical, neurological, immunological and emotional stressors that they experience during the day. An adolescent experiencing heavy training and a growth spurt may need up to 10 hours a night and athletes who are sick often need more sleep as a part of their recuperation. However too much sleep can be detrimental to performance as it can slow down the central nervous system and lead to increased levels of melatonin that can leave the athlete feeling slow and lethargic.

Melatonin is produced during the deep and slow wave sleep stages, but excessive or insufficient amounts due to too much or too little sleep can disrupt an athlete's ability to train and adapt to stress. Late nights, sleeping in, sleeping during the day, irregular eating habits or travelling to different time zones (*jet lag*) can disrupt this natural pattern and lead to unnecessary fatigue. This extra fatigue can delay the adaptive processes particularly if disruption to the biological clock is frequent, as it is with athletes on the professional circuit.

The body also *tunes-in* to and is partly regulated by meal times, so it is important for athletes to plan for regular eating times whenever possible. The need for athletes to regulate their sleeping and eating habits does not preclude them from having a social life and enjoying the occasional late night. To cope with this, athletes should be encouraged to standardise their wake-up time wherever possible. Sleeping-in after a late night should be limited to one to two hours within the normal wake-up time, so there is minimal disruption to the athlete's sleep patterns. Napping for longer than 10 minutes tends to disrupt the quality of night time sleep and upset the individual's body clock.

Getting to sleep can sometimes be difficult because of the excitement of the day's events so it is important that athletes develop habits to promote a good night's sleep. Appendix 3). Practising relaxation techniques from an early age can help the athlete to unwind easily. Other forms of passive rest involve techniques that help the mind to *switch-off* from all surrounding stimuli. Meditation, reading or listening to relaxing music are some of the other forms of passive rest.

Rest: Active Rest

Active rest is much undervalued by athletes. The end of the loading component of the training session is an ideal time to introduce active recovery activities, although active rest strategies can also be interspersed easily throughout the session. (i.e. sets and reps). Activities can be selected to fulfil several tasks. They can either help recover the physiological state of the athlete e.g. light jog, walk, swim or cycle to recover the lactate system), recover neural fatigue (e.g. light jostling/shaking of muscle groups), or used as a means of psychological and emotional restoration (e.g. light but different activities).

Planning active rest strategies can vary. Including lighter work loads at the end of a session, lighter sessions within a week (microcycle) and lighter weeks within a 4-6 macrocycle are some of the usual methods for integrating recovery into the training program. The role of stretching as a form of active rest has been the subject of some debate over the last 5-10 years. The stretching techniques selected to promote post training recovery should aim to restore a normal homeostatic state (normal resting muscle length) rather than aim to increase range of movement. Stretching to improve flexibility (developmental stretching) is best done as a separate and dedicated session when the athlete is not fatigued and there is less chance of exacerbating any residual microtrauma in muscles following heavy workloads. Ideally athletes should focus on developmental stretching in the evening while their muscles are still warm and before they retire to bed to rest. Stretches designed to increase the range of movement around a joint such as long held static stretches, assisted stretches and PNF stretches, can leave a muscle fatigued for up to an hour or more and so these stretching techniques are best done at a time when the athlete can rest afterwards.

Cross training can also be used as a form of active rest provided the work intensities are modest (light aerobic) and the exercises undertaken are different to those normally performed in training. Pool work (Appendix 4) particularly involving some backstroke and side stroke for non-swimming sports is an excellent form of active recovery post event (Photo 1).

Rest Days

Rest days are essential. Ideally at least one day per week should be a non-training day. This allows time for physical and psychological recovery as well as time for other interests and personal and family relationships. The challenge for some athletes is to understand that having a rest day does not preclude movement or light aerobic activity. It does not imply sitting down and watching TV or videos all day! Light activities such as walking the family pet, exploring the local museum, art gallery, or sight seeing in a new place, socialising, a little shopping, or short game of golf or surfing, can be used to ensure that the athlete is encouraging natural movements and do not stiffen up from being inactive. It is much better to move around at a gentle to moderate pace than to sit in a lounge or hotel room being physically and mentally dormant.



Photo 1: Static stretching in a pool after a game.

Other interests and activities also assist with psychological recovery post event. The old proverb that ‘*All work and no play makes Jack a dull boy,*’ indicates that there is a need for variety in order to prevent staleness and boredom. Athletes need one or two interests outside their sport in order to maintain a balanced life. For younger athletes coping with study, training and social and domestic commitments can be very difficult. Rest days structured into training and competition programs enable athletes to sustain a healthy balance in their lives.

Worksheet 4: List the types of active and passive rest undertaken by your athletes

Passive Rest Strategies	Active Rest strategies

Chapter 4: Nutrition for Recovery

On successful completion of this chapter the coach will be able to:

- identify appropriate hydration and nutrition recovery strategies post training and post event

Background reading and references

AIS Nutrition website: www.ais.org.au/nutrition

Burke, L. (2000). "Nutrition for recovery after competition and training". In Burke, L. Deakin, V. (Eds) *Clinical Sports Nutrition* (2nd Ed) (p. 396-427). Roseville, Australia: McGraw Hill Book Company Ltd.

Coyle, E.F. (1995). "Substrate utilisation during exercise in active people". *American Journal of Clinical Nutrition*. (Vol.61.(Suppl.): p.968-79).

Maughan, R. (2000). "Fluid and carbohydrate intake during exercise". In Burke, L. Deakin, V. (Eds) *Clinical Sports Nutrition* (2nd Ed)(p.369-395). Roseville, Australia: McGraw Hill Book Company Ltd.

Tarnopolsky, M. (2000). Protein and amino acid needs for training and bulking up. In Burke, L. Deakin, V. (Eds) *Clinical Sports Nutrition* (2nd Ed) (p.90-123). Roseville, Australia: McGraw Hill Book Company Ltd.

Management of Recovery Processes

While chapters 2 and 3 dealt with the **Monitoring** aspect of adaptation and recovery, this chapter and the following two chapters, will focus on the **Management** of recovery by the use of various techniques and modalities that can be used to reduce post training and competition fatigue.

Fluid and Fuel for Recovery

The most important nutritional considerations for recovery relate to fluid and fuel replacement strategies (Burke, 2000). Monitoring fluid loss so that it is kept to a minimum is essential. A bodyweight loss of 2% or more during exercise will result in a measurable reduction in aerobic output. If athletes dehydrate excessively, not only can this be dangerous due to overheating, but also their aerobic capacity is severely reduced by up to 6%. Educating athletes to hydrate before, during and after training and events, is extremely important. Fluid balance can be monitored through urine checks and weighing the athlete pre and post training. This strategy is especially important during tournament conditions in order to avoid cumulative dehydration when athletes are competing in several events throughout a day and/or over consecutive days.

