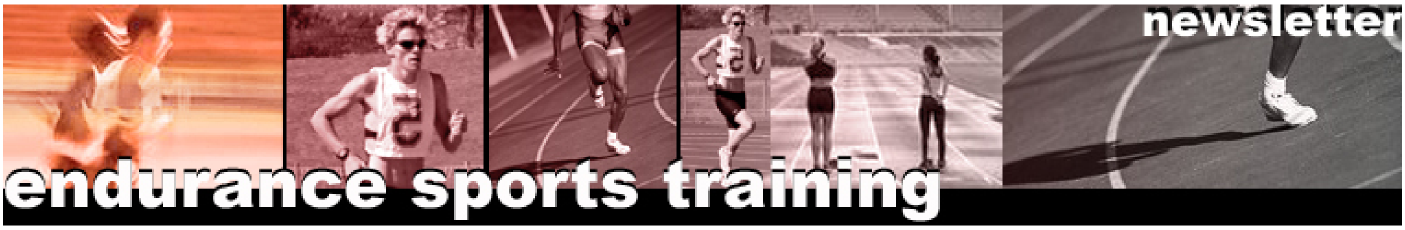


Volume 2
October 2004

Inside This Issue

www.endurancetraining.com.au

Welcome to the second edition of Endurance Sports Training's Newsletter. It has been quite some time since the last newsletter. We do apologise, and hope that this bumper edition makes up for the delay.

This edition includes some great articles from experts in the fields of nutrition, physiology and soft tissue therapy. Not only will this newsletter provide you will plenty of the latest information pertaining to endurance sports, but it will also introduce some new specialist services that Endurance Sports Training have on offer.

I hope you enjoy this newsletter. If you have any questions or comments please let us know. For a full list of services provided by Endurance Sports Training please visit www.endurancetraining.com.au

Monitoring Training Load

Training for endurance sports is physically and mentally demanding. Athletes trying to achieve optimal results are required to push themselves to their limits. In many instances it can be a fine line between optimal adaptations and excessive fatigue. For this reason, monitoring, tracking and analysing training load and athlete response becomes a key tool in athlete performance.

Training load often becomes the focal point of athletic training, with many coaches and athletes imagining a direct relationship between training load and the athlete's performance response. Unfortunately the relationship between these two variables is not that simple.

How many times have you completed a successful training program and taper leading into an event and achieved good results, and then underperformed for a similar event when you have tried the same approach again? While there may be many reasons for this discrepancy in performance, the simple fact is that many ingredients go into the pot to create overall performance. Specific training may not lead to a specific performance output. For this reason, monitoring athlete response is equally as important as monitoring training load.

