THE MASTERS ATHLETE

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Go Out or Come Home Hard?

© by Dr Peter Reaburn
Triathlon Research Initiative, Central Qld University

Reprinted from the last issue (without the errors!)

Introduction

How often do you see youngsters or inexperienced athletes at the start of an open water swim, triathlon or particularly fun run, go out hard then die? What is the best pacing strategy? Go hard and try and hold on or build the race? Very little has been written on the area of pacing so let's try and take a scientific look at the concept and see if we can come up with some answers.

Physiology

Going out too hard at the start of a race leads to a rapid accumulation of lactic acid which has three negative consequences for racing:

- It stops muscles contracting properly thus slowing us down
- It slows down the breakdown of carbohydrate and thus energy supply
- It hurts

That is, the athletes that head out too hard, "die". In addition, once produced at the start of a race, the lactic acid seems to "loiter with intent" and takes a long time to remove, even when we slow down.

Going out slower in the earlier parts of a race reduces the amount of lactic acid produced and prevents the negatives above from slowing us down. A slower start also allows the heart, lungs and blood vessels to get moving and deliver that all-important oxygen. The more oxygen, the less lactic acid. This allows middle and latter stages of the race to be done at a faster rate without any of the negative consequences outlined above.

The Research

Studies have compared the three possible pacing methods - even-pacing, fast-slow and slow-fast (negative splitting) pacing. Research, although from the 50' s and 60's, has shown that fast-slow pacing that the inexperienced youngsters use is the least effective method of racing. However, the research is relatively inconclusive as to whether even-paced or slow-fast pacing are the best way to go.

A 1958 study looked at three strategies to run 1245 metres as fast as possible. First run was started at 13.9 mph (remember miles?) and held that pace till the end- a time of 3min 20 secs. The second run was done starting at 13.5 mph and running at 14.9 mph till the finish - the same 3 min 20 sec time for the 1245 metre run. This run produced the least lactic acid and the lowest oxygen consumption. The third run was a disaster for the runners. They ran at 14.9 mph at the start and came home at 13.5 mph, the head out hard and die method!! Performances plummetted and both lactic levels and oxygen consumption skyrocketted.

In 1993, a study from Wisconsin, USA, studied nine-well trained cyclists and came up with strong support for the slow-fast method of pacing in a 2-K time - trial. The first one K was covered at 56, 53, 51, 50 and 48% of their best 2-K times. The final one-K was to be completed as fast as possible. The moderately-slow 51% method produced the best performance times and fastest second K. None of the nine cyclists performed well with the fast (48%) starting K.

What the elite use

Years of watching elite swimmers and runners has also revealed that most use the even or slow-fast slow pacing methods. While there are always exceptions in elite sport (eg. Perkins in the 1500 free or Thorpe' s unbelievable speed at the backend of a 400 free), the fast-slow method has seldom proved successful in endurance sport.

In support of the even-paced and slow-fast methods we can learn a lot by looking at runners like Daniel Komen (WR for 5K - 12:39) or Paul Tergat (WR for 10K - 26:27). Komen ran the following 1K splits in his world-record run - 2:32, 2:32, 2:31, 2:31 and 2:31 (slow bastard eh!!). Tergat, on the other hand, used the slow (!?) - fast method of pacing in his world record 10K run. He ran 13:17 for the first 5K then came home in 13:10 for the final 5K.

How can I prevent dying in a race?

Obviously a strong aerobic base, high aerobic capacity, anaerobic threshold and economical technique are crucial and have been discussed in previous issues of TMA. However, three strategies are important when preparing for and actually racing. Firstly, when preparing for racing, ensure you do goal pace training. That is, doing repeats in the pool, on the track, road or river, that are at the pace you want to race at. Secondly, at race start, warming up well before the race. An effective warm-up should include moderate pace work, above race- pace work and race-pace work. I see far too many masters athletes cruising in warm-up or not warming up at all and wonder why they perform poorly.

Thirdly, take the advice from the research outlined above, even-pace or negative split. Give those muscles a chance to get the blood and oxygen in so they don't produce that acid that slows us down and makes us hurt. Try the advice and see which of the even-paced or negative splitting works for you. See you well-warmed up on the start line!

This Issue..

Editorial

A final g'day to all our readers.

This is our last edition of *The Masters Athlete*. Sad for many of our readers, but for me a huge sigh of relief. I can now have some time to myself.

Peter and I are very proud of what we have achieved over the last four years. We feel we have produced a very high quality publication. Your feedback suggests we have achieved this. We hope you have enjoyed the articles and have taken something practical from each article.

If any of you know of someone with the time and skills to keep TMA alive, we would love to speak to them. Our contributors are happy to keep writing but we need a business-minded person to take over the running of TMA.

Our Subscription Form was structured so that everyone only paid up to Feb 99. Anyone who feels they have paid for more, and have not been reimbursed please write me a note.

We have enclosed a 'Back Issues' order form if there are any articles you missed out on. These have been very popular and we are now out of issues 10, 11 and 12.

Those of you receiving Issue 22 Dec 98, page 2 "Go Out Fast or Come Home Fast", would realise that someone had too much early Christmas cheer. I'd like to blame Peter, but unfortunately it was me. A reprint of that article is on this page.

We hope you all had a restful and happy Christmas. We wish you all the best in your endeavours and hope to keep in contact with many of you through various masters competitions. Thank you for your support, especially the very faithful who have been subscribers since we first started.

Peter & Claire

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PSYCHOLOGY

That Little Voice in Our Heads

© by Dr Stephanie Hanrahan

What we say to ourselves affects our performance. Negative self-talk creates stress and impairs performance. Usually if we are stressed and having a bad performance we are also not enjoying ourselves a whole lot. For these reasons negative self-talk is to be avoided.

Examples of negative thoughts include worry about performance, thoughts of "I'm not good enough", indecisiveness, preoccupation with physical signs of stress such as heat or breathing, worry about the possible consequences of performing poorly, and frustration about trying to change things we can't control.

Positive self-talk, on the other hand, can lead to realistic and constructive thoughts and can improve the chances of our reaching our goals. It must be pointed out, however, that positive self-talk by itself does not guarantee success.

Most of us are aware of the little voice in the back of our heads. It's great when we can learn to ignore it when it's saying things we don't want to listen to, but it's even better when we can learn to control what that voice says. We weren't born saying negative things to ourselves. We've learned to say these things and therefore we can learn to have more constructive self-talk. However, before we control our self-talk we need to be more aware of it.

Recognition

Negative self-talk often goes unnoticed because it is automatic. The first step is to learn to detect negative self-talk. This can be done by including notes of our self-talk during performance in our training logs. It can also be useful to backtrack when we feel stressed. Usually when we feel stressed there is an accompanying negative thought such as worry or frustration (as mentioned in the first paragraph).

Once an unwanted thought is recognised, the first way many people try to deal with it is to tell themselves not to think about it. For those of you who have tried this technique, you probably found it didn't work. Any time we tell ourselves not to think about X, we do nothing but think about X. (For example, right now, don't think about pink elephants)!

Thought Stopping

A simple but effective technique for dealing with unwanted thoughts is called 'thought stopping" or "thought stoppage'. This doesn't mean stopping all thoughts and becoming brain dead, but rather stopping the thoughts we don't want to be having (controlling that little voice). Thought stopping involves three steps:

1. Recognise
2. "STOP"
3. Replace

Once an unwanted thought is recognised we want to disrupt that thought. This can be done by screaming "STOP" silently to ourselves (or out loud if you're really game), snapping fingers, imagining a red flag flying in front of our face, or any other simple act that will momentarily interrupt the unwanted thought. The unwanted thought is then replaced with a constructive thought. I find that the easiest way to do this is to have a preselected cue word or phrase that I say to myself as I exhale (using the cue word in time with breathing is an added bonus, as breathing serves as another method of focusing our attention). For individuals involved in multiple events, it can be useful to have different cues that allow you to focus on relevant thoughts for different events. Select words that you feel will help you focus on relevant and useful aspects of performance. It doesn't matter if the words don't make sense to anyone else, as long as they work for you.