Preparing for an event or training session and also providing afterwards for the replenishment of fluid and fuel stores used in training requires planning. Athletes are responsible for balancing their nutritional intake in accordance with the demands of their

training. Adequate supplies of glycogen in the muscle and in the liver are needed to support the energy demands of the athlete and promote recovery for the next training session. Dietary carbohydrate is the primary source for the body to manufacture glucose (Coyle, 1995). Athletes can minimise the effects of metabolic fatigue by starting each session with their *fuel tanks* full. They can top-up during the event with sports drinks and take other carbohydrate and protein foods such as sandwiches, muffins and fruit to consume as soon as possible after the session or event concludes. There is a window of opportunity within the first 20 minutes after strenuous exercise, to replenish muscle fuel stores at a faster rate than if carbohydrate intake is delayed for longer. Small amounts of protein taken with carbohydrates before, during after hard training, are also recommended to help minimise muscle protein breakdown as a result of heavy workloads (Tarnopolsky, 2000).

A variety of carbohydrates (CHO's) are available and selecting the most appropriate for the situation requires careful consideration. Carbohydrates are classified in terms of their Glycaemic Index. This refers to the relative rate of absorption of glucose from a particular food. When food containing CHO is eaten, the amount of glucose in the blood rises to a peak after about 20 –30 minutes. The glycaemic index (GI) of a food is determined by the rate at which CHO is available for glycogen resynthesis in muscles and the liver. Foods are compared to white bread or glucose (both of which have an arbitrary GI of 100) in terms of their rate of CHO digestion and absorption.

The glycaemic index of some foods

HIGH (GI >85)	MODERATE (GI = 60-85)	LOW (GI <60)
white bread	pasta / noodles	apples /pears
wholemeal bread	popcorn	cherries
Nutrigrain	porridge	peaches
Cornflakes	potato chips crisps	apple juice (unsweetened)
Weetbix	Special K	All-bran
potato	white rice (boiled)	Baked beans
rockmelon	sweetcorn	lentils
raisins	sponge cake	ice cream
bananas	oranges	yoghurt
corn chips	orange juice	fructose
sugar / honey	chocolate	brown rice (boiled)
cordial / sports drinks		milk (all types)
glucose		peanuts

Foods with a high or moderate GI are recommended for rapid replenishment of glycogen stores in the liver and muscle. However, if foods with a high to moderate GI are mixed with foods of low GI, the food with the low GI will lower the rate of absorption of CHO into the blood stream. Consequently athletes need to be educated to take a sandwich, piece of fruit or have a sports drink with them, to consume after training.

Minerals and Iron

Minerals and trace elements are important for muscle regeneration. However extra intake of these by taking synthetic supplements may not be as effective as increased dietary sources due to the reactivity of some elements and metals with other foodstuffs in the gut. Professional nutritional advice is necessary for those athletes who

experience considerable muscle damage, or those who are continuously fatigued. Iron deficiencies or problems with absorption are not uncommon in athletes and they should seek professional nutritional and medical advice rather than self diagnose. **Nutritional Supplements**

Considerable debate exists over the use and misuse of supplements as an aid to recovery and performance. Coaches and athletes are often inundated with information, mostly anecdotal, and even pressured, to try specific products in the belief that these will aid performance. While this aspect of recovery was a feature of some former Eastern Bloc countries, evidence-based science supporting the use of many products is relatively rare. In view of the lack of reputable information, coaches and athletes should be very careful about how they assess the validity and reliability of a product before they consider using it.

As an aid to helping coaches and athletes work their way through this *minefield* the Nutrition Department at the Australian Institute of Sport has established a Supplements Advisory Group to evaluate published scientific information about specific supplements. This group of sport nutrition, sport science and sport medicine specialists has identified 4 categories of supplements, and information about these is updated several times a year.

The four supplement categories are:

Category A: Those products that have been substantiated as useful for improved performances based on sound scientific research. *Recommended for use.*

Category B: Those products that appear to have some benefit based on anecdotal information, but there is as yet no substantial scientific proof only a hint of possible benefit. There are no known detrimental effects and the substance is not on the banned drug list. These supplements need to be researched more before they can be identified as reliable products to aid performance. *Cautious recommendation for use with careful controls – need more information.*

Category C: These supplements and products have no scientific support to back up the claims that are made about their ability to improve performance. Many of these products are promoted by commercial bodies wanting to access the lucrative sports market for commercial reasons. Other products fall into this category based on tradition or *Old Wives Tales*. *Not recommended for use.*

Category D: Banned substances. *Not recommended for use.*

For further information and updates, coaches and athletes are encouraged to consult the following website.

www.ais.org.au/nutrition/

Alcohol

An issue for many sports is the management of alcohol. Here are a few suggestions based on work done with high performance Australian Olympic and Professional football teams:

1. The Team/squad as a whole should decide what are the best strategies it will adopt and all athletes should subscribe to the Team/squad's view.
2. During the club/competition season, athletes have a choice whether to drink or not. If an athlete decides to consume alcohol then they need to plan when and how they will do this. The following are some strategies to consider:

Managing Alcohol Responsibly

- Make sure you are well fed and hydrated before you start drinking. Do not consume alcohol because you are thirsty.
- Agree to a limit before you start. (e.g. 2 schooners of beer or 2 nips of spirits or 2 glasses of wine). Remember the ***Don't Drink and Drive Ads on TV.***
- For every alcoholic drink you need to match it with a schooner of non-alcoholic drink such as water or cordial etc.
- Keep hydrating after you finish drinking.
- For minimal impact on performance avoid drinking two days before a game, the day of the game, and one day afterwards.

Worksheet 5: List the current recovery activities you use with your athletes, or which they use, to address their fuel and fluid requirements to minimise fatigue

Timing	What do you use and how do you use it?
Pre training	
During Training	
After Training	

Chapter 5 Physical Recovery Techniques

On successful completion of this chapter you will be able to;

- Identify, use and assess a range of physical recovery techniques

Background reading and references

Calder, A. (1990). "Sports Massage", *State of the Art Review* No. 24, National Sports Research Centre, Australian Sports Commission, Canberra.

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Physical Therapies

A wide variety of activities and therapies are used to assist with recovery from training fatigue. Unfortunately, many recovery techniques popular with athletes and coaches have not been investigated extensively by scientists, so coaches and athletes often rely on anecdotal information about what is best to use. The following section provides a brief description of some of the most commonly used techniques for physical recovery.

Hydrotherapies

A wide range of hydrotherapies have been in use for several thousand years. Spas, pools, steam rooms, cold pools, and contrast temperature protocols were used by the ancient Greeks and Romans. The work-to-rest ratio for a Roman soldier was six days on and one day off. The day off was structured to include conditioning work in the gymnasium, followed by a swim, spa, cold plunge and massage with some socialising and relaxation throughout. The Roman regimen has formed the basis for Turkish Baths and protocols used traditionally in Scandinavian and other European Countries.

Although some research about hydrotherapies has been conducted in recent times very little has been published. A number of professional football teams in both Australia and New Zealand have conducted their own in-house research on the effectiveness of hydrotherapies for improved performance (e.g. the New Zealand **All Blacks** rugby union team), but such teams are understandably reluctant to publish their results and so their findings are not generally available for other coaches to examine. Needless to say, these teams have continued to include a number of hydrotherapy strategies as essential parts of their training and competition recovery and they continue to use hydrotherapies with both their senior and junior athletes.

One team that has published its findings is the soccer program at the Victorian Institute of Sport (Flanagan et al., 2000). However this research design included the concurrent use of a number of recovery strategies so it is difficult to tease out the specific effects of hydrotherapies alone.