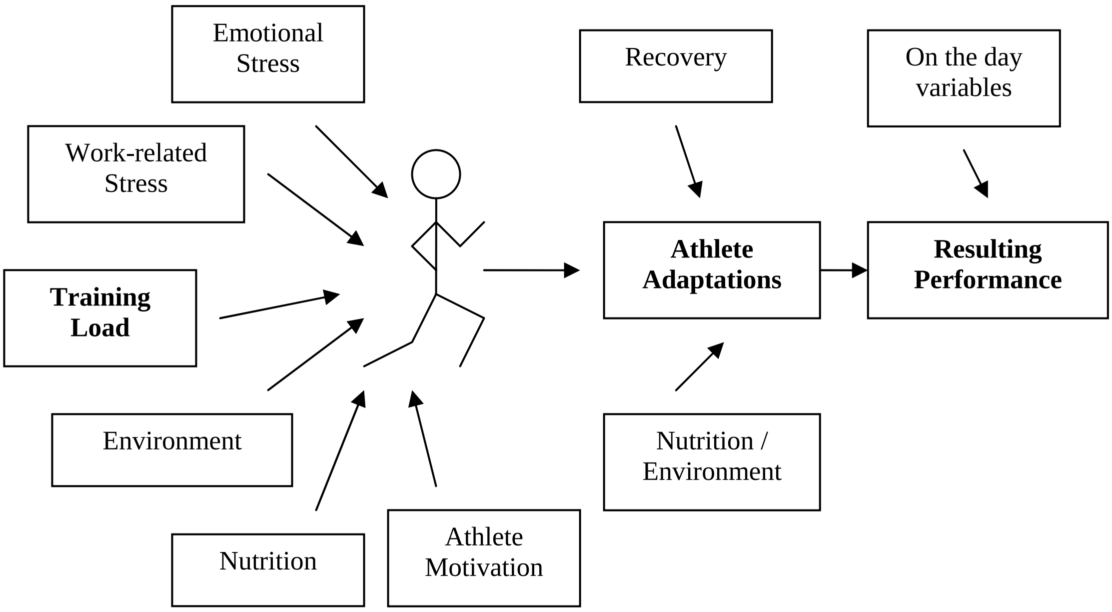


Figure 1. Inputs into the 'athlete system' and variables effecting the athletes adaptations and resulting performance.

Monitoring Training Load Continued

Why Monitor Training Load?

The goal of monitoring training, regardless of what method you use, is to quantify the training stress an athlete is undertaking. The two main variables that need to be quantified are volume and intensity. Most methods of monitoring training load attempt to roll these two variables into the one monitoring unit in order to keep things simple. However, this does not have to be the case.

Monitoring and retrospectively tracking training load allows a profile of training to be developed. The coach and athlete can then assess the training demand of varying training methods. This retrospective profiling also allows an understanding of the training load concept to be understood.

The next logical stage of the process will be using load monitoring tools to assist in the planning of your training. It is beneficial to plan your training load prospectively, and through the use of retrospective profiling you should now have an understanding of how to do this. Once an effective method of monitoring training load has been established, these methods can be used to plan your future training load. This can assist in the quantification of overall training load.

How To Monitor Training Load

There are many methods of monitoring training load. Many of the simplistic methods have existed since the early stages of athletic training, while other more complex methods are still evolving. Traditional methods that provide effective, yet simplistic, methods of quantifying training load include:

- total distance
- total duration

From this point, more detailed methods of monitoring load have evolved in an attempt to further quantify overall load. Some of these methods include:

- Foster's model – RPE (subjective intensity rating) x total duration
- Heart rate TRIMPS – time in zones x weighting factor
- Total Heart Beats - Average heart rate x session duration

Athletes involved in easily quantifiable sports such as cycling are now able to measure what is actually occurring throughout a race, or training session through the use of power monitoring devices such as SRM Power Cranks. These technologies open up a totally new scope for quantifying training load.

Runners have recently been exposed to a new device that has allowed a more detailed analysis of each training session. The new Polar heart rate monitor (S625) comes with an accelerometer which accurately assesses steady state running speed in all running environments. This information can also be gathered accurately by some GPS devices.

With the ability to monitor actual output during training, new, more detailed methods of monitoring training load are established. Some of these include:

- time in speed zones (for running)
- Power (cycling) / Speed (running) TRIMPS – times in zones x weighting factor
- Variations in power / speed
- Maximal sustainable power / speed for given periods of time

These more detailed monitoring methods are beneficial in that they allow a more detailed analysis of training load and what actually occurred during the session. They can, however, be less accurate in some cases if care is not given to their setup. With every level of detail you wish to delve into as part of this monitoring, you make an assumption or an estimation, which limits the accuracy of the monitoring tool.

It is beneficial to determine the overall

training load for each session so training load can be broken down to assess session load, day load, week load, month load, and even year load.

When it comes to determining what is the best method of monitoring your load, the following questions should help you to arrive at an answer.

What are the demands of your event? Training load monitoring should focus on these demands.

What methods can you use to quantify your training load? If you can only log your total duration and rating of intensity, then there is little value considering speed or power.

What level of detail do you want to achieve with your monitoring method? If you only want to get a general indication, then use a simple method.

Why Monitor An Athletes Response to Training?

Monitoring an athlete's response to training, either subjectively or quantifiably, is in many ways more important than monitoring training load. When it comes down to it, it is how an athlete responds to training that generates performance, not the actually training that is undertaken. Obviously without the training, then there would not be an adequate response, but when it comes to monitoring these variables, athlete response is probably the key.

By monitoring an athlete's response to training, the state of fatigue and adaptation can be assessed. This allows the training load to be manipulated when the athlete's response is not as expected. This flexibility is a vital aspect of any training program.