Ideas for Cue Words

alert	keep it simple
attack	powerful
be patient	push hard
concentrate	quality
control	quick
explode	speed
fast	ssmmoootthh
feels good	stretch
focus	technique
form	tempo
hang in there	timing
intense	tough it out

Practice

This technique, although simple, only works if it is well rehearsed. If we're stressing out and getting uptight, it won't do us much good to think, "now what was I supposed to do...say a word and breathe...what was that word...". The process of thought stopping should become automatic. This will obviously only occur if the technique is practiced regularly.

It is easiest to begin practicing the technique while lying down on your back with one hand on your stomach just below your belly button, and the other hand resting gently on top of that hand. If you have back trouble, put your feet up on a chair. With your eyes closed slowly inhale in such a way so that your stomach and hands rise and then exhale so that your stomach and hands fall. Try to spend the same amount of time breathing in as you do breathing out. Try to make the transition between the two as natural as possible as if your breathing has a mind of its own. Now every time you exhale say your preselected cue word(s) to yourself. All you should be aware of is your breathing and your word(s). If other thoughts come in to your head, STOP and redirect your thoughts to your breathing and your word(s).

Long hours of practice are not needed. Just 3-5 minutes once or twice a day is great. Once you're comfortable doing it lying down, then move to a sitting position and then a position that is relevant to your sport. Then practice the technique during training sessions. Eventually the thought stopping technique should become automatic so that unwanted thoughts can immediately be stopped and replaced with constructive ones.

"ANYONE WHO ENGAGES IN COMPETITIVE SPORT ACCEPTS THAT THERE MUST BE RULES AND REFEREES AND UMPIRES TO ENFORCE THEM. IF THE RULE BOOK IS TORN UP OR VICIOUS FOULS GO UNPUNISHED THEN THE SPORTING ELEMENT IS DESTROYED AND THE FUN FOR BOTH THE PLAYER AND THE SPECTATOR IS LOST."
SIR MICHAEL HAVERS (B 1923)
ATTORNEY GENERAL & LIFE PEER

The Team

PETER REABURN - Editor

CLAIRE REABURN - Co-ordinator/Editor

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EDITORIAL CORRESPONDENCE

Sports Performance Consultants, PO Box 61, CQU Post Office, Rockhampton, Qld. 4701. Phone (07) 49 265 269 A.H.

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SPORTS MEDICINE

Menopause and Female Masters Athletes

© by Dr June Canavan

The menopause transition is the period of time preceeding menopause when a woman's sex hormone levels may fluctuate markedly in a generally declining fashion. This period of time may be as short as a year or may last 5 - 10 years and cause considerable symptoms and signs which may affect athletic performance.

As a clinician I see female athletes who present with symptoms and thus I am dealing with women who are having difficulties in relation to the menopause or menopause transition. The comments that follow therefore do not necessarily apply to all female masters athletes but in fact some athletes here this morning who did not feel that the menopause had affected them may find that there are some symptoms which they have been unaware of or some training difficulties that have been ascribed to other conditions.

Menopause is defined as the cessation of menstrual periods and is therefore diagnosed in retrospect. Typical hormone levels at this time (which can be measure in a blood test) are an elevated FSH (Follicle stimulating hormone) and decreased serum oestradiol and serum testosterone.

Hormone levels in the menopause transition may be normal or may show an elevated FSH but a normal serum oestradiol and a normal serum testosterone. If these measurements are reviewed critically with respect to the time in the menstrual cycle at which the blood sample was collected the levels may in fact be lower than expected also.

Symptoms and signs of the menopause are really symptoms of oestrogen deficiency. These symptoms can be thought of as short-term, medium-term and long-term effects of oestrogen deficiency.

Short-term effects are more related to fluctuating circulating levels of oestrogen. Typical symptoms are hot flushes, mood lability, tiredness and perhaps palpitations. Medium-term symptoms which may occur after a year or two include dry skin, uro-genital changes causing vaginal dryness and urinary incontinence, and arthralgia. Long-term oestrogen deprivation causes problems such as osteoporosis, cardio-vascular disease and dementia.

If we now look at the symptoms and signs of menopause which may affect triathletes, both in training and competition, the impact of this change is sex hormone concentration becomes much more relevant.

Oestrogen receptors have been identified in many organs of the body and this explains many of the symptoms which have been described. For example the impact of **vasomotor symptoms** should not be ignored. Some women describe night sweats and the risk of heat illness due to dehydration becomes greater. Similarly the common hot flush may change thermoregulatory control. Palpitations are common in this menopause transition period and obviously may adversely affect performance.

Psychological symptoms may impact both on training and competition performance. Depression may make adherence to a training program more difficult and the fun and enjoyment of exercise may be lost. Poor concentration may increase the risk of accidents during a race and memory loss may cause confusion in transition areas. Mood lability and irritability may cause problems in squad training and athlete/coach relationships.

> "SYMPTOMS AND SIGNS OF THE MENOPAUSE ARE REALLY SYMPTOMS OF OESTROGEN DEFICIENCY. THESE SYMPTOMS CAN BE THOUGHT OF AS SHORT-TERM, MEDIUM-TERM AND LONG-TERM EFFECTS OF OESTROGEN DEFICIENCY."

Other symptoms which may impact on training include urinary stress incontinence and bladder irritability. Many women develop muscle cramps during the menopause and this may lead to muscle injury if not treated adequately. As mentioned earlier joint pain and stiffness may also result from oestrogen deficiency and may progress to arthritis.

Testosterone deficiency has its own symptoms which may affect triathletes. The four cardinal symptoms of testosterone deficiency are a generalised reduction in well-being, tiredness, weakness and a decline in libido. The first three symptoms all affect athletic performance and some triathletes I know would argue that the last one does too!!

It seems prudent to me to treat the conditions I have described above. Triathletes spend a lot of money on various aspects of the sport to enhance their performance yet if these perils of nature are not addressed this money is wasted. Treatment of **oestrogen deficiency** involves **oestrogen replacement.** Every women needs an individualised treatment program and needs to be reviewed regularly initially until the dose is adequate and appropriate. There are several forms of oestrogen replacement: oral tablets, transdermal get and patches, subcutaneous pellets or implants and topical applications.

Acceptance rates tend to depend on safety issues particularly that of breast cancer. Although there have been a few studies indicating a small increase in risk there have been large numbers of good studies which do not show an increased risk of breast cancer associated with HRT use. Endometrial cancer risk is higher if progesterone is not used in conjunction with oestrogen in women with a uterus. If a woman has had a hysterectomy she does not need to take progesterone supplements.

The evidence supporting the protective effect of oestrogen on the brain is now very convincing and leads to a reduced incidence of Alzeimer's disease. Similarly oestrogen replacement reduces a woman's risk of cardio-vascular disease considerably and as a triathlon doctor I am always concerned in age group races about the risk of heart attack during a race. I am very enthusiastic about the use of oestrogen in any female triathlete who has other risk factors for heart disease.

When we consider **testosterone replacement** in women there is usually mass hysteria. But it is well known that menopausal women lose some of their circulating testosterone and thus could be considered at a disadvantage. With the variation in age of the onset of the menopause transition some women in their late 30's and early 40's will be affected. There are several routes of administration of testosterone replacement in women: oral capsules, injections, hormone pellets or implants and in some countries a transdermal patch.

For both oestrogen and testosterone it is important to individualise dose depending on severity of symptoms, age and blood levels. It is possible to monitor response both by symptom score charts and blood levels.

There are many myths surrounding hormone replacement therapies. Contrary to popular belief, in my experience HRT does not lead to weight gain but weight gain occurs in menopausal period and fat tissue is deposited on the abdomen. Hair growth, particularly facial hair is one of the symptoms of menopause and can be prevented by HRT. I have mentioned breast cancer and acknowledge that it is a concern and regular screening must take place if a woman is taking HRT to enable early detection and therefore curative treatment.

