Maximising Olympic Distance Triathlon Performance: A Sports Dietitian's Perspective

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Nutrition is a key factor in maximising Olympic Distance Triathlon performance. The role of nutrition is to maintain health, support training, maximise performance, enhance recovery and achieve optimum body composition and weight. Triathletes and their coaches are advised to develop nutrition plans for training and competitition based on current scientific information, adapted to individual needs and specific training and competition situations. It is important that supplement plans are an integral part of an overall dietary strategy, rather than being considered in isolation. Fad diets need to be avoided as they have no proven benefit and may have adverse effects.

Nutrition is one of many factors contributing to optimum triathlon performance. It plays a critical role in maintaining health, supporting training, maximising performance, enhancing rate of recovery and in achieving optimum body composition and weight. Furthermore, nutrition can be and therefore must be controlled for in order to prevent or minimise the risk of problems which potentially lead to reduced performance. It is imperative for triathletes and their coaches to be fully informed on current, science based nutrition issues and principles and to develop personal nutrition plans for training and competition.

Baseline nutrition

Prolonged, intense exercise exerts adverse effects on the immune system. The resulting impaired immune function may last between three and seventy two hours during which time viruses and bacteria may gain a foothold and increase the risk of subclinical or clinical infection. Meeting baseline nutritional needs through consuming adequate amounts of foods from the core food groups assists in maintaining optimum immune function as well as general health and wellbeing.

Training nutrition

The role of nutrition is a supportive one, that is, appropriate nutritional strategies enable triathletes to physically cope with heavy training schedules all year round. The key nutritional requirements can be summarised as follows.

Triathletes have increased energy requirements to compensate for an increased energy output.

A high carbohydrate intake will provide much of the extra energy and is crucial as muscle glycogen, derived from dietary carbohydrate is the preferred exercise fuel in high intensity exercise. Triathletes commonly train more than once a day and are at risk from glycogen depletion. As glycogen repletion takes time, it is difficult to restore energy levels between training sessions. Consuming adequate amounts of carbohydrates at frequent intervals is therefore an essential strategy. This can be achieved by consuming carbohydrate rich food at every main meal and snack as well as before, during prolonged and after training. Carbohydrate further appears to play a role in immune function. In a recent investigation researchers observed that a high carbohydrate intake reduces stress to the immune

system in a group of triathletes. Recommended daily carbohydrate intake is 8-10g per kg body weight. Triathletes have increased protein requirements. Proteins have important functional and structural roles in the body. Protein catabolism may also contribute to total energy production, although this contribution is generally small. In endurance training protein is primarily associated with increasing and maintaining strength, recovery and immune function. Daily protein requirements for endurance athletes are 1.2 - 1.4 g and up to 1.6 g per kg body weight during high volume endurance training. Fat is an essential nutrient and needs to be included in the daily diet. Too much fat will displace carbohydrates and may contribute to an increase in body fat levels, however, too little fat can have a negative impact on health and performance. Recommended daily fat intake is 40-100g, depending on gender, energy requirements, training programmes and individual factors. The important issues are to consume the minimum required amount of fat for health and to obtain fat soluble vitamins and to consume mostly plant sources such as plant oils, margarines, nuts, seeds, avocados, and to make sure that fat does not displace carbohydrate. Once carbohydrate and protein needs are met, the balance of energy required can be obtained from carbohydrate or fat or a combination of both. The increased requirements for vitamins and minerals, particularly the B vitamins, vitamin C and E and the minerals Iron and Zinc are generally easily met through increased consumption of high quality carbohydrate and protein foods. Adequate fluid consumption is critical in the prevention of dehydration. A one litre sweat loss increases heart rate by 8 beats per minute and increases body temperature by 0.3°C. Scientists now believe that no level of dehydration is without physiological consequences. It is imperative that triathletes meet daily fluid needs by drinking at regular intervals right through the day as well as before, during and after training. Baseline fluid requirements are 4-5 litres a day and training increases daily requirements significantly. Fluid needs depend on training volumes, frequencies and intensities, environmental temperature and individual sweat rates. As there is considerable variation in sweat rates, triathletes are advised to take pre and post training body weight measurements to assess individual fluid needs.

