



Volume 1
October 2003

quarterly newsletter

inside this issue

THE IMPORTANCE OF TRAINING INTENSITY	1
CROSS TRAINING: IS IT BENEFICIAL?	3
THE EFFECT OF BODY TEMPERATURE ON PERFORMANCE	4
USING HEART RATE VARIABILITY TO TRACK ATHLETIC FATIGUE	5
BOOK REVIEWS	6

“No matter what your competition goal, top end speed is essential to performance”

Welcome to the inaugural edition of Endurance Sports Training's Research Newsletter. In producing this newsletter Endurance Sports training aims to provide scientific research, and present its application in a practical manner.

The newsletter will be released quarterly and will be available free to Endurance Sports Training Gold and Silver members. The newsletter can also be subscribed to for 1 year at a cost of A\$16.50 (US\$15 for international subscribers).

Each newsletter will include 5 pages of practical training information, including a key article, a couple of secondary articles and some brief notes of recent research.

I hope you enjoy this newsletter and if you have any questions or comments please contact us. For a full list of services provided by Endurance Sports Training please visit www.endurancetraining.com.au or www.endurancesportstraining.com for international residents.

The Importance of Training Intensity

All too often, individuals training for long distance events place extreme importance on their training volume, or weekly kilometers without paying much attention to the importance or the benefit of training intensity.

While it is true in any endurance sports that a large degree of aerobic endurance and strength endurance is required in order to perform well, optimal performance will never be achieved without a focus on training intensity.

Recent research by Billat et al. (2001) delves into the training habits of elite marathon runners from Portugal and France. While the overall training volume of

these athletes was quite high (averaging 187km/week for males and 158 for females), the stand out point was the amount of running that was done at marathon pace or faster. The males averaged 40 km/week at this pace while the females averaged 34 km/week, equating to approximately 22% of total weekly distance in both groups.

It was found that the male runners with the better marathon times, were also those who completed significantly more intensity work, despite most runners doing two quality sessions (at intensities between 3000m-10000m race pace) per week. For the women the story

The Importance of Training Intensity Continued...

was slightly different, with the total volume of intensity work being similar. Those with superior marathon performances, however, were completing on average more quality sessions per week. Despite completing no more intensity work in terms of volume, by spreading the training over more sessions, training intensity in each session would be improved.

This highlights that even athletes of a similar high ability can be separated in performance based on training intensity and not solely training volume.

This is also true on a career scale, meaning that training intensity or speed development is often overlooked throughout an athlete's training career. This leads to an athlete never reaching their potential and being limited in the magnitude of the improvements they can make.

The old rule 'speed before endurance' is very true in this respect. Endurance and strength will be developed as training background increases, and while a basic level of endurance is required in order to be able to perform quality interval training, this development is often over-emphasised in the case of many athletes.

To highlight this, the new breed of marathon runner is coming from ex-10,000m runners who have now shifted their focus. The speed background they have developed has allowed them to improve their strength and endurance, and successfully make the transition to the longer distances.

Previous research (**Paavolainen et al. 1999**) has indicated that in a group of runners, 5km performance rankings can be accurately predicted based on the athlete's ability over 20 meters from a flying start. This means that a distance runner's top speed over distances as short as 20m, is an indicator of 5km ability in a homogeneous group.

So how can this be applied to your training? Well, the key is firstly to establish the requirements of the event you are training for. Based on the speed, strength and endurance components of this event you can determine how much training time should be dedicated to each aspect of the event.

No matter what your competition goal, your top end speed is essential and by improving this, you can pull up your sub-maximal speeds through neuromuscular adaptations and improved efficiency.

Initially the goal is not to stimulate metabolic adaptations, and this means that you can focus on short high speed efforts with long recovery. This can then progress into longer efforts with a shorter recovery.

The inclusion of longer tempo efforts to improve anaerobic threshold, strength endurance, and economy is recommended for individuals training for longer events.

Top end speed and regular intensity work is an essential part of training for all endurance athletes. It has been shown to be beneficial for runners, cyclists, swimmers, rowers, as well as many others. Once a solid strength and endurance background has been developed, performance will predominately be determined by an individual's top speed and ability to maintain high intensities.