Some athletes argue that HRT is unnatural. However, if women are diagnosed with an underactive thyroid they take thyroid hormone replacement. Similarly with diabetes caused by insulin deficiency. Nature did not design us to compete in triathlon after the menopause but if we want to continue to compete safely, without injury, and enjoy our sport then some of us may need to consider treating our sex hormone deficiencies with HRT.

Above is a transcript of the address delivered by Dr June Canavan at the Female Masters Breakfast on Thursday 27 August 1998 held in conjunction with the 1998 ITU Triathlon World Championships in Lausanne Switzerland.

SWIMMING

Do Swimmers Sweat

© by Dr Peter Reaburn

When we exercise, we lose heat from the body via radiation (heat waves), conduction direct contact with water or a surface), convection (air or water moving past), or evaporation of sweat into the air.

In water, swimmers lose heat mainly through conduction and convection if the water is cool enough. However, if the water is warm, the temperature gradient between the body and the water is reduced and heat may accumulate. Fluid could therefore be lost in swimmers through the increased activation of the sweating response.

Fluid loss, particularly in endurance athletes such as distance swimmers, may also take place through breathing. In physically active persons, 2-5 ml of water are lost from the respiratory tract each minute during strenuous exercise. This may be a significant fluid and weight loss over a long and/or intense swim training session. Dehydration due to fluid loss through both the respiratory tract and sweating leads to changes in blood volume and electrolyte imbalance which may in turn cause a reduction in performance

What the research says:

A number of studies have shown that swimmers "sweat" when they train. The original studies showed that young, fit men lose about 1L/hour when swimming in a heated (28 degree) pool for a 4.7k session (about 1.5 hrs). Louise Burke from the AIS showed similar figures when she examined the Olympic swimmers training in Atlanta before the 1996 Olympics. She also observed that the harder the main set, the more the fluid loss. This makes sense since the harder we train, the more heat we generate, the more we sweat.

So What?

A number of previous studies using runners and cyclists have reported decreases in both aerobic and anaerobic performance following exercise-induced dehydration in hot environments.

Anaerobic or sprint performance appears more likely to be reduced if dehydration is due to both exercise and heat exposure. It appears that electrolyte imbalances and elevated body temperature accompanying exercise-induced dehydration reduce anaerobic performance. Dehydration may also lead to increased muscle temperature and elevate muscle acidosis, thus inhibiting the energy pathways and anaerobic performance.

Numerous studies have also observed decreased aerobic performance following dehydration in a variety of sports. Dehydration may be associated with a decreased blood volume which in turn increases blood viscosity. An increase in resistance to blood flow may reduce the amount of blood pumped per beat of the heart. This may lead to the heart rate increasing to maintain the blood flow to the swimming muscles.

Implications

The implication for masters swim coaches and swimmers is that heart rate at a given submaximal speed or intensity may become higher due to the extra heat load placed on the body.

If a swimmer is both heat stressed and dehydrated, aerobic performance may further be compromised. The combination of exercise and heat stress results in competition between the central and muscular circulation for a limited blood volume. In hot and humid conditions, the skin blood vessels dilate to increase skin blood flow so as to allow heat loss. This increased skin blood flow may reduce maximal aerobic power by reducing the proportion of blood getting to the swim muscles.

> IN PHYSICALLY ACTIVE PERSONS, 2-5 ML OF WATER ARE LOST FROM THE RESPIRATORY TRACT EACH MINUTE DURING STRENUOUS EXERCISE. THIS MAY BE A SIGNIFICANT FLUID AND WEIGHT LOSS OVER A LONG AND/OR INTENSE SWIM TRAINING SESSION.

The available research strongly suggests the importance of swimmers consuming liquid before, during and following a swim training session. The American College of Sports Medicine recommends athletes drink at least 100-200 ml (approx. three mouthfuls = 100ml) per 10-15 minutes of running. In swimmers, this would involve drinking after and during the warm-up, during the main set, after the main set and during the cool down. Drink bottles need to be kept accessible and ideally in a cool place (e.g. the shade of the blocks) since cooler fluids have been shown to be absorbed more quickly than warm fluids.

In hot and humid conditions, swimmers would also be advised to weigh themselves before and after training (1kg weight loss = 1L fluid loss) in order to measure how much fluid they are losing. While water has been shown to be adequate for fluid replacement in events or training less than 45-60 minutes in duration, research has shown that the body absorbs fluid containing 6-8 percent (6-8g/100ml) carbohydrate and sodium (approx 0.05g/100ml) much faster than using water alone. Most commercial sports drinks are about these concentrations.

The longer and harder a session, the more fluid will be lost. The hotter the water or surroundings, the more you will lose. And finally, the more dehydrated you are before you hit the water, the worse off you will be.

In conclusion, it appears that high intensity endurance swim training leads to significant weight and fluid loss in swimmers. Thus, fluid replacement is strongly recommended during high intensity or long swim training sessions. Furthermore, it is recommended that coaches or swimmers in hot and humid environments or warm pools should weigh their swimmers or themselves before and after training sessions and adjust fluid intake deficits are observed.

So yes, swimmers do "sweat". They should thus drink before, during and after a session to ensure optimal training performance and recovery.

From the Research

Fish Consumption and Sudden Death

Recent research suggests that eating one meal of fish per week may lower the risk of sudden death in 40-85yr olds by as much as 52%. The researchers followed 20,551 male doctors over 11 years. When the study began in 1983 they were all free of cardiovascular disease and cancer and reported how often they ate canned tuna, dark-meat fish, shellfish, and other fish. From the seafood intake, the researchers were able to calculate the intake of marine n-3 fatty acids that aid in prevention of cardiovascular disease.

During the 11 years of follow-up, 133 sudden deaths occurred. It appeared that the relative risk of sudden death was inversely related to fish consumption. That is, the more fish eaten, the less likely the incidence of sudden death. "Fish for thought"

Albert, CM. et al. (1998). Fish consumption and risk of sudden cardiac death. *Journal of the American Medical Association* 279(1), 23-28.

> OLYMPIC MOTTO
> CITIUS, ALTIUS, FORTIUS
> (SWIFTER, HIGER, STRONGER)
>
> *Taken from the coping stone over the doorway of a French lycee run by a friend of Baron de Coubertin*

Athlete Profile

Name: Jen Thomasson

Age: 55 years

Sports/Events: Swimming/ I try them all
Occupation: **Past:** Physiotherapist
Present: Swim Coach

What do you enjoy about masters sport?
Everything. I love swimming itself, both training and competing, I love the feeling of being fit and I enjoy the company of other fun loving, vibrant people with similar interests.

What motivates you to participate?
Enjoyment of the sport, I enjoy it too much not to participate.

How do you keep yourself motivated?
It takes no effort to keep motivated, but new challenges, for example improving technique of strokes that were previously not good, and learning how to swim distances as well as sprints increases my motivation.

Favourite training session:
one with plenty of variety, eg, 600 warm up including drills, 20 x 100 f/s descending 1-4, 12 x 50 form, 400 kick.

How often do you train?
4 times per week plus a couple of sessions in the gym

Do you train under a coach, with a group of friends, or by yourself? Why?
I train under a coach because I find it easier and more enjoyable to do a programme set by someone else and swum with other squad members, than on my own.

Person most admired and why?:
Carl Lewis because he's a fantastic athlete, totally dedicated, focussed, confident, determined, persistant, but most importantly has a great body.

Other interests/hobbies:
Reading, surfing, golf, if only I had the time.

Your most memorable moment in sport?:
There are 2, winning a bronze medal for 400IM at 1962 Commonwealth Games, and breaking my first world record in Masters Swimmming, in May, for 200 Breaststroke.

Your most memorable moment in life so far:
There are three, the births of my three beautiful sons.

Favourite movie:
The Shawshank Redemption

Favourite 'bad' foods:
Disgustingly sweet and rich desserts and cakes.

Favourite 'good' foods:
Pasta, rice and vegetables

Philosophy on life:
Make sure you enjoy today because there may not be a tomorrow.