How To Monitor Athlete Responses to Training

While there are a large number of methods available to monitor athlete training response, we will focus on methods that allow the athlete response to be measured daily. Other methods which can be done on a less regular basis include physiological testing, performance testing and the like. For the purpose of this article we will focus on more simplistic daily measures that are more easily tracked.

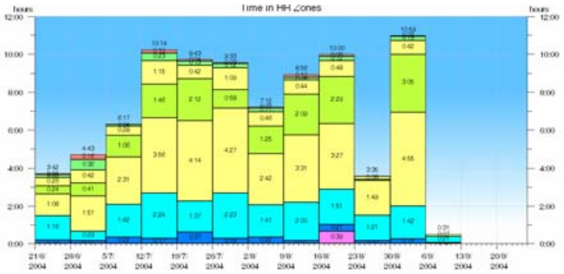
Most endurance athletes will at some stage have monitored their response to training. The most basic method of doing so is through the use of a training diary or training log. This simple and effective methods is available to all athletes. The only commitment is a little time and effort.

Ultimately it is the athlete's responsibility to fill in the training log. If this is too difficult it will not be done on a regular basis and therefore inconsistent results will be gathered. This is of minimal value.

It is important that the data capture in a training diary generates an accurate and true measure from the athlete. While measures such as heart rate variability taken during a morning test can be more accurate because they take out the athlete's subjective rating, they also require more equipment and time from the athlete. For this reason, the simplest training log may in actual fact be the most effective.

Key areas that need to be covered within a training log vary sport to sport, and even athlete to athlete. However, some general areas that should be covered within most sports include:

- General fatigue
- Lifestyle stress
- Illness
- Sleep
- Recovery modalities (such as massage, flexibility etc.)
- Nutrition
- Body mass
- Resting heart rate
- Travel



While monitoring training load and athlete training response requires an extra time commitment, in the long run the committed athlete will be rewarded by having the ability to look back over effective training methods and how different circumstances have lead to good/bad results. This will ultimately allow a more detailed plan for the athlete to be generated, thus increasing the confidence in producing a good result on the day, when it counts.

In the past, Endurance Sports Training has used a simple training log, coupled with athlete feedback, to monitor training response. We are currently undertaking a project to enhance our coaching service by providing a more detailed online training log. This training log will be coupled with an actual versus planned monitoring of training load. The purpose of this project is to enhance athlete to coach feedback, evolve our current training plans, and present a new monitoring tool to our athletes. This service should be available to all Endurance Sports Training athletes by the end of December, 2004.

Nutrition for the Ironman Athlete

By Greg Cox

A tip– the use of protein as a fuel source increases as the duration of the exercise increases. This increase is in direct proportion with a decrease in your muscle carbohydrate stores. In simple terms, you burn muscle if you don't feed your muscles with carbohydrate during long duration events.

Having competed in numerous sports and numerous ultra-endurance races and being trained in nutrition, I have a unique insight into the nutritional demands and challenges faced by ultra-endurance athletes. I have worked with athletes from

believe me, there is no sport where an athlete's food and fluid selection in the days leading into and during an event impact on the outcome of that event like an ultra-endurance race. There is no one *"race day nutrition formula"* that will meet the needs of every ironman triathlon competitor for every ironman triathlon. However, in order to optimise your exercise performance on race day, there are four nutrition issues to tackle.

The first of these is to start the event well-fed (but not over-fed) and adequately hydrated. Manipulating your carbohydrate intake leading into a race is critical if your aim is to increase muscle and liver carbohydrate stores (carbohydrate load) prior to the race. Although everyone says they 'carbohydrate load', few athletes do this well, as their knowledge regarding the carbohydrate content of food is poor.

Pasta, rice and potatoes are nutritious sources of carbohydrate, however they're not the most compact carbohydrate foods. So if your plan is to increase your carbohydrate intake by eating these foods, it's important to realise you will need to increase your intake considerably to achieve this.

The second of these goals is to meet hourly carbohydrate needs while racing. Some nutrition experts suggest you match hourly energy (calorie) demands while racing. Research has shown that it isn't necessary or possible to replace hourly energy demands.