Billat, V.L., Demarle, A., Slawinski, J., Paiva, M., and Koralsztein, J.P. 2001 Physical and training characteristics of top-class marathon runners. *Medicine and Science in Sports and Exercise*, Vol. 33, No. 12, pp. 2089-2097.

Paavolainen, L., Häkkinen, K., Hämmäläinen, I., Nummela, A. and Rusko, H. 1999 Explosive Strength Training improves 5-km running time by improving running economy and muscular power. *Journal of Applied Physiology*, Vol. 86, pp. 1527-1533.

Visit www.endurancetraining.com.au to sign up for the quarterly Endurance Sports Training newsletter. You will also find more information on the staff at Endurance Sports Training and the services offered. If you are an international resident and wish to make the most of our services please visit www.endurancesportstraining.com

Cross Training: Is It Beneficial?

We've all heard of the importance of specificity in training, but what value does cross training have in your training program?

Cross training can be used to maintain conditioning during an injury period, or incorporated as part of your normal training schedule. To show that cross training does work, one only needs to think of the importance of core stability exercises for performance in running, cycling, and other sports.

No doubt the best training for your sport is your sport, however other sports have value in helping to train or maintain physiological parameters. Value also exists when injury prevents you from doing your normal training.

How does cross training benefit you when you are injured? Cross training minimizes what's called the reversibility principle, or detraining. Detraining (as a result of injury) leads to the following:

- recently acquired VO₂max gains decrease;
- resting muscle glycogen levels return to baseline;
- carbohydrate utilisation increases and the lactate threshold is lowered;
- at the muscle level the extent of the capillary network, arterial-venous oxygen difference and oxidative enzyme activities all decline; and
- oxidative fibre proportion is decreased in endurance athletes (Mujika *et al* 2000).

Cross training when injured has obvious benefits in helping to reduce some of the above detraining effects when endurance athletes are injured.

Cross training can also be beneficial when not injured. It is well known that training adaptations only occur in the muscle groups that are trained during that specific activity. However, cross training adaptations do occur in the respiratory, cardiovascular, and musculo-skeletal systems that the cross training utilises. (Baechle *et al* 2000). Cross training can be used to increase your overall training volume without increasing the risk of injury. Beneficial adaptations from

cross training include:

- Respiratory muscle strength and endurance will be maintained or even improved;
- Oxidative capacity of muscles used will improve;
- Microcirculation in muscles used will improve;
- Cardiac hypertrophy occurs with all endurance training;
- Ventricular contractility transfers from one endurance exercise to another; and
- The combination of all these aerobic adaptations will be of benefit (Zupan *et al* 1995).



The psychological benefits of cross training are often overlooked. Varied workouts help to decrease burnout, maintain your interest in training, reduce your stress levels, promote mental recovery, and help you to maintain focus when you are injured. A variety of workouts can help you regain that spark by providing a stimulating training environment.

Some other general adaptations that occur through the correct use of cross training include:

- Effective in maintaining training induced adaptations in heart and lung function without doing your normal activity;
- Can reduce the risk of overuse injuries from your normal activity by distributing the load of training among various body parts;
- Can enhance recovery (light exercise);
- Promotes balance in exercise activities;
- Allows strength/coordination development in stabilising muscle groups; and
- Promotes bilateral muscle development.

General guidelines to Cross Training

1. Substitute normal sessions with a cross training session. Don't just add them in unless you are aiming to increase your overall aerobic volume.
2. Cross training is phase specific. Carefully

Cross Training: Is It Beneficial? Continued...

- plan where you use cross training sessions, to maximize the benefit gained.
3. Expect normal learning and training curves in your chosen cross training activity.
 4. Avoid activities that will aggravate injuries common to your endurance sport.
 5. Train in the same heart rate zones as you would normally. Bear in mind, that sports that have a weight-bearing component have higher heart rates for the same intensity (for example, running heart rates can be around 10bpm higher than cycling at the same intensity)
 6. Maintain normal exercise frequency and intensity to minimise the risk of overtraining.
 7. Keep in mind that your main focus is your sport and therefore don't let the cross training sessions detract from your primary sports training sessions.