Advice to masters athletes wanting to improve:
Work hard on technique, remember that the quality of your training is more important than quantity, and if possible do some strength work in the gym.

Other Comments:
There is something for everyone, of all abilities, in masters swimming, and our motto of "fun, fitness and friendship" is spot on.

Tapering Science

© *by Dr Peter Reaburn*
Adapted from *International Journal of Sports Medicine, 19: 439-446, 1998.*

The hard work is done and it's now time to wind down the training ready for a big race. Athletes young and old love this time, coaches cross their append ages, and science and art come together to (hopefully) pull off the perfect taper – scientifically defined as reduction in training volume during a variable period of time leading to a major competition.

The purpose of this article is to present what sport science has to say about tapering. This science should then be individualised to each masters athlete as the art of tapering.

When tapering, a number of factors need to be considered. These include training intensity, training volume, training frequency, tapering duration and type of taper (progressive versus step).

Training Intensity

Of all the above factors, training intensity appears to be the one that must be maintained. To highlight this, a classic 1985 study took a group of moderately trained subjects who trained for 10-weeks with running and cycling. For the next 15 weeks they reduced the training intensity in some of the athletes by 33% and some by 66% while maintaining training time (40 mins/day) and frequency (6x/week).

The 33% reduction group appeared to maintain 5-minute effort performance for the 15 weeks but dropped both their aerobic capacity and ability to hold 85% max heart rate cycling duration.

The group that dropped training intensity by 66% dropped aerobic capacity, 5-minute effort performance and the long ride time after 5 weeks of tapering. The sport scientists concluded that training intensity is essential to maintain endurance performance during and following a long taper.

In a more realistic seven-day taper, Shepley and others (1992) compared three tapers in highly-trained runners:

1. moderate volume-low intensity
2. low volume-high intensity
3. rest only

> WHEN TAPERING, A NUMBER OF FACTORS NEED TO BE CONSIDERED. THESE INCLUDE TRAINING INTENSITY, TRAINING VOLUME, TRAINING FREQUENCY, TAPERING DURATION AND TYPE OF TAPER (PROGRESSIVE VERSUS STEP).

While aerobic capacity was not affected by any of the three tapers, the high intensity taper lead to increased carbohydrate muscle stores as well as a 22% increase in run time to exhaustion. The other tapers had no affect on run performance.

Again, this study supports the belief that a maintenance of training intensity is necessary to avoid decreases in performance during a taper. However, it appears that training volume needs to be dropped to recovery from the intense work.

Training Volume

Numerous studies have shown that training volume needs to be reduced during a taper to maximise race performance. In both highly trained runners and swimmers improvements in economy (less oxygen consumed for any speed), power output and actual performance improved when a gradual reduction in training volume was done while maintaining training frequency (how often you train) and intensity.

Training Frequency

The current consensus from sports scientists is that performance and training adaptations can be maintained during a taper with low training frequencies in moderately-trained athletes. However, normal training frequencies appear necessary to avoid detraining or performance drops in highly-trained athletes.

Taper Duration

Again, it appears that in moderately-trained people, a long taper may be adequate to maintain performance. However, in highly-trained athletes, it appears that decreasing training volume too much may decrease performance.

In highly-trained athletes (cyclists, triathletes, runners and swimmers), improved

Continued on page 12

ROWING

Estimating VO_2max on the Concept II Erg

© by Dr Peter Reaburn

There is no doubt that rowing 1000-2000m demands a high aerobic capacity (VO_2max). Measures of Olympic Rower's VO_2max show that the higher the aerobic capacity, the better the performance.

Many direct laboratory tests have been developed over the years. However, such tests require technical laboratory equipment, trained expertise such as sports scientists, are expensive, and require an all-out effort by the oarsperson.

Recently, a sub-maximal test has been developed for rowers that uses just a heart rate monitor, a Concept II ergometer, and a *nomogram* (see below).

The Test

1. The larger of the two cogs on the Concept II ergo is used with the vanes fully closed. The electronic display is set to show 500m split times and the exercise time set to 6 minutes.
2. The warm-up is for 6 minutes at an intensity that gets the heart rate up to 50-60% of maximal heart rate (220-age unless you know your own).
3. Following a 2 minute recovery, row for 6 minutes at a speed that raises the heart rate to 80-90% of maximal heart rate. You should try to keep the 500m split times as constant as possible throughout the test.
4. At exactly 2 minutes from the end of the test (4 minutes into test), the distance shown on the display is recorded (D2). During the final minute of the test, average heart rate is recorded.
5. Subtract D2 from the total distance covered in the 6 minutes to determine the distance covered in the final 2 minutes. You should now have the heart rate and distance covered in the final two minutes of the 6 minute workout.

Calculating VO_2max

- On the *nomogram* below, draw a line from the vertical average heart rate line on the left to the vertical line on the right that is the distance you covered in the last 2 minutes of the test.
- Where the drawn line crosses the sloped predicted VO_2max line is the value of your aerobic capacity in litres per minute.
- The nomogram used here is for a rower with a maximal heart rate during rowing of 191. A correction factor should be used for your own maximal heart rate (Table 1). That is, you multiply your estimated VO_2max value by that correction factor.

Table 1: Max HR Correction Factors

HRmax	Factor
200	1.07
195	1.03
190	0.99
185	0.95
180	0.92
175	0.88
170	0.85
165	0.81
160	0.78
155	0.75

- Now that you have your estimated aerobic capacity in litres per minute, the usual way rowers express aerobic capacity, you can turn it into another value called a relative (to body weight) VO_2max in ml/kg/min. This is done by multiplying your corrected Litres/minute value by 1000 to turn litres into millilitres then dividing by body weight.

Comparing Values

Elite young rowers will generally be above 5.5 litres per minute. The older we get, the more this drops (about 5-10% per decade), primarily as a result of a drop in maximal heart rate that means less blood and therefore oxygen is transported to our muscles. One elite masters rower (male, 55 years) I have tested had a value of 3.9 litres per minute.

In ml/kg/min, elite young rowers would be 70 ml/kg/min plus. Again, a drop of 5-10% per decade would mean an elite 40 yr old might be close to 60 ml/kg/min, an elite 60 yr old 50 ml/kg/min.

I would suggest the major role of such testing is to see **improvements in yourself** through rowing training, losing weight, or cross training such as swimming, cycling or running.

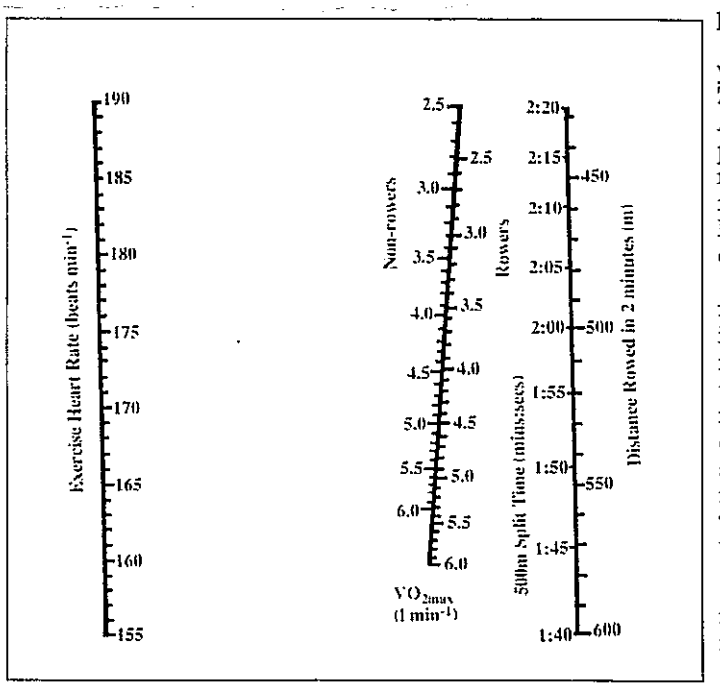

Figure 2: A nomogram for the prediction of VO_2 for males from submaximal exercise on a Concept 11 rowing ergometer

Training to improve VO_2max

Novice rowers will improve aerobic capacity just by rowing easy at low intensity. How-

Continued on page 7

Rowing continued from page 6

ever, in a carefully constructed training program for an experienced masters rower where intensity is gradually lifted over time the following pieces might be suggested:

1. Easy Aerobic (U2) - heart rate below 75% of maximal
- 20-90 mins rating 20-24
2. Strong Aerobic (U1) – heart rate 76-84% maximal
- 2-3 sets of 15-20 minutes rating 22-26 with 1-3 minutes recovery between sets
3. Anaerobic Threshold (AT) – heart rate 85-90% of maximal
- 2-4 sets of 10-15 minutes rating 24-30 with 3-5 minutes recovery between sets
4. Maximal Aerobic (Transport) – heart rate greater than 90% of maximal
- 3-5 sets of 3-6 minutes rating 26-34 with 3-6 minutes recovery between sets
- 2-3 sets of 4-6 by 30 second efforts rating 30-34 with 15 seconds between efforts and 3-5 minutes easy between sets.