The body uses a mix of fuels (fat, carbohydrate and protein) during extended endurance exercise. Carbohydrate is the only fuel source that is in short supply, however. Maintaining your carbohydrate intake throughout the race in order to spare oxidation of stored carbohydrate (glycogen) in the muscle is important in ironman triathlon events.

The third nutrition goal is to remain adequately hydrated during the race. Although this may seem simple, matching fluid intake with sweat losses is difficult, even for experienced athletes. The catch cry "drink as much as you can" doesn't apply to athletes competing in ironman triathlon events.

Recommended fluid intake guidelines developed for high intensity, short duration sports (sports <2 hrs) in some cases may overestimate the fluid needs for ultra-endurance athletes. There is hot debate amongst researchers at present regarding fluid guidelines for athletes competing in ultra endurance events. Environmental conditions, intensity of exercise and individual physiology are all factors that influence hourly sweat losses. When planning your hourly fluid intake for racing, all issues should be considered and strategies put in place so you drink to match your sweat losses.

Your last goal and an even more controversial issue, is replacing electrolytes, specifically sodium, while racing. Issues surrounding sodium and fluid balance have received considerable attention recently. Much of this interest has been sparked by the issue of hyponatremia or low plasma sodium. In a recent study Speedy and colleagues (1999) reported that 18% of 330 race finishers at the 1997 NZ ironman were hyponatremic (sodium <135 mmol/L). The authors concluded that fluid overload was responsible for 73% of those individuals with severe hyponatremia (sodium < 130mmol/L). Dehydration and/or a lack of sodium has been linked with the onset of muscle cramp, a nightmare for every ultra-endurance racer. It is popular amongst long course triathletes to consume sodium during a race to avoid the likelihood of developing hyponatremia (low plasma sodium levels). Some athletes go one step further and think they can 'sodium load' prior to the race as they would 'carbohydrate load'.

Current research suggests that hyponatremia is most likely caused by over-consuming low sodium fluids, above and beyond fluid requirements. We don't have any definitive answers regarding optimal sodium intakes for athletes competing in ultra endurance events, although the American College of Sports Medicine (1996) suggests athletes consume 0.5-0.7grams of sodium per hour during prolonged exercise. Other researchers have suggested slightly higher intakes, while others have found no relationship between sodium intake and plasma sodium levels. Finding the balance, and considering all these views is the key in planning the sodium content of your race food and fluid choices.

Nutrition for the Ironman Athlete continued

Outlined in the table below is a sample hourly plan for an athlete competing in a long course triathlon for both the cycle and run. These guidelines are for an athlete well-fed and well-hydrated before the race start, with the race held in moderate temperature conditions.

Discipline	Hourly Suggestions	Expert comment
Cycle	500ml of 6% sports drink (i.e. Gatorade), a vegemite sandwich and additional sips of water	The sports drink provides 30g of carbohydrate, with an additional 30g from the vegemite sandwich. The sandwich offers a great source of sodium and a savoury option compared with the sports drink. Water can be consumed to increase hourly fluid intake.
Run	Power Gel, two cups of sports drink and two cups of cola soft drink	The gel provides 28g of carbohydrate. Assuming you drink 100ml from each cup, that's 400ml total and an additional 36g of carbohydrate – total carbohydrate 64g.

Greg Cox is a sports dietician with the Australian Institute of Sport and has many years of experience working with endurance athletes. Greg has also completed many Ironman events with a best time of 9:11.

If you require advice to plan your pre-race and race day food and fluid selection please contact Greg at gcox@endurancetraining.com.au and request a dietary race assessment form.

The service being offered is tailored for endurance athletes and is focused on developing a carbohydrate loading plan and a race day/competition nutritional plan. Each plan is written up individually based on the information provided to Greg through the dietary race assessment sheet. The cost for this service is $85 (inc. GST) or $75 (inc. GST) for Endurance Sports Training athletes.

Massage and Lactic Acid - The Myth

By Brad Hiskins

Lactic acid has long been the focus of sports massage therapists. Traditional wisdom tells us that massage 'rids' the body of the evil, muscle ravaging chemical, leaving the body 'recovered' and ready for another exercise bout.

So what exactly is lactic acid? Does it really cause muscle soreness? Does it really sit in the blood stream and muscles for prolonged periods of time after exercise? And the million dollar question: does 'massage' make any of difference?