One of the few published articles on the effectiveness of hydrotherapies comes from research with nationally ranked Finnish track and field athletes (Viitasalo et al., 1995). Researchers demonstrated that underwater massaging (using the jets in a spa) following plyometrics training helped athletes to maintain leg-explosiveness on the following day. In contrast, passive rest after such training resulted in a significant reduction in leg power. One of the major factors fatigued by plyometrics training is the peripheral nervous system (PNS) and the rationale for underwater massaging was to assist the PNS to recover faster. This has also been the recommendation of Sayers (1994).

The protocols used by the Finnish researchers were very similar to those used by the ancient Romans. Essentially this routine involves first having a shower, followed by a spa (39 to 40°C) for three minutes (Photo 2) and then a cold shower or a plunge into a cold pool (10 to 15°C) for 30 to 60 seconds (Photo 3). Warm immersion produces vasodilation of the peripheral circulation and the cold immersion encourages vasoconstriction. Three to five sets of this protocol produce rapid vasodilation and vasoconstriction with a resultant acceleration in blood flow.

A shorter protocol without warm immersion is also used by many athletes to reduce post exercise swelling in legs and minimise post exercise soreness. The national Australian netball team takes a small fold-up canvas pool (1.5m long x 1m wide x 20cm high) to games. Cold water with a bag of ice reduces the pool temperature to about 15°C and athletes spend 30 -60 seconds sitting in the pool after showering. The process is repeated three times. A toddler's paddling pool would suffice. Athletes report that their legs feel lighter and fresher and their muscles are not as sore after using this protocol. Patrick Rafter and Lleyton Hewitt have also used this protocol very effectively post-event (*Herald Sun*, 10th July, 2002).

In 1998 at the Australian Tennis Coaches Conference in Melbourne several hundred coaches were given the opportunity to experience the effects of cold water immersion by placing one leg only, in a bin (thigh high) of cold water with some ice in it (about 18°C). One minute in the cold water and then one minute out, repeated three times was sufficient for the coaches to appreciate the different effects of cold water immersion on fatigued muscles. The treated leg felt much lighter and refreshed for several hours afterwards whereas the non-treated leg felt heavy and tight.

A contrast temperature protocol involving a hot pool, with no underwater massaging and cold plunge (same protocol as outlined above), was also used by researchers from the University of Canberra in 1996 to measure lactate recovery in high performance hockey athletes after a series of Wingate tests. A comparison of lactate clearances following (1) passive rest, (2) light exercising (active recovery) and (3) contrast immersion techniques was undertaken. Results indicated that lactate levels were recovered equally fast by using either the contrast water immersion protocol or the active recovery protocol. Lactate recovery following passive rest was significantly slower (Sanders, 1996).



Photo 2: Spa pool at 39°C

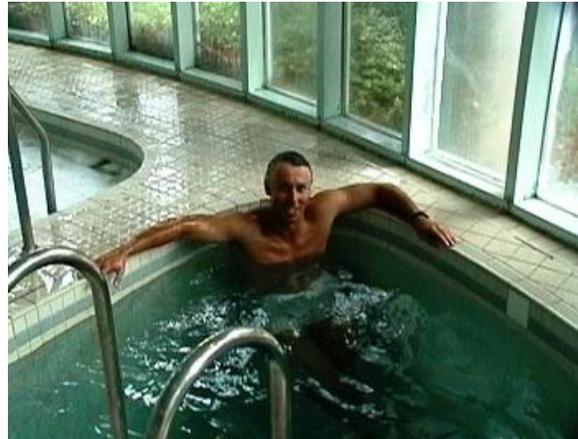


Photo 3: Plunge pool at 12°C

Note: Spas should be used only if the athlete is in a healthy state and has no recent soft tissue injuries. Athletes should also limit their spa immersion time to no more than five minutes as they are likely to experience a large drop in blood pressure and this can make them feel light headed and faint.

Showering within 5 to 10 minutes at the end of a training session is a good way to accelerate recovery of both lactates and peripheral neural fatigue. If there is access to a pool then a few light active movements (of at least 5 minutes) with some active and static stretching in the pool (Appendix 5) is also reported to be beneficial by some professional sporting clubs. The practicalities of accessing a pool immediately after training or an event can make this option impractical however. Contrasting temperatures can be achieved with a shower and bath at home or the use of a small paddling pool or tub for cold immersion.

The choice between hydrotherapies or an active rest routine after training provides for an interesting debate. It is essential to replenish energy stores as soon as possible after training. Active recovery (e.g. light jog, walk, cycle etc.) for 10 to 15 minutes following training requires a reasonable amount of energy. The energy demands required for a spa or shower routine are much less than for active recovery. Rehydration and refuelling can occur concurrently with either strategy. One benefit reported by athletes is that they find the hydrotherapies more relaxing and enjoyable than active recovery after a hard session or event. Developing an effective post-training and post-competition routine is very important as it helps athletes to unwind and recover physically and psychologically.

Many athletes and coaches comment on the psychological benefits associated with hydrotherapy routines post event. It is an opportunity for both athlete and coach to start to unwind, recover and prepare for the next day. It is important for coaches to recognise that they also need to recover as they undertake large amounts of physical work and stress. The chance to do this with athletes is a useful communication strategy for a coach.

Saunas

Saunas are like a hot dry bath. The use of saunas in training is not well understood by many coaches and athletes. As a result saunas are often misused and can be detrimental to the health and performance if an athlete dehydrates or experiences a severe reduction in central drive.

In some Scandinavian and former Eastern Blok countries saunas were often used after periods of high intensity training when athletes experienced high degrees of fatigue in the central nervous system (CNS). A sauna for 5 minutes (40°C +) with cold plunge for 30-60 seconds, repeated 3-4 times was used to slow down neural activity in the CNS and prevent over-stimulation following high intensity training. There is a lack of published research on the performance benefits of sauna use and as many athletes misuse the modality it is often not recommended by Australian Sports Institutes and Academies.

Sports Massage

Sports massage (Photo 4) has gained wide acceptance over the past twenty years. There are now many well-qualified professionals available for athletes to access. However not all athletes can access a professional therapist and some may not be able to afford a massage on a regular basis. Parents, spouses and playing partners can provide some massage for backs, shoulders and hips. If the cost of professional services is prohibitive, or a professional is unavailable, then self-massage techniques are free and easy to administer. In particular, lower leg massages are an effective way to minimise compartment problems such as *shin splints* or repetitive strain problems.



Photo 4: Sports massage

Self-massage techniques can be used when athletes are showering, especially for the forearms, chest (photo 5), shoulders, and neck. These techniques take a few minutes to perform and can be done in a relaxing atmosphere while watching television or in the shower or bath.

Many claims are made about the benefits of sports massage and numerous research studies examining these claims have been undertaken over the last 15-20 years. Despite this there is not much evidence-based science to substantiate many claims that are made about the benefits of massage (Calder, 1990). Nonetheless what

little information that does exist provides evidence for two physiological, one neural and several psychological indices that demonstrate positive effects from massage treatments.