All recoveries should be easy rowing rating 16-20 with heart rates low.

Conclusion

The primary aim of the test outlined above is to allow you to easily and simply monitor your training status. I suggest you try the test for a couple of trials 6-8 weeks apart from the start of a training cycle. If you like it, hold onto it. If not, forget it.

A word of caution on the training methods suggested above. A progressive training program should build in intensity. Your local club coach will be able to assist you in prescribing a program that suits your years of training, fitness level and goals.

How much Carbohydrate in a Day?

© by Dr Peter Reaburn

All athletes young and old know the importance of carbohydrates in the diet. They are the major energy source for racing and training and are the only energy source for our nervous system.

The following article itemises the amount of carbo we need in a day depending on how hard we exercise. In addition, a table is given that lists typical foods and the quantities of these foods required to give us 50 grams of carbs.

How much Carbohydrate?

Table 1 lists the number of grams of carbohydrate needed per kilogram of LEAN BODY WEIGHT for athletes training for various lengths of time.

Importantly, LEAN BODY WEIGHT is your body weight minus your fat weight. For example, a 100 kg athlete might have 15% body fat, their fat weight would be 15kg, therefore their LEAN BODY WEIGHT is 85kg. From the table below, if you were a moderate exerciser, you would need between 510 grams (85kg x 6g / kg) and 680 grams (85kg x 8g/kg)of carbohydrate in a day.

Table 1: Carbohydrate needs per Day (grams carbo / kg Lean Body Weight - LBW)

General Exercise (up to 60 mins exercise / day)	5-6 g/kg LBW
Moderate Exercise (1-2 hours moderate to high intensity)	6-8 g/kg LBW
Endurance Exercise (greater than 120 mins high intensity)	9-10 g/kg LBW
Extreme Exercise (greater than 4 hours intense exercise)	11-13 g/kg LBW

Typical Food Sources of Carbohydrate

The following lists show foods that we westerners typically eat in our diet. The lists show the quantities needed to yield 50 grams of carbohydrate. The list can hopefully help you get the carbo's you need to meet the amount of carbo you need as calculated from Table 1 above.

Bread and Cereals	
Food	*50 g carbo*
Bread	4 slices
Bread roll	4
Crumpet	2
Pocket bread	2
Crispbread	8 large
Cooked pasta	1.5 cups
Cooked rice	1.5 cups
Cooked noodles	1.5 cups
Untoasted muesli	1 cup
Weetbix / Vitabrits	4
Sustain	1 cup
Cooked porridge	2.24 cups
Muffin	2-3
English muffin	3 halves
Pikelet	4
Pancake	2 large
Dairy Products	
Fruit yoghurt	2 tubs
Plain yoghurt	600 g
Diet yoghurt	6 tubs
Milk (all types)	1 litre
Custard	300 g
Vegetables	
Corn	2 cups
Potatoes	2 large
Sweet potatoes	2 average
Mashed spuds	2 cups
Lentils	1.5 cups
Beans	1.5 cups
Fruit	
Banana	2 medium
Apple / Orange	3 average
Apricots	10
Grapes	2med bunches
Peach	6 medium
Strawberries	3.5 cups
Melons	3.5 cups
Mango	1 large
Dates	9
Dried apricots	10
Sultanas	6 tablespoons
Other	
Honey / Syrup	2 tablespoons
Jam	2 tablespoons
Sugar	2 tablespoons
Muesli bar	1.5 bars
Sports Bar	1
Carbo Gel	2 sachets
Fruit Juice	600 ml
Softdrink/cordial	500 ml
Sports Drinks	750 ml

Conclusion

Hope this list is as useful for you as it is for me. I use it when recovering, planning race diets for the longer triathlons (use 30-60 g cabs / hr), and those long rides or runs in training. If you still have concerns, it is worth your while consulting a sports dietician to discuss your training and racing diet. See you on the line.

"THE BIGGEST PROBLEM TODAY IS THAT THE OLYMPIC GAMES HAVE BECOME SO IMPORTANT THAT POLITICAL PEOPLE WANT TO TAKE CONTROL OF THEM. OUR ONLY SALVATION IS TO KEEP THEM FREE FROM POLITICS".
AVERY BRUNDAGE US PRESIDENT OF THE IOC 1964.

"CALIFORNIA SHARED THE OLYMPICS WITH THE ATHLETES OF THE WORLD, I SUPPOSE, BUT FIRST AND FOREMOST IT SHARED THEM WITH ABC TV".
FRANK KEATING - SPORTSWRITER

"THE GAMES NEED TO TAKE THE PILL BEFORE THE SPORTING EXPLOSING GETS ENTIRELY OUT OF HAND".
PETER WILSON - SPORTSWRITER

RUNNING

Heat Acclimatisation Strategies for Endurance Runners

© by Dr Peter Reaburn

Triathlon Research Initiative, Central Queensland University

Summer is here with a vengeance. Those of us into endurance sports know just how tough it is to train in the heat. We generally train during the cooler times of the day, focus on what we wear, drink heaps, and lower the intensity of the workouts.

However, come race day, we have no control over when we race, may have to wear clothing the rules stipulate, may have limited access to fluids, and race hard. Many of us also choose or have to race in hot conditions that we never experience at home. However, the smart athlete can and should - acclimatise!

Heat and Performance

Heat and dehydration impair performance and their effects are additive. Who can forget Gabrielle Andersen-Scheiss wobbling into the LA Olympic stadium at the end of the marathon? High heat, dehydration and an unacclimatised athlete make for trouble and decreased performance.

Recent research has shown that optimal endurance performance occurs when the temperature (degree Celsius) is in the mid to late teens and drops off dramatically when temperatures get up over 30 degrees, particularly when the humidity is high.

Responses to Heat Acclimatisation

The following physiological changes occur when we acclimatise to heat - and all of them help our performance!

- increased blood volume
- enhanced ability to sweat
- faster onset of sweating
- greater distribution of sweat over the body
- the salt content of sweat is reduced
- psychologically getting used to the heat

The above responses are all highly individual and do not always occur in highly-trained people who appear to adapt much more quickly to heat.

Acclimatisation Strategies

The following strategies are important to follow in preparing yourself for the heat:

1. Allow 7-14 days to fully acclimatise. 75% of the adaptions take place within 5 days.
2. You can wear warm clothes (eg. tracksuit, jacket) to make a microclimate of heat between your skin and the outfit.
3. Reduce the intensity and volume of training for at least the first few days.
4. If training twice a day, do the quality work first and in the morning coolness.
5. Train in the heat at least every 2-3 days. Research has shown that exercising in the heat every third day for 30 days has the same effect as training every day for 10 days.
6. It appears the type of exercise is not important so if you have access to a hot room (eg. indoor pool, bathroom with steam) and are a runner, you can set up an exercise bike/windtrainer and get the same effect as long as you exercise for 60-100 minutes. Research has shown that exercising for longer than 100 mins has no additive effect.
7. You can do intervals with short breaks and get the same effect as going continuously.
8. Research has also shown that training for 30 minutes at 85% of max heart rate has the same effect as training for 60 minutes at 60% of max heart rate.