Timing of food intake is another critical issue. Consuming carbohydrates and fluids pre training is important in topping up energy and fluid levels while consuming carbohydrates, protein and fluid within thirty to sixty minutes post training enhances rate of recovery. Consuming carbohydrates and fluids during training helps prevent glycogen depletion and dehydration. The following guidelines will assist in meeting daily training nutritional needs.

- Consume three main meals every day, designed as follows:

1. Base around a staple carbohydrate wholegrain breads and breakfast cereals, rice, noodles, pasta, potatoes, or kumara
2. Incorporate fruits and / or vegetables fresh is best, but can be supplemented with frozen or canned
3. Add a protein sourcelean red meat, fish, chicken, eggs, pulses, soy foods, or milk products
4. Include fluids drink water. Fruit juice or cordial optional

- Depending on total daily energy needs, snack on high carbohydrate foods between main meals
- Consume 50-100g carbohydrates in the two hours prior to training

- Consume 500 ml fluid in the hour before training
- Consume 500-1000 ml fluid per hour during training, depending on intensity of training, environmental temperature and individual requirements (pre and post training weight measurements show individual needs)
- During prolonged training sessions, consume 30-60g carbohydrate per hour. Using a sports drink is an effective and practical way to simultaneously meet fluid and carbohydrate requirements.
- Post training, consume one and a half times the amount of fluid lost in sweat (If weight loss is 1 kg, drink 1-2 litres fluid). Start drinking immediately post training and continue to drink at regular intervals until full rehydration is achieved.
- Consume 1*g* medium to high glycemic index carbohydrates within thirty minutes of finishing training and continue to consume carbohydrates at regular intervals to meet total daily needs.
- Consume protein within in hour of finishing training. Although post exercise protein requirements have not been quantified, it seems reasonable to recommend approx. 20g high quality protein.

The following protocol will assist in developing individual training nutrition plans.

1. Estimate total daily energy, carbohydrate and protein requirements based on training programmes, body weight and experimentation.
2. Calculate pre-, during- and post training carbohydrate, fluid and protein needs
3. Subtract total training needs (2) from total daily requirements (1).
4. Divide the amount of carbohydrate, protein and fluids in 3 over three main meals and further snacks.

For instance, an estimated nutrient requirement for a 75 kg male triathlete is 675g carbohydrate (9 g / kg) and 113g protein (1.5g / kg) per day. Assuming he swims early morning and runs at 4 pm, his requirements are 50g carbohydrate prior to and 75g carbohydrate and 20g protein immediately after both sessions, adding up to a total of 250g carbohydrate and 40g protein. If his swim session is particularly hard and long, he may consume a further 60g carbohydrate during the session. Total training related requirements are 310g carbohydrate and 40g protein. His main meals need to provide a total of 675 - 310 = 375g carbohydrate and 113 - 40 = 73g protein which can be divided evenly over breakfast, lunch and dinner. Similar calculations can be made for varying training schedules.

A further goal of training nutrition is to experiment with planned race nutrition strategies and to achieve optimum body composition.

Competition nutrition

Pre competition nutrition goals include maximising muscle glycogen levels, topping up liver glycogen and blood sugar levels and optimising hydration. Nutrition goals during competition are to prevent energy depletion, dehydration, gastro intestinal problems and disturbances in electrolyte balance, while the objective of post race nutrition is to enhance rate of recovery. The latter is particularly important when racing frequently. The race nutrition plan is dictated by nutritional requirements as well as by practical issues such as where the race is held, accommodation, access to suitable foods and availability of fluids at aid stations, and is therefore personal and may need to be adapted

to different race situations. Nevertheless, the following general recommendations can be used in designing a personal plan.

Pre race

As glycogen depletion has been shown to occur in endurance races of over one hour, carbohydrate loading may be of benefit. Carbohydrate loading simply means increasing usual daily carbohydrate intake in the three or four days prior to a race without increasing total energy intake, and this is achieved by reducing fat intake. The increased carbohydrate will result in 'superloading' muscles with glycogen, thus increasing the body's available energy reserves. Carbo loading can be viewed as an extension or exaggeration of the normal diet and to what degree and how often a triathlete loads will be determined by racing schedules and previous experience.