The Energy Systems

It is important to have an understanding of the energy systems the body uses to supply energy to the working muscles before looking in greater detail at lactic acid.

For muscles to contract, they require energy. Energy is supplied to the muscle cells as molecules of energy called ATP. There are three methods the body uses to supply energy in the form of ATP. Two of these methods, called the ATP/ alactic system and the glycolytic/lactate system, are both considered to be anaerobic systems because they do not require oxygen immediately for their chemical processes.

The third system is considered aerobic as it relies on a steady supply of oxygen to regenerate the ATP energy molecule. The type of exercise an athlete endures, will determine which of the three energy systems the athlete will use and hence whether lactic acid will be a factor.

ATP/alactic energy system

- Power athletes (ex: weightlifters, 100meter sprinters)
- No lactic acid formed

A power athlete such as weightlifter will use the ATP/alactic system for energy. ATP is a molecule found inside muscle cells that when broken down, provides fast and large amounts of energy for muscles to do work. As ATP is broken down, it is simultaneously reformed via a substance called Creatine Phosphate. Throwing, jumping and 100 metre sprints are all events that rely on this ATP-Creatine Phosphate system.

This system **does not** produce lactic acid as a part of its cycle and hence athletes using this energy system will not suffer from excess lactic acid production.

A major drawback of this pathway, however, is that it can only produce continuous energy for up to 15 seconds of muscle activity due to a very limited quantity of ATP and Creatine Phosphate being stored within the muscles. If strenuous exercise is to continue beyond this brief period, the means of replacing lost ATP must come via the second anaerobic system, the glycolysis/lactate system.

Glycolytic/lactate system

- Intense amount of muscle activity beyond approximately 15 seconds and up to 3 minutes (e.g. 100 meter swimming, 400 meter running)
- No oxygen necessary for energy production
- Lactic acid produced as bi-product

A 400m runner and a 100m swimmer are typical athletes who would rely heavily on glycolysis/lactate system. At this distance, requiring an intense amount of muscle activity, the ATP present in the muscle cells would have been almost used up at the start of the race, and now the lactate system has kicked into gear and contributes significantly to the energy required to complete the event.

The fuels for glycolysis comes from the molecule glucose that has been circulating in the blood or that have been stored in another form called glycogen in the muscles and liver in the body. These forms of glucose are broken down via a series of ten different chemical reactions into a substance called pyruvic acid. Whilst the energy, or ATP, released from these reactions is extremely rapid and does not require oxygen, only a small amount of ATP is resynthesised. Consequently in events such as the marathon, soccer games and endurance cycling, the pyruvic acid must be shunted into the third energy system to keep providing energy - the aerobic system – described below.

The Aerobic Energy System

- Prolonged muscle activity beyond approximately 3 minutes (e.g. marathon)
- Oxygen is required

The Aerobic System is required for any athletic event that extends beyond about 3 minutes in duration, such as a 5km run, 800m swim, or a soccer match. This final and virtually limitless supply of energy will provide for more than 90% of the energy required for such activities (Anderson, 1997). However the rate of maximal energy production from this system is not as high as from the anaerobic systems and so aerobic events like the marathon are run at a considerably slower pace then a 400m run.

It is important to keep in mind that none of the energy systems are used in isolation. At all stages of exercise and rest, each energy system is active to some extent, even if it's contribution is relatively minor.

Why is lactic acid formed?

The rate at which the glycolytic/lactate system burns to provide energy in the form of ATP is critical to the development and maintenance of high power outputs or speed. However, a problem can arise if the product of glycolysis (pyruvic acid) is not being removed and funnelled into the aerobic system for further metabolism, as fast as it is being produced by glycolysis. If the concentration of pyruvic acid becomes too high it will bring glycolysis to a halt – and the energy it provides. To avoid this dilemma, an enzyme called lactate dehydrogenase steps in and converts some of the pyruvic acid to lactic acid (removing pyruvic acid and half of the free H+ ions produced during glycolysis) and hence 'buys some time' to allow glycolysis to continue to reform the ATP molecule.