Remember, the aim is to raise the body temperature and stimulate sweating without putting yourself at risk.

Safety Precautions

- Recover in a cooler area and drink and eat high glycemic index goodies to increase recovery rates.
- Be cool before you train so the body temperature is as low as possible. Try a cold shower before the workout.
- Reduce the length of the warm-up and do it in a cool environment.
- Train in the shade.
- Train in minimal clothing made of natural fibres or "cool-max" type material that wicks the sweat to the surface.
- Ensure you replace the fluids lost by weighing yourself before and after training (1kg lost = 1L of fluid to replace). The more you acclimatise, the more you sweat, the more fluids you need.
- Many athletes may lose their appetite and decrease food intake - not what an athlete in training needs when trying to maintain energy levels.

Monitoring Acclimatisation

The following strategies are useful and easy ways to check whether you are acclimatising:

a. weighing yourself before and after the same workout. Weight should not decrease and in fact might increase due to an increase in blood volume.

b. monitor urine colour - the darker it is (as long as vitamins intake has not changed), the more the need for fluids.

c. check heart rates for the same workout - they should drop as you get more acclimatised.

d. check your sweat rates - they should increase, unless you are already highly fit.

e. you should feel cooler for the same workout.

f. monitor subjective feelings on how you feel (fatigue, tiredness, aggression etc).

Conclusion

There is no doubt that an endurance athlete racing in the heat but training in the cold will be at a disadvantage to those that train in the heat. Following the guidelines outlined above will specifically prepare you for the race conditions. It worked for Heather Turlan(paring for the Kuala Lumpur marathon, i work for you.

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From the Research

The Latest on the "Stitch"

For years scientists have been trying to pinpoint the cause(s) of the 'exercise-related transient abdominal pain' commonly known as a "stitch". Researchers from the University of Newcastle here in Oz recently surveyed 848 runners and walkers from the 1987 City to Surf race in Sydney.

27% of the respondents claimed to have had a "stitch" with the runners (30%) experiencing it more than the walkers (16%). 42% of these people said it significantly affected their performance.

The prevalence appeared to decrease with age, was unrelated to gender and had nothing to do with body size or race pace. However, those most likely to experience a "stitch" had consumed a large mass of food relative to body weight in the one to two hours before the race. The type of food did not appear to make any difference.

Morton, D. et al. (1998). Epidemiology of 'stitch' at the 1997 City to Surf. *Proceedings of the Australian Conference of Science and Medicine in Sport*, Adelaide.

CYCLING

Spinning to Win: How to master the art of pedalling

© by Liz Hepple (QAS cycling coach)

What could possibly be difficult about pedalling your bike. I mean all you have to do is simply turn your legs in circles. That has to be easy, right? Wrong! The neuromuscular mechanisms in the body love to generate force in a single direction (as in a simple leg press), but when it comes to constantly changing the direction of force, the brain and muscles get confused. Only hundreds of hours of pedalling practise can help optimise this circular movement.

Ideally, your muscles would push the pedals around so that the resultant force is at right angles to the crank. In other words, your legs would force the pedal downwards at the front part of the pedal stroke, pull it back wards and upwards at the bottom and back of the stroke and push it over the top of the stroke. It was previously believed that elite cyclists could ideally achieve this perfectly round pedalling. This illusion was shattered when the A.I.S. developed a machine which measured the forces on the pedal during the stroke. It was found that there was constantly a downward force on the pedals, even during the 'pulling up' phase. What separated the Olympians from the recreational cyclists, was that the better cyclists were able to apply less downward force at the back of the stroke.

Given that none of us will ever achieve the perfect pedalling action, the message here is that the closer we get to what is perfect, the faster we will go. The trouble is that in these modern times, so much fuss is made over varied seat positioning, aerodynamic equipment and other technology, that the essence of cycling - the pedalling action - seems to have been overlooked. To achieve optimum pedalling first it is useful to break the action into four components.

Pedalling segments

1. 'Top dead centre'

At the top of the pedal stroke, think of dropping your heel slightly and pushing the pedal forward over the top of the stroke, from the 10 o'clock to 1 o'clock position.

2. 'Down stroke'

At the 'front' of the pedal stroke, the force of the pedal stroke is mainly downwards, and this is the segment with the best energy input. It is not really necessary to work specifically on this segment as it comes naturally.

3. 'Bottom dead centre'

At the bottom of the pedal stroke, think of pulling the pedal backwards. This is where the toes come into force and the action is like 'scraping dirt off the bottom of your shoes'.

4. 'Up stroke'

At the 'back' of the pedal stroke, you need to use your hip flexors and hamstrings to 'pull' the pedal upwards. Think of pulling your knees upwards towards your chest, to take the weight off the pedal.

Ankle movement

An important part of pedalling is the ankle movement. The foot should perform a fluid up-and-down movement. The heel rises to about 30 degrees from the horizontal during the 'up stroke', then drops so that the foot is almost flat prior to the top dead centre, gradually rising again through the 'down' and 'backward' phases. The slower the pedalling (e.g.: when climbing hills) the lower the heel - the heel will actually drop below the toes prior to the 'top dead centre'. The faster the pedalling (e.g.: sprints) the more the cyclist pedals on their toes. Good ankle mobility is crucial to optimal pedalling, and riders should aim to achieve this fluid 'paddling' movement.

> " IT WAS FOUND THAT THERE WAS CONSTANTLY A DOWNWARD FORCE ON THE PEDALS, EVEN DURING THE 'PULLING UP' PHASE. WHAT SEPARATED THE OLYMPIANS FROM THE RECREATIONAL CYCLISTS, WAS THAT THE BETTER CYCLISTS WERE ABLE TO APPLY LESS DOWNWARD FORCE AT THE BACK OF THE STROKE".

Sample training for working all the pedal segments.

a. Perform 4 x 2 km efforts at slow rpm (eg: climbing a long hill)

Effort 1. - Concentrate on working the 'pull back' phase

2. - Work the 'pull up' phase

3. - Work the 'push over the top' phase

4. - Work the entire pedal stroke

b. Perform 8 x 1 km efforts.

- Take one foot out of the pedal and pedal with one foot for 1 km.

- Swap feet, and pedal with the other foot for the next 1 km.

- Repeat this another 2 times, then do the last 2 efforts with both feet in the pedals and concentrate on pulling back and up with one leg, while pushing over and down with the other.

- Gradually increase the pedal rpm through the 8 efforts.

Cadence

When I started cycling, I remember being told to learn to 'spin' the pedals fast. We didn't even contemplate using big gears until we had clocked up thousand of kilometers at a high cadence, until the action became automatic. These days, too many people jump on a bike, throw it straight into the big chain ring, and off they go - at an rpm of about 75. While they achieve moderate results quite quickly, they will never pedal efficiently, and therefore will never reach their potential.

The most efficient pedalling rate is 95 to 105 rpm. At this rate the muscles save energy and accumulate the least amount of lactic acid, which is critical for any race. Triathletes in particular have trouble running after the bike ride if they have been pushing a big gear at a low cadence.

However, when you first get on a bike, you are probably most efficient at an rpm of around 55. This is because you don't have the neuromuscular co-ordination to pedal at a high rate. Many beginners avoid working on their cadence because they actually go slower when they pedal a small gear quickly. But by continually training at a higher cadence, your muscles become more efficient at pedalling at this optimal rate, and in the long run you will achieve much better results.

Sample training for cadence

Whenever you are on your bike you should spend at least some part of the ride focussing on your pedalling technique. In the early part of the season, or if you are just starting out, you should do at least one session per week where you are specifically working on cadence. Some examples are as follows:

1. Do one weekly ride on flat to undulating roads where you maintain a high rpm the whole ride. Maintain a high cadence on gradual hills. When you ride downhill, 'spin' your pedals as quickly as possible, while keeping your hips perfectly still on the seat.