The pre race meal is best consumed between two and four hours prior to the start, depending on personal preference and race starting time. An intake of 200 g of carbohydrate is recommended in the four hours pre race. Fat consumption should be limited while protein may be added in moderate amounts, depending on personal preference. It is unclear whether low glycemic index carbohydrates are beneficial and the choice of carbohydrate food is therefore a personal one. Those triathletes who experience hunger during a race could potentially benefit from consuming low glycemic index carbohydrates such as oats or mixed grain breads. Some athletes have difficulty tolerating solid foods because of pre race nervousness or when race start is very early, and a liquid meal such as Sustagen™ and sports drink or fruit juice in amounts to meet carbohydrate needs are an alternative option.

During the race

As glycogen depletion can occur in an Olympic Distance Triathlon, consuming a sports drink is beneficial. Volumes depend on on environmental temperature and individual needs. Suitable sports drinks have a carbohydrate concentration of 4-8%, contain a mixture of carbohydrates with only small amounts of fructose and provide 500 - 700 mg sodium per litre. Recommended carbohydrate and fluid intakes are 30-60g carbohydrate (or 1g / kg) in 600 - 1200 ml fluid per hour. It is best to start drinking in the swim - bike transition and to drink at regular intervals during the bike and run sections. In practice, most triathletes find it easiest to consume fluids on the bike. During the run section, when it is not possible to carry one's own bottles, the options are to have personal drinks at aid stations, to use gels and water or to use the available race drink in which case it is important to try the product prior to the race.

Post race

Especially when racing frequently, appropriate nutrition strategies are vital. Within 30 minutes post race, consume 1-1.5 g high glycemic index carbohydrates and 1.5 times the amount of weight lost as sweat. A sodium containing beverage promotes rehydration. A mixed meal, containing protein as well as carbohydrate should be consumed as soon as is practical with regular carbohydrate consumption in the 24 hour post race period to achieve a total of 600g carbohydrate or 10g / kg.

Body composition

A triathletes physical characteristics are determined by genetic factors, the environment, and past and present training and nutrition status. Elite triathletes are generally tall, of average

to light weight with low levels of body fat. Such a physique provides the advantages of large leverage and an optimal power to weight ratio. It is expected that body fat levels vary to some degree between the training and competition season. Typically, elite male triathletes have body fat levels of 6-10% while female body fat levels range from 11-18% . The New Zealand Triathlon Academy uses skinfold ranges rather than percent body fat and current criteria for sum of 8 skinfolds for Academy triathletes are 35 - 75 mm for males and 45 - 100 mm for females. The range acknowledges the considerable individual genetic variation in body fat.

Supplements

In addition to a nutrition plan, triathletes need to have a supplement plan. Supplements are as the name suggests supplemental to the diet and the need for supplements viewed as part of an overall dietary strategy, rather than in isolation. The potential role of supplements as part of a triathletes nutritional plan is fourfold:

1. To supplement the diet in meeting total daily nutritional needs. For instance, a liquid meal supplement may be used to help meet high total daily energy needs.
2. To meet a particular nutritional need in a triathlon specific setting. The use of a sports drink during training or in a race is effective in the prevention of energy depletion and dehydration. Another example is the use of an iron and vitamin C supplement when training at altitude.
3. To manage or treat a specific nutrient deficiency. When suffering an iron deficiency, using a high dose iron supplement in conjunction with a high dietary iron intake, may be beneficial.
4. To exert a direct and specific performance enhancing effect. A multitude of substances are used for this purpose, yet very few have a proven benefit. The only nutritional ergogenic aid which has been shown to enhance endurance performance is caffeine. However, as caffeine is a restricted substance, it's use as a beneficial aid to performance has to be carefully planned

Other dietary regimens.

Although such dietary programmes as the 'Zone', the 'PR' programme and high fat diets are popular with athletes, there is no actual evidence these diets enhance triathlon performance. On the other hand, there is a large and increasing body of evidence showing the benefit of a high carbohydrate diet. It could be argued that the claimed benefit of these programmes merely results from the fact that any plan is better than no plan.

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