Once lactic acid has been formed in the working muscle cells, it immediately breaks down into a salt called lactate and hydrogen ions, which are then transported out of the muscle cells and diffuse into the blood and surrounding tissues. The constant formation of lactic acid in the blood, and then its removal by various tissues, means that lactic acid levels in both the muscles and blood can remain at constant levels without adverse effects on cell metabolism for long periods of exercise. Lactate can later be reconverted into pyruvate, acting as a fuel source to tissues not working as hard.

For this reason, an athlete such as a marathon runner, will have near resting levels of lactic acid in their blood following a race, due to a balance between the lactic acid that is released into the blood and the rate it is removed from the blood. In addition, because this event relies predominately on the aerobic energy system and oxygen is readily available, very little pyruvic acid is allowed to accumulate due to its removal into the aerobic system rather than being converted to lactic acid.

When does the lactic acid become a problem?

At some point of exercise intensity between 75 and 90 percent of VO2 max (intense muscle activity such as 800 meter running), the 'anaerobic threshold' is passed. Up until this point the lactate is being used by the aerobic system at the same rate it is being produced. Now due to physiological shortages (oxygen availability to cells, certain enzymes, or lack of cell mitochondria (the energy houses in cells)) the utilisation of lactate as an energy source is overwhelmed by its production. Blood lactate levels increase rapidly, acidifying the blood (lowering pH) which in turn overcome natural ph buffers and eventually block the rate of the glycolytic/ lactate system. It is at this stage that lactic acid becomes a problem for the athlete as energy production is decreased and the effects of low pH levels in the blood take effect – the lactic acid 'burn'.

Hence the only type of athlete that will experience excessive lactic acid levels are those that compete in sports that demand high intensity exercise for prolonged periods of time. Furthermore, these athletes tend to train the glycolytic/lactic system (resulting in increased mitochondria, enzyme levels and oxygen supplies) enabling them to withstand high levels of lactic acid.

What happens to these excessive levels of lactic acid?

Scientific evidence has shown that approximately 70% of the lactic acid formed during any intensity of exercise is converted back to pyruvic acid and is used as a substrate by the heart and skeletal muscle. The efficient action of the body's circulatory system results in lactic acid concentration in the blood being almost at resting levels 30-60 minutes following all intensities and durations of athletic events (Dodd, Powers, Callender & Brooks, 1984).

Given this fact, those sore achy muscles that occur the day after an especially tough exercise session can hardly be blamed on lactic acid. Muscle soreness that occurs 24-72 hours after exercise (delayed onset muscle soreness or DOMS) is not affected by lactic acid levels.

Does massage help remove blood lactate?

What we have seen so far is that lactic acid only affects a small proportion of athletic performance and hence most athletes that present to a soft tissue therapist will not be affected by excessive levels. Secondly, the normal levels of lactic acid are a good source of energy and a necessary part of the energy production process. But what about those athletes that do break that lactic acid barrier and endure excessive levels? Does recovery massage help?

Several studies have shown massage to be no more effective for speeding up lactic acid removal from the blood than simply resting after exercise (Dolgener & Morien, 1993; Hemmings et al., 2000, Gupta et al., 1996). The failure of massage to benefit lactic acid removal is thought to be because massage, like passive recovery, fails to effect any significant change to the volume or rate of blood flow that enters and leaves muscles. (Shoemaker, Tiidus & Mader, 1997).

It has been widely acknowledged, however, that blood lactate is removed more quickly during active recovery. This is because blood flow remains elevated through the active muscle, which in turn is believed to enhance lactate removal from the muscle cell (Wilmore, 1994).

Quite simply, if blood lactate levels are back to normal levels one hour post exercise no matter what the athlete does post exercise, of course recovery massage does not make a difference to this physiology. So what does recovery massage do?

So what does recovery massage do?

So if blood lactic acid removal is unlikely to be one of the benefits of recovery massage post exercise , then what does it do? There are many possible effects, all of which need further study to substantiate what we are trying to achieve with recovery massage.

Benefits:

- It is possible that massage leads to an enhanced exchange rate of fluids situated around the cells, although as described previously, this is unlikely to occur via an increase in blood flow.
- Normalising hypertonicity:
  - Decreasing metabolic rate (possibly decreasing fuel usage and metabolic waste production)
  - Relaxed muscle decreases pressure on surrounding tissues (possibly improving local circulation and lymphatic drainage)
- Neurological calming affects
  - Reducing hypersensitivity of nerve ending posts exercise
  - Alleviating pain-spasm-pain reflexes
- Release a cascade of chemical messengers associated with parasympathetic responses

These effects provide a beneficial impact on an athlete's ability to recovery and adapt to training, while also decreasing the risk of injury.