2. Do one weekly session of 5 x 2 km efforts (2 kms recovery) and 1 x 10 km effort at the highest cadence you can maintain. Start at about 85 rpm and build up until you can rev at over 120 rpm. Do the shorter efforts on a slight downhill or with a tailwind if possible.

Learning how to pedal properly takes time as the circular movement is not a natural action. However, if you patiently work on achieving optimal force production at a fairly high cadence, you will reap the rewards in the end.

TRIATHLON

11 Tips for Speedy Tri Transitions

© *by Dr Grant Schofield*
Triathlon Research Initiative, Central Queensland University

From my perspective as a triathlete, a sports scientist, and a sometime triathlon coach, below are the ten most important factors that most triathletes could use to improve their transitions. I am talking about improvements in both the actual speed of getting through the transition area itself and the way that the athlete can maximise their ability to bike after swimming and run after biking.

In the shorter races fast transitions are particularly important. In the draft-legal pro races they are extremely important. However, racing is very competitive in all age groups in triathlon these days. So every second counts if you wish to perform at he limits of your potential. In terms of speed through the transition area there are several important factors that I think you should consider.

- *Know your way around the transition area.* Where are the swim exit, the bike exit, the bike entry, and the run exit? Often I see athletes arrive late at the race venue and are generally just trying to figure out the basics such as where the swim, bike, and run are without paying attention to the details of the transition area. The first step in being quick through the transition area is, of course knowing where you are supposed to go.
- *Identify if the transition area is a "fair" one.* Do all competitors have to travel the same distance? For example, at the Hawaii Ironman swim/bike transition the transition area is out on a pier where the entry and exit points are both at the land end of the pier. Some competitors will have to go 150m to get to their bike while others only have to go 20m. Unfortunately there is nothing that you can do about this at Hawaii other than being a seeded pro athlete. However, many races have similarly designed transition areas that are unfair. The smart athlete can use this to their advantage.
- *Identify the transition rack that involves you running your bike the least possible distance.* It is faster to run with a bike than without. This may be difficult however. Sometimes you are allocated to a numbered bike rack. Alternatively, everyone has the same idea as you and has arrived at some ungodly hour of the morning to stake their claim at the "best spot". In this situation it is probably best to run your bike the extra distance in order to have a little more room and use a rack which is less crowded.
- *Know where your bike rack is and be able to find it using some permanent landmarks.* When you come out of the swim the transition area may not look the same. The same also applies when coming in off the bike. Depending on your ability there may be very few bikes, or a lot of bikes already in. Some athletes have been known to tie inflated balloons to their bike rack in races such as the Noosa triathlon where there are a lot of bikes to choose from.
- *Be prepared, make a list.* What gear do I need? What steps will I go through in the transition? It is always a great idea to plan out exactly what you will need to take with you and how you will get it on board. This may be different for different races. An Ironman triathlon will have different requirements than a sprint distance triathlon. They will therefore require different planning. In the Ironman race you must use the bags provided by the race organisers to hold your gear. You may choose to use elasticised laces in a short race but figure that the extra comfort of shoelaces is important to you in a long race and the time lost in tying shoelaces is not significant. In a shorter ace you will usually have all your gear spread around your bike. The transition scenario will also be different for a wetsuit swim versus a non-wetsuit swim. Since wetsuits are allowed, many male triathletes have started using Lycra singlets that they can wear in the swim leg or roll up quickly as they run into transition.
- *Be deliberate, avoid hurrying.* An important key to a good transition is moving smoothly through the changes such as fastening your helmet or putting shoes on. The best way to achieve this result is not to hurry. You can be just as fast, if not faster, if you slow things down just a bit and eliminate any mistakes made by rushing franticly.
- *Use some mental training.* Visualise yourself being smooth through the transitions. Run through exactly what you will see, hear, and feel during both transitions. This is a great way to practice because you can train whilst lying down under a shady tree without getting tired!

The second, and perhaps more important aspect of this article in terms of maximising your ability to change from competing in one discipline to another. Here are some suggestions on how to minimise the damage.

- *Be specific in your training.* Practice swim-bike-run sessions regularly. Do a triathlon in training. Occasionally do your swim-bike-run near your race effort with your race gear running through the transitions exactly as you would in a race. The body is a wonderfully adaptive mechanism. Give it a specific adaptation to achieve during training.
- *Don't hurry the swim-bike transition.* Many athletes find themselves very disoriented as they come out of the swim. One reason for this may be that they have been in a prone position during the swim and the body has trouble adapting to the sudden change in

Continued on page 12

ENDURANCE

Training for Economy

© by Greg Rowsell (Triathlon Research Initative, Central Qld University)

Want to optimise your economy and improve your race performance, then read on. The purpose of this article is to illustrate the importance of training to improve your economy and then to outline some training strategies that you can use to do so.

Why train for economy?

Your performance as an endurance athlete is ultimately determined by three main physiological variables. These are:

- Your maximal aerobic capacity - the maximum amount of oxygen you can transport to the muscles and use to produce energy.
- Your anaerobic threshold - the speed that you can sustain without building up large amounts of lactate ('hurt but hold').
- Your economy - how well you use the available oxygen.

Economy refers to the actual cost of swimming, cycling and running at a particular speed. Exercise economy can be calculated as the ratio between the amount of oxygen used (energy in) and the speed achieved (energy out). The less oxygen you use to row, swim, cycle and run at any speed the more economical you are.

Training to use less oxygen at a particular speed is important because it means that you will be able to row/swim/cycle/run at a lower percentage of your maximal aerobic capacity. This is a very useful training outcome because it will allow you to use less muscle glycogen and the speed will feel easier. As a result of this you will be able to sustain the same speed for longer or you could go faster for the same relative effort.

Still not convinced? Think of it this way, to reach your potential as an endurance athlete you need to develop a V8 engine with small car fuel economy. The question is how?

Improving Your Economy

Research evidence strongly has shown that there are four main training strategies that can be employed to improve economy.

1) Technique

Many athletes 'turn off' whenever the coach prescribes drills for technique enhancement. This is a pity because the athletes with the best technique generally win! World-renowned swimming coach Gennadi Touretski stresses the importance of what he calls the three R's; rhythm, range and relaxation.

- Rhythm implies a smooth fluid movement pattern. Think of your pedal stroke when cycling or your stroke rate (arm turnover) when swimming or rowing and you can see how important a smooth continuous action is.
- Range refers to the ability to work through a full range of motion. You need to be able to get your arms and legs into the right position to move you forward. Range is determined to a large extent by your flexibility so keep stretching!
- Relaxation means using only the muscles that are needed to generate speed while relaxing the rest.

It is recommended that you incorporate technique training into your training program. The best way to improve your technique is to seek out and consult a knowledgeable coach and work with them on a regular basis.

2) Endurance

The body has a limited store of muscle glycogen (made from carbohydrates) so the more fat you can use to 'drive' you during a race the better. When you are using fat you are effectively 'saving' muscle glycogen for use later in the race. Long slow training sessions, where the heart rate is kept 50 to 60 beats below maximum, promote the use of fat as a fuel source. In addition, this type of training increases the amount of fat stored within muscles which means that fat is more readily available.

> "ECONOMY REFERS TO THE ACTUAL COST OF SWIMMING, CYCLING AND RUNNING AT A PARTICULAR SPEED. EXERCISE ECONOMY CAN BE CALCULATED AS THE RATIO BETWEEN THE AMOUNT OF OXYGEN USED (ENERGY IN) AND THE SPEED ACHIEVED (ENERGY OUT)".

A typical endurance session (often referred to as a long slow session) for an Olympic distance triathlete may involve a 45 minute swim (preferably open water), a 3 hour bike and a one and a half hour run. These may be completed as single sessions although it is common to combine the swim with the bike and follow it with a short run off the bike to promote a transition effect.

