Nutrition issues for ironman triathlon events

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This is a brief summary of the nutrition issues that triathletes face while competing in an ironman triathlon. The key issues I discuss relate to within race nutrition issues – these issues do not apply to everyday nutrition goals. Sodium and fluid balance have become a central issue for discussion amongst ironman triathletes in recent times, mainly due to the issue of hyponatremia or low plasma sodium. Dehydration and or a lack of sodium has been linked with the onset of muscle cramp, a nightmare for every ultra-endurance racer. In a recent study Speedy and colleagues (1999) reported that 18% of 330 race finishers at the 1997 NZ ironman were hyponatremic (sodium <135 mmol/L). The authors concluded that fluid overload was responsible for 73% of those individuals with severe hyponatremia (sodium < 130mmol/L).

There are a number of mechanisms by which hyponatremia is likely to occur. The most likely mechanism is one in which an athlete who has lost a significant amount of water and sodium through loss of sweat, drinks a large amount of a low-sodium drink (ie sports drinks, water or cola) during the course of exercise. This phenomenon is unlikely to be a concern in everyday training, but is more an issue that requires attention while racing in ultra-endurance events.

There are three issues that I will address in this article:

- The amount of fluid that needs to be consumed while racing an ironman triathlon
- Should athletes aim to consume an hourly carbohydrate intake or an hourly energy intake?
- Hourly sodium needs during ironman racing and the various options athletes have in meeting these guidelines.

Fluid Quantity:

It has been recently suggested that recommended fluid guidelines developed for high intensity, short duration sports (sports <2 hrs) appear to overestimate the fluid requirements for ultra-endurance athletes. The American College of Sports Medicine suggests that athletes need to consume between 150-250ml every 15-20 minutes, which is equivalent to 600-1200ml per hour. Some researchers, most notably Tim Noakes and Dale Speedy, have suggested that ultra-endurance athletes need to consume between 400-800ml of fluid per hour of exercise. They have based these recommendations on observations of triathletes while competing in ultra-endurance ironman events. It is worth noting however, that much of their data has been collected during ironman triathlon events completed in relatively moderate conditions (i.e. New Zealand IM).

Field studies of ironman triathletes show that athletes consume 700ml of fluid an hour on average – a relatively easy target on the cycle, however a more difficult target on the run. Field observations have shown that some athletes consume far in excess of this, with some athletes consuming as much as 1.8 L per hour. Another interesting issue that has been shown is that the slower the athlete finishes the more likely they are to consume a larger volume of fluid.

My take for base amount for hourly food intake:

Athletes need to consume 600-800ml of fluid per hour of exercise.

In hotter conditions this should be increased slightly.

For athletes racing fast, it is worth encouraging them to create opportunities to drink this amount, however for athletes simply completing the race they need to be educated so they don't make too much of the opportunities they are presented with and consume excessively large volumes of fluid. Often for athletes racing quickly, the intensity of exercise limits the opportunities they have to consume adequate amounts of fluid. On the flip side, athletes competing at a lower intensity have ample opportunity available to drink which sometimes creates the situation of athletes over consuming fluids.

The cycle presents the most opportunity to consume fluid, whereas it is far more difficult to consume the required amounts of fluid while running unless the athlete slows down during feed stations. Therefore – athletes should consume more than suggested hourly intakes on the bike to compensate for the lack of opportunity during the run.

An excellent option to encourage drinking during the run is to leave the cycle/run transition with a drink bottle, so at least you are sure they will have a substantial fluid intake during the early part of the run. Another good option is to walk briefly through every other feed station to ensure an appreciable amount of fluid is consumed.

Most importantly as a coach you need to encourage your athletes to develop a fluid intake plan and a method for tracking the quantity they consume during the race. The cycle leg is where it all happens, so be sure your athletes plan their fluid intake for the bike and be sure they keep track of their fluid intake. Athletes quickly lose track of their fluid intake when they're whizzing past aide stations grabbing at drink bottles and discarding half finished bottles.