A study comparing the effects of passive recovery versus massage in 11 male subjects did demonstrate that mechanical massage applied for 20 minutes by a modified pneumatic intermittent device improved duration of cycling on a subsequent exercise cycling bout (Zelikovski, Kaye and Fink, 1993).

Several studies have also confirmed that during the application of massage to the triceps surae muscle group, there is a decrease in muscle tone as measured by a decrease in the H-reflex amplitude, a measure of motor nerve excitability (Morelli et al., 1990, Morelli et al., 1991; Sullivan et al., 1991) However, these H-reflex amplitudes returned to normal immediately on termination of the massage, so the lasting effects of this tone reduction have yet to be studied.

Whilst there are numerous anecdotal accounts attesting to the positive affect of massage on psychological well being, empirical evidence is scarce and hampered by poor experimental designs and sample sizes.

One study has shown massage to have an affect on positive mood state, synonymous with decrease tension, anger, anxiety and depression in physical education students (Weinberg, Jackson & Kodny, 1988).

Further, various massage techniques applied to the hamstring muscles has been shown to cause a measurable increase in hip flexion range (Crossman et al 1984). Massage therapy has also been shown to increase neck extension range and shoulder abduction in a group of university dancers (Leivadi et al 1999) and shoulder joint internal rotation range in swimmers (Blanch et al 1995).

In conclusion...

Undoubtedly, athlete feedback has provided vast anecdotal evidence supporting recovery massage. However, the challenge as a Soft Tissue Therapist is to discover, understand and impart what is actually physiologically achieved through application of recovery techniques. In addition, it is necessary to support these claims, and moreover squash ill-founded beliefs, through scientific evidence.

Brad Hiskins is a soft tissue therapist at the Australian Institute of Sport and runs Clinic 88, a soft tissue practice is Canberra. For more information go to www.clinic88.com.au

Endurance Sports Training Services

Endurance Sports Training has been providing online coaching services for over 3 years, in the process helping many runners, triathletes, cyclists and adventure races to achieve their goals.

Endurance Sports Training continues to excel in the coaching of these sports with experienced coach and sports physiologist Ben Wisbey leading a specialist group of coaches.

Services provided by Endurance Sports Training:

- Online coaching
- Health and fitness programs
- Physiological Testing at the AIS
- Race day nutritional planning
- Run training groups for Canberra runners

Specialist coaches provide:
Endurance sports coaching

- Track sprint coaching
- Team sport coaching
- Strength and power programs
- Orienteering coaching

For more information on the services offered by Endurance Sports Training please visit
www.endurancetraining.com.au

28 Racing Team Training Camps

The 28 Racing Team will be holding organised run training camps starting in January, with the first camp to be held at Bundanoon in NSW. The training camp is designed to meet the needs of runners from all levels including the complete novice looking at running their first 5km race to the experienced marathoner. The camps are not focused on preparing individuals for a particular event, but could be an ideal platform for those who are targeting an event at the Canberra marathon or the Sydney Morning Herald Half Marathon.

The first camp has been scheduled for the 14th-16th of January 2005 with the possibility of a second camp on the 21st-23rd of January 2005 based on the numbers. There will only be 25 places for each camp.

Each camp will have up to eight staff looking after your needs and the following is included in each camp:
- Two nights accommodation (Friday and Saturday night)
- Food for the duration of the camp (Friday evening - Sunday afternoon)
- One-hour massage including a clinical assessment and written feedback
- Twenty-minute consultation on your training program, upcoming races and goals
- Gait analysis with written feedback and a copy of your footage on CD
- Two spinal fitness classes
- Two stretching classes
- Four seminars on Nutrition, Race Planning, Recovery and Self-massage
- Videos from some of histories greatest running races
- Trivia Quiz
- Question time with numerous 28 Racing Team members
- T-shirt
- And of course, lots of running.

For more information visit the 28 racing team website at www.28racingteam.com