It is important to focus on technique during endurance training. Long sessions provide you with the opportunity to reinforce the most economical technique. It is important to note though that you need to have some carbohydrate in the system to use fat as a fuel source.

3) Strength

Research has confirmed that functional strength training is the best way to enhance economy. Sport scientists believe that this is because when you train against increased resistance (running uphill, cycling uphill and using paddles in swimming) the nervous system is forced to 'learn' how to make better use of the muscles. So it's official, you need to head for the hills to improve your cycling/running economy.

Strength training for cycling can be done on hills, on the flat or on the wind trainer, and is well covered in issue 17, FEB 1998. Runners can incorporate a hilly run each week, working the ups and cruising the downs. It is also possible to do interval work on hills. For example, you could build up to a main set of 6 to 8 three minute intervals, running strongly up the hill and cruising back down. You can develop swimming specific strength through the use of a pull-buoy and paddles.

4) Race pace

Race pace training is very important because you must be able to row/swim/cycle/run at your race pace with minimal fatigue. You have to train to be economical at your race pace. In fact, there is some research to suggest that training at slightly faster than race pace will lead to the biggest improvements in economy. For example, a triathlete who wants to run 40 minutes 'off the bike' for 10km could incorporate the following transition session into their weekly training.

Main set: 15 minutes on the wind trainer using a race gear (big chain ring) at race cadence then a 2km run done in 8 minutes. This set could be repeated 2 to 3 times with a 5 to 8 minute spin between each repetition to promote recovery.

Summary

Economy is one of the key physiological variables that effectively determines how fast you swim/cycle/run. It can be improved through developing the best possible technique, increasing fat utilisation, increasing strength and training at race pace.

> "GENIUS IS THE ABILITY TO PUT INTO EFFECT WHAT IS ON YOUR MIND".
> F. SCOTT FITZGERALD
>
> "THE GREATEST THING IN THIS WORLD IS NOT SO MUCH WHERE WE ARE, BUT IN WHAT DIRECTION WE ARE MOVING".
> OLIVER WENDELL HOLMES
>
> "THERE IS NO END. THERE IS NO BEGINNING. THERE IS ONLY THE INFINITE PASSION OF LIFE".
> FEDERICO FELLINI

10 Tips for Speedy Transition continued from page 10

posture as they exit the water. Take this part easy. I recommend that instead of sprinting flat out up the beach you run comfortably until you get to your bike rack. Anyone who has ever worn a heart rate monitor in a race will testify about how high their heart rate was in the swim-bike transition.

- *Kick in the last part of the swim.* Almost every triathlete has experienced the difficulties of pedalling at race pace straight after a swim. Why is this? The theory is that most of the working blood is in the arms and shoulders which provide most of the force in swimming. One way to alleviate this problem is slow your stroke rate and kick a little more in the last part of the swim. The extra work required in the legs may redistribute some blood to the legs and make the first part of the bike a little less painful and a little more speedy.
- *Use the arms in the run start.* Finally, the thing which almost all triathletes have trouble with is running fast after a hard bike ride. Improvements will easily be made in this area as fitness improves and with specific training bike-run (brick) training (as mentioned above). One aspect that I think many triathletes overlook is the role the arms have to play in running. I recommend let your arms set the pace early in the run leg. Generally the legs will follow. Keep a nice high hand carriage and set a good fast strong rhythm with your arms. You may be surprised how your legs respond.

From the Research

Fluids and Recovery

Summer is here and those early morning rows, runs, cycles or swims seem to be a little harder in the heat. Here in Rock Vegas, the humidity is extreme some mornings. Getting older and hopefully wiser, I always concentrate on my fluids upon my return from morning training. Recent research suggest fluid intake pattern is crucial to recover from those morning workouts or between races on one day.

On 2 occasions, 7 fit young runners ran on a treadmill for 90 mins at 80% of their max heart rate then four hours later ran as far as they could to exhaustion at the same speed. On one occasion they were allowed to drink a sports drink at any rate or volume they liked. On the other occasion they had to drink the exact amount of fluid they lost in the previous 90 minute run (about 2.6% of body weight).

The results showed that the second run to exhaustion was much longer when the runners replaced exactly the prescribed amount they lost. In addition, they also put more sports drink and thus carbohydrate in their system in the fourth hour when the prescribed amount was used.

The lesson learnt? Weigh yourself before and after training and replace what you lose over time.

Wong et al. (1998). Influence of fluid intake pattern on short-term recovery from prolonged, submaximal running and subsequent exercise capacity. *Journal of Sports Sciences*, 16: 143-152.

Tapering continued from page 5

performances have been observed following 4-14 day tapers, with some studies showing that performance can be improved even with 28-day tapers, as long as intensity is maintained.

Progressive or Step Tapers

A progressive taper means a gradual reduction (taper) in the quantity of training. A step taper means training volume is dropped in blocks of days. While few studies have compared the two types of taper, it appears that a step taper maintains performance while the gradual reduction in training volume positively impacts on performance.

Conclusion

In highly-trained athletes, it appears that a gradual reduction in training volume over 14 days is recommended. This is achieved via decreased mileage, a moderate drop in training frequency, and a maintenance in training intensity.

While science has given us guidelines, tapering is an art that the astute masters athlete must master through experience, trial and error and most of all, "listening to their body".

From the Research

Physical Activity or Training and CVD

Over 30% of Ozzies who die each year die through cardiovascular disease (CVD). We masters athletes know the value of physical training and wonder why the vast majority of others aren't following our lead.

Health authorities, rather than pushing *training* are pushing *physical activity* as a means of reducing CVD. A recent paper examined the relationship between aerobic capacity (VO_2max) we physical trainers have, physical activity (PA) per se (walking, gardening etc), and CVD risk factors. They tested 576 low-fit adults by a PA questionnaire, a bike test to determine VO_2max, and checked out their CVD risk factors (blood pressure, cholesterol, smoking, obesity etc).

The results, as expected, those people that had the highest aerobic capacity (like we masters athletes), had a lower relative risk of CVD compared to those that had the lowest PA levels.

McMurray, R.G. et al. (1998). Is physical activity or aerobic power more influential on reducing cardiovascular disease risk factors? *Medicine and Science in Sports and Exercise* 30(10): 1521-1529.

Massage and Soreness

All of us have faced the early season or after race muscle soreness, regardless of how fit we might be. Most large events always seem to have a massage tent that always seems busy. But we've always wondered – does it really work? Will it help me recover? A recent review suggests yes!

A paper published in the latest issue of the British Journal of Sports Medicine reviewed seven controlled studies that determined whether massage alleviated the delayed muscle soreness.

While the review criticised many of the studies methodologies, the overall consensus that massage, particularly a number of them rather than just the one, may be a promising treatment for those aching muscles after racing and training. See you at the tent!

Ernst, E. (1998). Does post-exercise massage treatment reduce delayed onset muscle soreness? A systematic review? *British Journal of Sports Medicine*, 32: 212-214.

Creatine and Endurance

Creatine (creatine monohydrate) is being touted around the traps as the new wonder supplement for athletes. Sure, it has been shown to work in power athletes, particularly those that do all out repetitive efforts. However, the marketers of the product are saying it can also enhance endurance performance. A recent paper supports what we sports scientists have theorised – it doesn't benefit endurance!

12 well-trained cyclists were tested on three occasions – once with loading creatine at 25g/day for 5 days prior to testing (the standard way), once doing this load plus using 5g/hr during the test (see below), and once with a placebo or dummy drug.

The test consisted of a 2hr 30 min ride to exhaustion then immediately followed by 5 x 10 sec sprints with 2 minutes between sprints. Aren't sports scientists bastards sometimes?!

The results? Creatine loading alone without using it during endurance racing, improved the mean sprint power and peak power by as much as 8-9%. Neither creatine loading method had any effect on endurance performance, supporting what we have thought for a long time – the marketers are ripping us off again.

Vandebeurie etal. (1998). Effect of creatine loading on endurance capacity and sprint power in cyclists. *International Journal of Sports Medicine*, 19: 490-495.