Cross training can be a vital tool both physiologically and psychologically in helping you maintain or even improve your performance in your chosen sport. Why not try some cycling, running, aqua-running, swimming, gym work or even rock climbing for variation in your normal training routine? Get an edge on your competition by structuring some cross training sessions into your program.

References

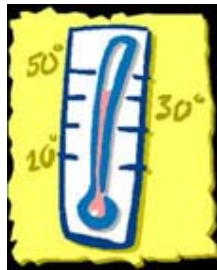
Baechle, T., Earle, R. (2000). *Essentials of strength training and conditioning*. Human Kinetics, Illinois.

Mujika, I., Padilla, S. (2000). Detraining: loss of training-induced physiological and performance adaptations, part 2: long term insufficient training stimulus, *Sports Medicine*, Vol.30(3):145-54.

Zupan, M.F., and Petosa, P.S. (1995). *Aerobic and resistance cross-training for peak triathlon performance*. *Strength and Conditioning*, 17:7-12.

The Effect of Body Temperature on Performance

Many endurance sports events are held in locations where hot conditions are experienced. This has been the case for many recent Olympic Games, as well as being a regular feature of many important national and international events across a range of sports.



is of no surprise that skin temperature was also higher in the 32 degree test, and this in turn caused an increased sweat rate. The interesting observation however was that rectal temperature maintained similar values and a similar trend throughout each test.

These conditions have a marked effect on performance. Some research on elite male Australian cyclists has come up with some ideas about why this may be the case. A group of eleven cyclists performed two 30 minute time trials several days apart. The first was conducted in a heat chamber at 32 degrees Celsius while the second was conducted in controlled conditions at 23 degrees Celsius, with a relative humidity of 60% in each case.

As you would expect, power output was lower when the test was performed in the heat. Average power output was 6.5% lower during this test. It

This would indicate that performance is subject to body temperature, and that there is an individual cap at which body temperature will cause a reduced performance. Power output for the first 10 minutes of each test was the same, but due to the environmental conditions and the faster rise of body temperature in the hot conditions, athletes in this test significantly lowered their power during the last 10 minutes to ensure that body temperature did not continue to rise.

This research indicates the close relationship between performance and body temperature,

The Effect of Body Temperature on Performance Continued...

and that body temperature is definitely a limitation of performance in hotter environments, especially in longer events.

This highlights the value of pre-cooling techniques such

as ice jackets and cold water immersion that have the ability to reduce core body temperature prior to the start of events in hot conditions.

It also gives weight to the practice of performing heat acclimation prior to competing

in a hot environment, as there is the potential to have better thermoregulatory control once the body has adapted to exercise in these conditions.

Tatterson, A.J., Hahn, A.G.,

Using Heart Rate Variability to Track Athletic Fatigue

One of the great mysteries of athletic training is 'how much is too much?'. To answer this question has long been the quest of many coaches and sports scientists. If the answer was discovered, it would allow optimal training load to be conducted and thus optimal performance improvements would be made.

Many different methods have been used to try and quantify athletic fatigue, and in recent years, tracking daily heart rate variability has received much attention. It is proving to be very effective in providing feedback to the coach and athlete, and while it is not yet the gold standard, it does provide accurate and beneficial advice when used correctly.

A daily orthostatic test is conducted using a Polar heart rate monitor that is capable of capturing RR intervals. The orthostatic test involves recording a 3 minute lying down period immediately followed by a 2 minute standing period. This 5 minute test, which is conducted each morning, can give you an accurate guide to the type of training you should be completing that day.

Time and frequency based analysis are used to examine the results of the test, with the focus of analysis being on the sympathetic and parasympathetic tone present.

Sympathetic tone is associated with a rise in heart rate as well as the preparation of the body for exertion, while parasympathetic tone is associated with withdrawal and relaxation.