An excellent and much under utilized field test that can be employed to assess whether an athlete is drinking enough during exercise is to weigh the athlete before and after training. If you take into account fluid consumed and urine losses, it is possible to estimate hourly sweat losses. For IM triathletes, this field test is extremely useful during long combined sessions in training. In most exercise situations, athletes should aim to finish the session close to their starting body weight. However, athletes undertaking ultra-endurance exercise should aim to be within 1-2kg of their initial body weight at the end of the session as some allowance needs to be made for metabolic fuel losses.

Pre-race Fluid Intake:
The last issue which has become somewhat contentious is the amount of fluid an athlete should drink in the days leading into a race. Typically, the couple of days leading into an event are relatively light exercise days, so there is little point drinking large volumes of fluid on these days. Some triathletes increase their fluid intake in the couple of days prior to a race in the belief they can fluid load. Obviously, athletes should start the race hydrated, but regular drinking patterns should be maintained the couple of days leading into a race as it is impossible to fluid load as you might carbohydrate load.

Interestingly, the pre-race snack/meal does present an opportunity to influence race hydration status and should include 500-750ml of fluid. It is important that the pre-race meal contain sodium to stimulate fluid uptake from the gut and assist fluid retention. Furthermore, in hot IM events it is worth athletes trailing a bolus of 400-600ml within 30 minutes of starting the race – ideally this should be sports drink or a higher sodium beverage which should be trailed in training.

Sodium Intake:

In ultra-endurance racing it is important to replace sodium losses simultaneously with fluid losses. In short duration exercise, sodium replacement is not a priority, however in ultra-endurance racing it is paramount to replace, or partially replace sodium lost in sweat. This sodium replacement must occur during the race, not before and not after, but during. Researchers are still undecided as to optimal amount of sodium that should be consumed during exercise??

Under training conditions it is unlikely athletes need to add salt to their meals or consume salt tablets while training (although during longer training sessions it is important to practice race nutrition practices). Generally, regular food choices contain adequate sodium to replace additional sodium lost in sweat on any given training day. Some athletes training in hot conditions however may benefit from adding salt to some meals to ensure adequate sodium is replaced. In an ultra-endurance race however, when athletes rely heavily of sports foods such as sports drinks, sports bars and carbohydrate gels along with other low sodium items such as water and coca cola, it becomes more difficult (actually impossible) to consume adequate sodium to balance sodium losses while racing.

Sweat contains about 50mmol of sodium per litre, but may vary between 20-80mmol/L. Sports drinks, which are commonly touted as a high sodium fluid, only contain around 10-25mmol/L of sodium (10mmol/L – Powerade to 25mmol/L – PB Sports). Nancy Rehrer a well known researcher in the area of fluid balance has recently suggested that athletes need to consume around 30-50mmol/L of sodium. This is probably a slight overestimation of the amount of sodium that should be consumed, but when you take into account recommendations from the American College of Sports Medicine, it would appear that athletes should consume around 30mmol of sodium each hour of exercise during ultra-endurance events.

It is worth considering carbohydrate goals when considering how best to meet hourly race sodium requirements. Carbohydrate goals during ironman triathlon are 1-1.5 gram per kilogram body weight per hour of exercise. That means for a 70 kg athlete they would need to consume 70-100g of carbohydrate for each hour of exercise while racing. The examples below take into account the carbohydrate needs for a 70kg athlete.

So how does an athlete meet their sodium requirement while simultaneously meeting carbohydrate and fluid requirements?

Case study:
Let's say that an athlete drinks a 750ml water bottle per hour of full strength sports drink (i.e. Gatorade). This would provide 14 mmol/hr of sodium, 45g of carbohydrate. If the athlete also consumes one gel (i.e. Power Gel) this would provide a further 2 mmol/hr of sodium and 28g of carbohydrate. Another option instead of the gel could be a sports bar (i.e. Power Bar) this would provide 4 mmol/hr of sodium and 41g of carbohydrate. In both situations, carbohydrate needs are met but sodium intake is between 16-18mmol/hr, about half of what is currently suggested for the ultra-endurance racer.

So can an athlete increase their sodium intake:
include some higher sodium beverages or foods during the race.