Massage increases peripheral blood flow in localised areas through the mechanical warming and stretching of soft tissues and this can provide temporary flexibility gains. Increased muscle and skin temperatures also lead to a relaxation response as demonstrated by a decrease in excitability of the motor-neuron pool. Improved mood states and feelings of well-being have been recorded in several studies (Calder, 1990) and many athletes will use massage as both a means of relaxing physically and psychologically.

Perhaps the greatest benefit, but one not reported in the literature, is the biofeedback athletes obtain from massage whether self administered or provided by a professional or parent. Massaging is an excellent means by which an athlete can become more aware of those muscles and tendons stressed by sport and even by activities such as sitting in a car or on a plane for long periods. Tuning-in to the way the body has been stressed helps the athlete to monitor musculo-tendinous stress and also provides a management tool that can be used readily even when there are no therapists available.



Photo 5: Self massage for the insertion of *pectoralis major*.

Acupuncture and Acupressure

Acupressure is often performed as an adjunct to sports massage but acupuncture requires more extensive qualifications and is less accessible and more expensive than massage. Both acupressure and acupuncture focus on applying pressure or stimulus to specific points located on fourteen meridians (line patterns) on the body. Acupuncture points have a lower cutaneous electrical resistance than adjacent areas and these can be measured and evaluated. Stimulation of specific points is claimed to influence a wide variety of conditions including oxygen uptake, respiration and the immune system. Unfortunately few reliable scientific studies have been conducted to substantiate these claims. However a reputable study from China in the late 1980's using the left and right *vastus laterali* (outside thigh muscles) of experienced weight lifters, demonstrated that the acupunctured *vastus* muscles relaxed with treatment unlike the untreated *vastus* muscle (Lu Dinghou, 1986). This relaxation response was measured by examination of the sarcomeres (contractile units within a muscle cell) taken through muscle biopsy. Relaxed muscles would have a positive contribution to the aforementioned conditions and contribute to a sense of well-being and improved mood state.

Hyperbaric Oxygenation (HBO)

Hyperbaric Oxygenation Therapy (HBO) is a means for increasing the availability of oxygen to the body. This is achieved by inhaling gas with a high oxygen content in an environment with increased atmospheric pressure. The most common method is to present the client with 100% oxygen at 2 atmospheres of pressure. This increases the partial pressure of oxygen in the body. That is, oxygen molecules can reach damaged and fatigued body parts more easily than under normal atmospheric pressures which have an oxygen content of only about 21%.

The technology has only recently been applied to sporting situations in Australia and it has focussed on accelerating the repair process for injuries. However HBO has also been used in the former Soviet Union as an aid to accelerate training adaptations particularly for athletes undertaking anaerobic training activities. HBO is still in its infancy in Western countries and is unlikely to be readily available to most athletes. There is still some controversy amongst medical specialists about the effectiveness of this technique as an aid to injury repair and its effectiveness in accelerating adaptation to training awaits exploration by more scientists.

Worksheet 6: Experience a 1 hour sports massage.

Experience a one-hour massage for yourself. Comment on your physical and psychological responses to this:

Physical:

Psychological:

Other comments: e.g cost, availability. competency of practitioner at providing a sports massage etc.

Chapter 6 Psychological Recovery Techniques

On successful completion of this chapter the coach will be able to:

- Identify and use a range of psychological skills for recovery.

Background reading and references

Hogg, J.M., (1998). "The post performance debriefing process: Getting your capable track and field athletes to the next level of performance", *New Studies in Athletics*, (Vol.13, No.3: p.49-57).

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Psychological skills

There are three main psychological strategies that are used to enhance recovery: debriefing, mental toughness skills and relaxation techniques. In addition to these all coaches should be prepared to manage traumatic situations when there is a need for emotional recovery.

Debriefing

Debriefing is one of the most useful ways to evaluate performance and provide emotional and psychological recovery post training or post event. A successful debriefing approach helps both the coach and athlete to evaluate performances objectively, identify what specific changes are needed and then set realistic goals for the next training session or event. A systematic and constructive approach that focuses on process rather than outcomes can provide athletes with achievable performance goals that they can manage and monitor (Hogg, 2002).

Although many coaches conduct post event reviews, the emotions of the situation, a win or a loss, can interfere with closure from that event. Adopting a constructive approach to evaluating performances through a systematic debriefing process, enables an athlete's performance to be viewed objectively. While no two coaches will have the same operational style for reviewing performances, there are some critical elements that should be incorporated into the process. Recognition of factors that can affect the process, such as the timing, venue, and maturity of the athlete are some of the issues to consider (Hogg, 1998). The length and breadth of the debrief should relate to the event or event. A short debrief focusing on simple performance issues, such as the strategy used, is appropriate for a post game or in competition situation. In contrast a post competition debrief is likely to be more comprehensive and include numerous performance factors and take longer to conduct.

A critical underpinning construct of any debriefing strategy is to have a clear set of performance indicators, specific to the individual athlete. Developing appropriate process-based performance indicators is not always easy for coaches and athletes and this aspect of the debriefing model can be very time consuming. This type of measure relates to the quality of the performance, such as “how well” a specific skill, tactic, or strategy was executed by the athlete. Ideally the performance indicators should be holistic in nature. They should relate to those critical aspects of training, performing, behaviour, attitudes, self-management, etc. that can be monitored and managed by the athletes themselves. These become the variables against which the individual is evaluated and they are also the tools for setting realistic goals. Other recovery methods that promote post-training relaxation can then be applied more effectively.

Mental toughness skills

Recognition of the complex interaction and strong relationship between physical and emotional states is important for recovery training. This is evident when muscle relaxation is observed in conjunction with lowered heart rates and blood pressures and improved mood states. Skills associated with developing mental toughness or emotional control and relaxation strategies, are important strategies for athletes to use. Positive self-talk and developing positive body language are some of the effective skills that have been used by elite sport athletes (Loehr, 1992). These techniques can be used within training and event situations as well as afterwards and associated with biofeedback techniques for greater effect. Biofeedback can be used to train athletes to recognise when they are tense and what it feels like to be relaxed after they have applied one or more of the relaxation techniques outlined below.

Relaxation techniques

Many relaxation techniques revolve around the concept of REST (Restricted Environment Stimulation Therapy), sometimes called sensory deprivation or sensory minimisation techniques. Some of these skills are as simple as closing the eyes in order to reduce stimulation while other techniques require training (meditation) or specialised equipment (flotation). Reducing the amount of stimulation to the brain enables the athlete to focus more effectively on relaxing and becoming emotionally calm.

(i) Meditation

Although passive rest is an important aspect of recovery practices the time spent during passive rest can be used to include one of several relaxation and / or focusing techniques. Meditation trains the individual to relax by controlling the parasympathetic (calming) nervous system through reducing *noise* or stimulation to the brain. By controlling this system the individual can lower blood pressure, reduce heart rate, slow down breathing rates, relax muscles and calm the sympathetic (excitatory) nervous system. This technique is useful for controlling stresses from training or competition particularly if the athlete is over aroused. Meditation techniques, like any skill, take time to acquire. It is often easier for younger athletes to learn these skills as they tend to have fewer inhibitions than older athletes.