Through the daily monitoring of heart rate variability (HRV) using these methods an accurate and effective assessment of the athlete's readiness to perform becomes available. This information can then be used to alter training based on the current goals of the athlete. If the athlete is in the competition season for example, then high intensity training becomes crucial to performance gains. Thus there would be little value in doing a key intensity session when the HRV feedback is suggesting the individual is suffering from sympathetic fatigue and therefore not ready to achieve maximal gains from such a session.

Using these HRV methods, the readiness of the athlete to

perform certain sessions can be assessed prior to training.

The main limitations in this method are that responses are individual and therefore it can take up to a month of consistent sampling before reliable and useful interpretations of the daily sample can be made. It is also important that data sampling is consistent. This method is not effective when used erratically. If too many days are lost, then the interpretation can become less accurate and therefore less effective in making accurate changes to training load.

These measures have also been shown to track and predict performance, as well as predict VO₂ Max to within 2% of actual values.

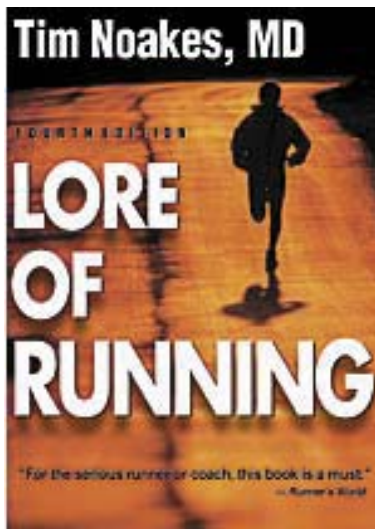
The value of HRV is evident, and over the coming years it will become more widely used and accepted as an accurate method of monitoring training state.



Book Reviews

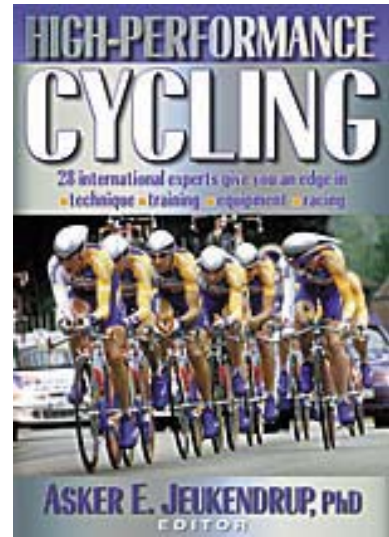
Lore of Running - 4th Edition
By Tim Noakes MD
Human Kinetics, 2003

When it comes to the running bible, this is the book. Tim Noakes is a world leader in the area of running related research. He presents a wealth of scientific and anecdotal information in a useful and applied manner. All 944 pages of this book provide useful information to runners of all distances, and everybody will learn something. The book provides a detailed background of general physiology, practical training advice based on solid scientific backing and information on some of the world's greatest runners and their training.



High Performance Cycling
Edited by Asker Jeukendrup
Human Kinetics, 2002

Edited by one of the world's leading exercise physiologists, High Performance Cycling offers the reader 22 chapters of high quality, easy to read, and easily applied cutting-edge information on technique, training, equipment and racing in road cycling. The book is divided into four sections, where 28 international experts give you information on training, performance assessment, aerodynamics / biomechanics, nutrition, and conditioning / recovery. A great resource for any serious cyclist wanting to gain that edge that only knowledge can give.



Proudly Supported By



Endurance Sports Training Services

Endurance Sports Training offers individualised training programs aimed to meet your training and competition goals, and set around your life.

The program includes detailed day to day description of all sessions, and will focus on sessions most important to your training.

This program includes regular contact to monitor progress and answer any training/racing related questions.

The number of sessions and focus of this session is based on individual needs, time availability, strengths and weaknesses.

For more information on Endurance Sports Training and our services please visit our website at www.endurancetraining.com.au A full range of services are also available to international residents through our international site at www.endurancesportstraining.com

If you wish to sign up to receive the Endurance Sports Training quarterly newsletter then please do so through our website or by emailing bwisbey@endurancetraining.com.au