Consuming some real foods as opposed to sports foods during the cycle leg will help to increase sodium intake. Including real foods also assist the athlete in meeting other nutrition goals such as hourly carbohydrate requirements. A vegemite sandwich (2 slices of white bread with crusts removed, 1 tsp vegemite contains 26mmol of sodium and 24g of carbohydrate) and provides a great relief for athletes to eating and drinking sweat foods during the race. Other salty foods that are well tolerated by athletes include potato crisps and savory biscuits.

Gator Lyte, an electrolyte powder produced by Gatorade, is another option. Adding a Gator Lyte to your drink significantly increases your intake of sodium. Each Gator Lyte contains 770mg of sodium which is 33mmol of sodium. Adding ½ a sachet to each drink bottle filled with a sports drink would increase sodium content to roughly 34mmol per 750ml bottle.

Gastrolyte (an oral rehydration solution) is another option - it contains 60mmol/L of sodium when made at full strength. However, if an athlete were going to use it, it is better to use it as a concentrate as it contains little carbohydrate - what I mean is if an athlete consumed it at regular strength, they would meet suggested sodium requirements, but would have to rely on foods and gels to meet suggested carbohydrate requirements. A better use would be to use Gastrolyte as a concentrate or have it added directly to a sports drink.
For instance: a 750 ml water bottle made up at 2.5 times full strength would contain 120mmol of sodium. If this were consumed over five hours of riding (lets say 180km in an ironman) hourly sodium intake would be increased by 24mmol/hr. Add this to the above sum of 16-18 mmol/L for the sports drink and bar or gel you have a total sodium intake of 39-41 mmol/hr of sodium.

Another option is salt tablets. They are generally available from pharmacies with a number of products on offer. They can simply be added to the athlete's intake so the amount of sodium falls into the guidelines as stipulated above. Salt tablets are an excellent option during the run as they are easy to consume - Saltadex tablets for instance contain 420mg of NaCL per tablet which is 7mmol of sodium. Go and buy a fat and calorie counter (available at newsagents) that includes sodium contents of food and have a look at the different contents of various foods. It may give you some ideas about foods you would like eating while you're racing. For conversion purposes 23 mg of sodium equals 1 mmol of sodium. And 58mg of sodium chloride equals 1 mmol of sodium.

References:

Hiller, W. D. (1989). "Dehydration and hyponatremia during triathlons." Med Sci Sports Exerc **21**(5 Suppl): S219-21.

Hiller, W. D., M. L. O'Toole, et al. (1987). "Medical and physiological considerations in triathlons." Am J Sports Med **15**(2): 164-7.

Kimber, N. E., J. J. Ross, et al. (2002). "Energy Balance During an Ironman Triathlon in Male and Female Triathletes." International Journal of Sport Nutrition and Exercise Metabolism **12**: 47-62.

Rehrer, N. J. (2001). "Fluid and Electrolyte Balance in Ultra-Endurance Sport." Sports Medicine **31**(10): 701-715.

Speedy, D. B., T. D. Noakes, et al. (2001). "Fluid balance during and after an ironman triathlon." Clinical Journal of Sport Medicine **11**: 44-50.

Speedy, D. B., T. D. Noakes, et al. (2000). "A prospective study of exercise-associated hyponatremia in two ultradistance triathletes." Clin J Sport Med **10**(2): 136-41.

Speedy, D. B., T. D. Noakes, et al. (1999). "Hyponatremia in ultradistance triathletes." Medicine and Science in Sports and Exercise **31**(6): 809-815.

Speedy, D. B., I. R. Rogers, et al. (2000). "Diagnosis and prevention of hyponatremia at an ultradistance triathlon." Clin J Sport Med **10**(1): 52-8.

Speedy, D. B., I. R. Rogers, et al. (2000). "Exercise-induced hyponatremia in ultradistance triathletes is caused by inappropriate fluid retention." Clin J Sport Med **10**(4): 272-8.

Speedy, D. B., J. M. Thompson, et al. (2002). "Oral salt supplementation during ultradistance exercise." Clin J Sport Med **12**(5): 279-84.