One of the greatest examples of a meditation technique used in a sport environment was that used by Arthur Ashe when he played against Jimmy Connors in the 1976 Wimbledon final (Photo 6). Ashe had planned his approach to this critical event knowing that he would have to stay focused on each point and not get distracted by the surrounding pressures of his opponent, press gallery, and spectators. He used the time

between changing ends to stay focussed by closing his eyes and sitting still, covering his head with his towel – unusual on-court behaviours in the mid 1970s.



Photo 6: Arthur Ashe during the Wimbledon Final against Jimmy Connors, 1976.

(ii) Progressive Muscle Relaxation (PMR)

Progressive muscle relaxation (PMR) can be performed at the end of training or before going to bed. The technique involves tightening specific muscle groups and then holding them firm for 5-10 seconds and then relaxing. The regimen usually works by starting at either the feet or the head and neck and working through muscle groups to the other end of the body. This process enables the athlete to identify the sensations of muscle tension and muscle relaxation in that specific body part. This increased awareness helps the athlete to recognise and then reduce muscle tension when it occurs. Like any sporting skill PMR needs to be practised regularly to be most effective.

(iii) Imagery and Visualisation

All individuals have an imagination that can be developed as a training aid. Imagery and visualisation involve using the mind to create a vivid and realistic scene. All the senses are used to generate the image; sight, smell, sound and touch. The image created by the individual should evoke feelings of comfort and relaxation (Photo 7). Escaping to a relaxing place at the end of each day just before going to bed is a useful way of practising the technique and switching-off before going to sleep. Other images can be created and rehearsed to enable the athlete to focus on positive feelings and to reinforce game strategies.

(iv) Breathing exercises

Breathing exercises are used frequently in the martial arts. Learning breathing techniques and focusing on relaxing any tense muscles helps athletes develop good biofeedback mechanisms. Exhaling while applying static stretches also helps to induce a relaxation response in the body.



Photo 7: Angie's visualisation of a warm relaxing place to go in winter

(v) Flotation

Flotation Tanks provide an environment with minimal stimulation. By reproducing weightlessness through immersing the body in warm (34°C) salty water, no sight, no sound (unless the individual relaxes to music or listens to an affirmation tape) the athlete is deprived of stimuli from normal sensory signals. This technique takes two or three trials for most individuals to feel comfortable to relax in, but it is remarkably effective for reducing stress and burnout. Not all athletes enjoy the enclosed feeling in the float tank and a few dislike the salty conditions of the water. Some wear swim goggles to protect their eyes.



Photo 8: Flotation tank

(vi) Music

Most individuals enjoy music, but as an adjunct to training music is often underutilised. Although music is sometimes used in the gym to provide a motivational atmosphere conducive to sustaining repetitive workloads, it is equally as effective in evoking a relaxation response if the appropriate music is selected. Most athletes have access to a portable music system such as a *Walkman*, MP3, or similar. Athletes should be encouraged to create tapes and CD's that they enjoy and that evoke a range of moods and positive emotions. These can be motivational if they feel "flat" or calming if they feel stressed. With practice, athletes can learn to manipulate mood states to generate either optimal arousal or relaxation.

Apart from flotation and music, all of these psychological techniques can be practised daily without the need for any specialised personnel, equipment or facilities. An ideal time for rehearsing these skills is immediately before going to bed. Learning how to *switch-off* from the events of the day will prepare the athlete for a good night's sleep. (Appendix 3).

Emotional recovery

In the case of a major set-back or traumatic situation or event, a systematic debriefing strategy is critical in helping an athlete to evaluate the situation realistically and start the process of emotional recovery. An example that is sometimes encountered is for an athlete to have to deal with the death of a parent, sibling, relative, partner, coach or close friend. Additional resources and strategies may assist the athlete to manage this process and help them to take the first steps in "coming to terms" with the situation. It is important for coaches to identify in advance the strategy or strategies that they will use if such situations arise. Contingency planning is an important aspect of preparation for handling emotionally traumatic events.

Other extremely stressful experiences that need to be managed can occur during or after competition. Some of the simplest distracters to use during a competition are mood lifting activities. These can include watching an amusing video or comedy show on TV, reading an escapist or adventure novel, or going to a fun park, zoo or light entertainment centre. A sense of humour and a feeling of mateship, or team support, are invaluable in times of emotional stress. For athletes in extended competitions away from home, and especially overseas, planning such activities as part of the tour is essential.

Worksheet 7: Visualisation

Close your eyes and create a visually calming scene. The images should evoke feelings of comfort and relaxation for you

For consideration:

What sounds, scenes, smells, sensations, evoke calming images for you?

Worksheet 8: Music

Consider creating or collecting a set of tapes or CDs that help you to relax. Teach your athletes to do the same.

For consideration:

What sort of music helps you to relax?

What sort of music increases your motivation / drive to perform?

Worksheet 9: Other Relaxation Strategies

List any other relaxation techniques or strategies, that you have experienced and would recommend to your athletes or other coaches.

Chapter 7: Putting it all Together:

- I. Selecting Appropriate Recovery Techniques;
 - II. Coach and Athlete Responsibilities
-

On successful completion of this chapter you will be able to:

- Select and integrate appropriate recovery activities for the training program
- Identify which recovery roles are the responsibility of the coach and which are to be managed by the athlete

Background reading and references

Calder, A. (1994). "Accelerating Adaptation to Training", In *Proceedings of the Australian Coaching Council's Conference*, pp.29-31 Australian Sports Commission, Canberra.

Putting it all together

The amount of recovery an athlete needs to undertake will depend on how well they are adapting to training and life stresses. A regular monitoring system should be in place to gauge the individual athlete's responses. These strategies include such things as regular hydration checks, via pre and post training weighing and athlete urine checks, for any training or competition situation.

1. Selecting appropriate recovery techniques.

Selecting the best recovery techniques will depend on several factors. First, the athlete and coach will need to recognise what has been fatigued in training in order to recover any residual fatigue from the work done. Is it metabolic fatigue where the fluid and fuel stores need replenishing, is it neural fatigue from explosive powerful exercises or skill training, or is it psychological fatigue? Training sessions often involve combinations of all of these types of fatigue so specific recovery activities can be selected to address these.

Restoring metabolic fatigue can be achieved by restoring fluid and fuel stores and increasing the delivery of these consumables to fatigued muscles (hydrotherapies or light aerobic activities). Neural fatigue can be reduced by using a spa or jostling massage techniques in conjunction with one of the many relaxation techniques. Psychological fatigue can be addressed by relaxing mentally and physically or by choosing a light entertaining activity if emotional recovery is required.

Secondly, the use of recovery techniques also depends on their availability, cost, and time involved in their delivery or use. Those techniques which can be self administered and incur no cost are the ones most readily used and accessible to all athletes. Costs increase, and techniques become less accessible if specialised equipment is used or if skilled personnel are required to administer the technique.

Post-training and event

Athletes need to develop simple routines for post training and game situations based on the availability of facilities and services – minimal (provide your own) to situations where optimal facilities exist (easy access to a physiotherapist, massage, pool spa, etc). In every case the post training or post event routine should follow this simple protocol:

1. **Rehydrate and Refuel.** (check pre & post game weight if possible)
Refuelling with carbohydrate and protein foods and drinks.
2. **Recover physically.** Shower using contrast temperatures (60 seconds warm 30 seconds cool), stretching and light self massage in the 60 seconds of warm water, repeat three times. Cold water (10-18°C) immersion for the legs if possible with 30-60 seconds immersion in a bath, tub, or pool, interspersed with one minute towelling the legs dry. Repeat three times.
3. **Relax psychologically.** Use music, visualisation or relaxation strategies to switch off.

If the athlete has access to a pool then 10-15 minutes of light movements, including some backstroke and hip rotation movements are beneficial. Continue to rehydrate and refuel during the recovery process.

Some self-massage on the legs and more stretching can be performed in the evening. Plan strategies for the next day and then relax and unwind for at least 5 -10 minutes before retiring to bed.

Recovery strategies *On the Road*

Travelling requires that the athlete identify in advance, what recovery facilities may be available and to be prepared to be resourceful in using these facilities. Essentially the recovery protocols follow the same format as those for home-based situations. That is; (1) rehydrate and refuel, (2) recover physically using some form of hydrotherapy, stretching and massage and then (3) relax and unwind.

The first priority is to cover nutritional requirements. The amount, type and availability of foodstuffs need to be identified before travelling. Preplanning will enable the athlete to identify what needs to be brought to the competition venue for consumption during and after the event. The availability of showers, spas, baths, pools and cold tubs, can also be identified in advance, as can the availability of massage and physiotherapy services. If none are available then the athlete can use showers and self-massage techniques as outlined above. Travel plans should include some relaxation strategies to help the athlete relax when not competing.

Recovery for hot conditions

In addition to normal recovery protocols outlined above, staying cool in a hot environment will require extra attention. Hot dry conditions are easier to cope with than hot humid conditions because it is much harder to lose excess heat through sweating when humidity is high.

It is essential to monitor pre and post training/event, weight. Regular fluid consumption during and after training sessions and events is paramount as an aid to maintain hydration levels. Cold towels for the face, arms and legs, can be used on and off court, and cold plunge pools and showers can be used in the change rooms. Pre-cooling of muscles can help conserve energy and increase reaction times. A quick cold shower

before a warm-up or some cold towels applied to the legs and arms for a short 30-60 seconds can help to minimise sweat loss and conserve fluid levels.

Athletes should stay in shady areas or air conditioned environments when not performing as this will help to conserve their energy levels and reduce heat stress. Frequent changes of socks and clothes during and between games can also help, as sweat-laden clothing can be heavy, uncomfortable and reduce evaporation. A dip in a cool pool after the event and before bed can help the athlete to relax and maintain a normal core temperature in hot conditions.

Worksheet No 10

Using the table below, rank the degree of fatigue / depletion in each of the four main systems (nutrition, physiology/metabolic, neurological, and psychological), as a result of training for each of the components of performance (the 5 S's). That is, on a rating of 1 (greatest) to 4 (least), rank the order in which you think the four main systems will be most stressed as a result of each training type. The Table has been partly completed to assist you.

Ranking of Fatigue / Depletion				
Training Type	1 (greatest)	2	3	4 (least)
Stamina	nutritional	physiological	neurological	psychological
Strength	neurological		psychological	
Speed		physiological		psychological
Skill	neurological		physiological	
Suppleness	neurological		psychological	

Note: The ranking of fatigue / depletion of the 5 S's may be different between sports, as the emphasis placed on each of the training types will depend on the individual sport. For example, a team sport like softball may have a much higher emphasis on skills training than on stamina, unlike soccer which relies heavily on stamina as well as skills training.

Worksheet 11. Ranking the 5 S's in your sport.

For consideration:

Rank the order of importance of the 5 S's for your sport. What implications does this have in terms of the systems stressed in training?

Planning Recovery Training

Off Season / Transition / Early Preparatory Phase

This is the most important period for developing recovery training skills. Pre-season screening is essential in order to detect any potential problems which may be exaggerated by training during the season. This is also the time when athletes should start their self monitoring programs by using a diary or log book, and begin to learn to *tune-in* to their bodies.

Basic time management skills should be introduced now in order for athletes to learn how to plan for training, study/work, home life and a balanced social life. Some of the most essential recovery techniques should be introduced and reinforced during this phase. These include appropriate nutrition, stretching, including postural efficiency exercises, hydrotherapy in the shower, self massage and one or two relaxation techniques. These skills should be reinforced throughout this phase.

Specific Preparatory / Conditioning / Pre-Competitive Phase

Training loads are often heaviest during these phases so now is an ideal time to make use of cross training to minimise overuse problems. By now athletes should know how to balance their training sessions in relation to their other priorities such as work or study, and their home and social lives. Self monitoring through reference to the diary or log book should be a habit and checked regularly by the coach. The increase in training loads will generate a greater need for more physical recovery techniques especially hydrotherapies, massage, other active recovery activities, including postural correction techniques. Increased work loads also means that there is a need to reinforcing nutrition strategies to ensure that appropriate and sufficient fuel and fluids are being consumed. Fatigued bodies tend to perform techniques inefficiently and are therefore more predisposed to injury, so adequate nutrition is critical in order to minimise fatigue.

Psychological skills to promote muscle relaxation such as PMR (progressive muscle relaxation) are also usefully introduced here. Each athlete should practise the relaxation techniques they plan to use during competition and spend time selecting the music they like to use to create a relaxing atmosphere for the times when they will be competing.

Competition Phase

By this time all recovery skills should be automated. Athletes should be familiar with a range of self recording and self management strategies. They should know how and when to use all the techniques they have practised and be comfortable using these during intense competition. There may be a heavier reliance on psychological recovery during this phase because of competition stress. However if the competition program is planned in advance and athletes know and understand their requirements for this, their stress levels will be lower and they will have more control over their physical and psychological states.

Coaches need to plan carefully to include appropriate recovery training activities around the competition schedule in order to maximise recovery from one game or event to the next. If the competition or tournament involves travelling away from home this includes planning the travelling time, and travelling conditions including arrival time. All major activities need to be forward planned - wake-up times, meal times and food selection, stretching, showering arrangements, post game recovery activities, access to a pool or spa for recovery, massage availability, and planning the *time-out*.

It is important to organise appropriate entertainment in order to find a suitable balance between stress and relaxation. A wise coach will also have strategies in place for emotional recovery in the event that athletes or teams are unsuccessful in their performances. Planning ahead for every eventuality minimises problems associated with stress and promotes performances under challenging competition conditions.

Responsibility for Recovery Training

At the beginning of the training year it is advisable that coaches and athletes have a clear understanding of their own distinct, but complementary roles and responsibilities for recovery training. Both parties need to be clear about each others' responsibilities and both need to agree to undertake these respectively. This agreement can be in the form of an unwritten contract or a *Gentleman's Agreement* but it is essential that both coach and athlete have clearly defined roles and duties for recovery training.

The Coach and Recovery Training

Overall planning of workloads and appropriate *work-to-rest* ratios is the responsibility of the coach. In order to assess adaptation to the training loads the coach needs to monitor athletes at the beginning and during each training session for any signs or symptoms of non-adaptation.

To encourage self monitoring skills the coach will need to familiarise athletes with the use of a training diary or log book and check these on a regular basis, eg at least once a week. The coach can encourage the use of self management skills that athletes will need. This can be done throughout the training year by introducing techniques in the preparatory phase and reinforcing the use of these throughout the year. Also it is a wise coach who recognises the external demands placed on athletes, such as exams or work, and tailors training loads to complement these external pressures so athletes are not excessively stressed.

Many coaches will not have all the knowledge or skills required to teach many recovery techniques, so they may have to use other specialists to educate athletes how to perform these skills, eg self massage. However the coach has a responsibility to reinforce this educational aspect of the training program. by encouraging and reviewing the application of these techniques and activities on a regular basis.

Training programs need to be flexible so coaches have the option to change workloads relative to the adaptive responses of individual athletes. This flexibility also applies to the different requirements placed on athletes by different environments and venues. Careful planning and evaluation of training needs and adaptive responses will ensure that coaches fulfil their responsibilities for recovery training for their athletes.

The Athlete and Recovery Training

Athletes have two major responsibilities. First they need to learn to *Listen to their bodies*, and secondly they need to *Look after themselves* physically and psychologically. The very least an athlete can do to fulfil these responsibilities (Appendix (9)).

If athletes learn the essential skills of self monitoring and self management not only will they optimise their chances of adapting to heavy workloads, they will also develop effective life skills that they can use after they have finished their competitive careers.

Athlete responsibilities for Recovery Training

Monitoring & Management Strategies

Daily

- Every morning monitor resting heart rate, body weight, and quality of sleep:
- Each evening, rate daily energy levels/tiredness for the day.
- Eat a balanced diet and plan appropriate meals and post training snacks.
- Use shower/spa/bath for stretching, self massage, and Hot & Cold contrasts.
- Before bed practise relaxation eg music, visualisation, PMR, breathing exercises.

Weekly

- Have at least one rest day a week.(can do a light non-training activity eg. golf)
- Plan active rest eg, stretching, postural exercises, cross training,
- Organise a massage (professional, partner or parent) and use self massage at least three times a week.

Weekly Time Management: Plan in advance

- Prioritise all weekly commitments (work, study, training, domestic, social events).
- Add a few varied recovery activities around these commitments, eg spa, pool, float, movie, music etc.

Partners and/or Parents of Athletes and their support for Recovery

Partners and parents can help to reinforce the responsibilities of the athlete. By encouraging the use of a training log or diary they can help the athlete to *learn to listen* to his or her body. Parents can use the concept of the **Smiley Faces** to gauge how their children are responding to training, or school, or life in general. Both partners and parents can play a very useful role by learning and applying massage techniques on their children. A few minutes massaging tight legs, shoulders, or back, before the athlete goes to bed can mean the difference between a heavy stiff body or a more relaxed recovered body the following morning. Preparing balanced meals with appropriate post training snacks and a drink bottle to include in a kit bag is essential.

Close family members inadvertently monitor their partner or child's responses to stress so they are aware of the signs and cues when the athlete is not coping. Like the coach, partners and parents should also keep watch for excessive stress in the athlete and they should be able to communicate freely and openly with the coach if they suspect that the athlete is having difficulties adapting. The same principles apply to parents and partners, as to coaches and athletes, ie. plan, monitor and manage carefully to minimise the occurrence of any problems.

Summary

Intense pressure on athletes and coaches to produce bigger and better results has increased the necessity to train hard, but sometimes this is achieved *at all costs*. Athletes and coaches often fall victim to illnesses associated with excessive stress, and occasionally the temptation to cheat in order to succeed is very attractive. Finding a balance in training programs so that best performances can be realised without the athlete or coach breaking down has often been difficult because many coaches and athletes are unaware of the role and benefits of recovery training.

The principle of *recovery* is the most frequently forgotten training component and the most poorly understood of all the training principles. Yet recovery training is as important for an athlete's development as are the improvement of energy systems, strength, flexibility and mental skills training. The benefits from blending recovery training effectively within programs are many and include:

- Athletes learn how to monitor their training responses (*listen to their bodies*) and manage themselves (*look after their bodies and control their emotions*) so they can cope with their workloads and stresses and promote adaptation to training loads.
- A spin-off from successful adaptation is the reduction in injuries, illnesses and burnout often experienced by excessively overstressed athletes and coaches.
- Recovery training methods offer athletes a safe and natural alternative to banned performance enhancing drugs.
- Through recovery training athletes and coaches acquire effective life skills in self awareness, self management, and self maintenance which they can use even after they have finished their competitive sporting careers.

Conclusion

Every training session is important. Every training session is a chance for an athlete to become an even better athlete. In the same way that every point, every game, and every set count towards an event, so does every training session help the athlete to improve in the long term. Athletes should aim to start each training session or game in as fresh a state as possible so that they can maximise the training benefits and experiences of the session or game. Recovery strategies are aimed at helping athletes to do this by focusing on reducing residual training fatigue and stress.

The coach can help educate the athlete to understand, plan and use recovery strategies with a view to the athlete learning to manage this for him/her self. Effective monitoring and recovery management will enable both the coach and athlete to train hard, perform better more consistently, reduce training injuries and illnesses and develop sound self-management strategies for a competitive life in sport, and for life after sport.

The winning formula is:

Work Hard + Recovery Well = Best Performance

Recovery Training Workbook

5=Excellent 4=Good 3=OK 2=Poor 1=Awful	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Quality of Sleep	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
Energy Levels	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
Self Confidence & Self Esteem	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
Muscle Soreness	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
Motivation and Enthusiasm for Training	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
Attitude to Work / Study	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
Communication with Coach	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
Health	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5

Appendix 2: The Weekly Monitoring Sheet.

Sleeping Tips

Things to do:

- Practise relaxation techniques before going to bed. eg. soft music, muscle relaxation, breathing exercise, visualisation, light reading
- Lie down to sleep **ONLY** when you are sleepy
- If you don't fall asleep within 30 minutes after turning out the light, get up and do some relaxation again
- If you wake up in the night and can't get back to sleep – get up and do some relaxation again
- Get up at the same time each day

Things to avoid in the late evening:

- Caffeine, eg coffee, tea, chocolate, cola drinks
- Nicotine
- Alcohol – leads to disturbed sleep patterns
- High protein and large meals

Reduce thinking and worrying in bed

- Practise *switching-off*

Fatigue Fighters Checklist

After each training session

- Drink & eat
- Walk / move (at least 5 minutes)
- Stretch
- Hot / cold shower

Evening / End of day

- Hot / cold shower / spa / sauna
- Stretch & self massage (especially legs)
- Practise relaxation 10 - 15 minutes before bed
(Music, Progressive Muscle Relaxation, visualisation, breathing exercises)



Note:

1. Monitor how you feel each day
 - Get up at the same time each day
 - Record how you feel



Great



OK



Tired / Stuffed

2. You need at least four hours between training sessions.
3. If the *fatigue fighters* don't work seek help from a specialist.

Appendix 4: Fatigue Fighters Checklist

Pool Recovery Session

by
Angela Calder

Pools are excellent environments in which to conduct recovery activities after hard sessions or games. Both active and passive recovery techniques can be used depending on the temperature of the water in the pool. During active recovery work, water provides buoyancy and resistance properties which allow the individual to undertake gentle exercise with minimum impact on the body. Immersing the body in cool water (c.22 - 28°C) following hard exercise minimises post exercise oedema and much of the ensuing residual tension, as a result of the hydrostatic pressure experienced by the immersed body parts. These factors together with water's capacity for efficient heat transfer enhance the effectiveness of recovery techniques post game or training.

Duration of session:	10 - 15 minutes (depending on the size of the pool and the number of athletes involved)
Intensity:	Light to moderate
Formation/work pattern:	Follow the Leader (walk along side of pool in a rectangular formation).

Preparation: Athletes should be showered and rehydrated (sports drink or appropriate fluid) before the session begins. Each person should locate his/her drink bottle on the side of the pool for the duration of the session. Drinks (water, sports drink, or cordial) should be taken regularly throughout the session, eg every 5 min or after the lap sequences.

NB 1: Laps should be done at a moderate to fast pace to keep athletes warm enough for stretching. Stretches are done against the wall/side of the pool. A shallow pool (eg waist to chest deep) is preferable as deep pools are more difficult to stretch in.

NB 2: If there are no recent injuries or bruising, and no colds or viruses, then contrast temperatures can be used in the shower: 1 - 2 min hot, and 10 - 60 secs cold. (repeat three times). Drink / hydrate to finish.

Appendix 5: Pool Recovery Session

Pool Activity	Lap or Reps
Laps	
Walk forward with arm swings*	1 lap
Walk backwards with arm swings*	1 lap
Side steps with flapping arms* (L)	1 lap
Side steps with flapping arms* (R)	1 lap
Backstroke	2 laps
	Drink / Hydrate
Stretches	
Calves (R) & (L)	2 each side
Shins (R) & (L)	2 each side
Laps	
Side stroke (L)	1 lap
Side stroke (R)	1 lap
Walk forwards with arm swings*	1 lap
Walk backwards with arm swings*	1 lap
Lunges with shoulder outward rotations* (elbows bent into side – <i>Flasher</i>)	1 lap
Backstroke	1 lap
	Drink / Hydrate
Stretches	
Adductors (R) & (L)	2 each side
Quads (thighs) (R) & (L)	2 each side
Bottom (R) & (L)	2 each side
Laps	
Side steps with flapping arms* (L)	1 lap
Side steps with flapping arms* (R)	1 lap
Hurdle steps forwards	1 lap
Hurdle steps backwards	1 lap
Side stroke (L)	1 lap
Side stroke (R)	1 lap
	Drink / Hydrate
Stretches	
Face wall - standing hip rotations (R)	10 reps x 2 sets
Face wall - standing hip rotations (L)	10 reps x 2 sets
Outward rotator stretch for hip (R) & (L)	2 each side
Hamstring (partner held) (R) & (L)	2 each side
	Drink / Hydrate

*Keep hands underwater to increase resistance

Shower after pool work and complete upper body stretches in the shower:

Triceps (R) & (L)	2 each side
Lats (R) & (L)	2 each side
Pecs/chest (R) & (L)	2 each side
Neck (R) & (L)	2 each side

Appendix 5: Pool Recovery Session

Guidelines for using Shower, Spa and Plunge Pools

1. Use the toilet before you enter the spa facility.
2. Hydrate and take a plastic drink bottle with water or sports drink for use during the session. *Do not take in other food.*
3. Change into swimmers / togs / bathers / costume / trunks.
Some European facilities will not permit clothing of any description to be worn in a spa or sauna. Check first
4. **Shower BEFORE entering the spa, plunge pool or sauna. Clean the skin with soap and shower off.**
5. Remove any strapping and place in the rubbish bin.
6. Keep your head out of the water in a spa or plunge. Do not put your head under the water at any stage.
7. 3-4 minutes in the spa, then 30-60 seconds in the cold plunge. Repeat 3 times. Hydrate between the spa and plunge each time. This is the same protocol for using a sauna.
8. Showers are 30 seconds warm then 30 seconds cold water, repeat 3 times.
9. Stretch in the spa and focus the jets on to your most fatigued muscles.
10. Finish the routine with a shower.

DO NOT use the spa, sauna, or plunge pool when you have a:

- **cold**
- **virus**
- **diarrhoea**
- **any cuts and bruising or**
- **recent injury**

REMEMBER – ALWAYS

- Shower before and afterwards
- Keep your head out of the water in the spa & plunge
- Take a drink bottle to hydrate

Appendix 6: Guidelines for Using Showers, Spa and Plunge Pools

Recovery Strategies for Different types of Training Fatigue

Fatigue Type: **Metabolic (Energy Stores)**

Fatigue Results from : Games, and training lasting more than 1 hour.

Recovery Strategies:

- First 5 minutes after exercise/game - *recovery your energy*
 - Check post game weight.
 - Drink, eat, carbs and protein.
 - Stretch while warm
 - Walk/move lightly for 3 - 5 minutes
- 5 - 10 minutes after exercise - *recover physically*
 - Shower - stretch and self massage
 - Alternate Hot/Cold showers 3 times.
 - Continue hydrating
- Within the first hour after training - *continue to recover*
 - Drink plenty of fluid
 - Have some more food
 - Use some relaxing music or techniques to unwind
- In the evening - *continue to unwind*
 - Hot shower/bath/spa - continue to hydrate
 - Stretch and self massage eg legs, feet, hips
 - Read, watch TV, relax, socialise
- 10 minutes before bed - *switch-off*
 - Use relaxation skills - visualise, music
 - Get out of bed if you can't sleep, try again
- Next day - *monitor your recovery response*
 - Record how you feel
 - Plan your day carefully
 - Pool Recovery - move through water for 15 - 20 minutes

Work Hard + Recover Well = Best performance

Appendix 7: Recovery Strategies for Different Types of Fatigue

Time Management Checklist

Each week identify the following
(Use different coloured highlighter for each category)

- | | | |
|-----------------------|---|---------------------------------------|
| Training times | - | Court / Field / Training arena |
| | - | Weights |
| | - | Pool |
| | - | Body/core stability training |
| Nutrition | - | Meals |
| | - | Snacks |
| Recovery | - | Stretching |
| | - | Massage |
| | - | Spa / Contrast showers |
| | - | Mental training / visualising |
| Work / Study | - | Uni / Tech. / School / Job |
| | - | Homework / other educational |
| | - | Other job eg casual work |
| Domestic | | Washing / Shopping / Cooking |
| Time Out | - | Movie |
| | - | Visit friends |
| | - | Hobby |
| | - | Read a book |

Appendix 8: Athlete's Time management Checklist

Athlete Responsibilities

The least you can do to help yourself cope with training:

- | | | |
|---------------------------------|---|--|
| Work/Rest | * | Monitor daily: |
| | | Heart Rate/Body Weight/Sleep |
| | | How you feel |
| | * | Stretch |
| | * | Cross Training (different activity) |
| Nutrition | * | Check Fluid balance (urine) |
| | * | Eat a balanced diet |
| | * | Replace carbos ASAP after training |
| Physical Techniques: | * | Contrast showers /s pa / bath |
| | * | Massage / self massage |
| | * | Pool work |
| Psychological Techniques | * | Muscle Relaxation Techniques |
| | * | Breathing exercises |
| | * | Music |
| | * | Visualisation |
| | * | Meditation |

Appendix 9: Athlete Responsibilities

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