



The Science of Ironman Nutrition

After months of training your heart, body and mind for 140.6 miles of swim/bike/run, GI shutdown is the last thing you want to end your day. That said, a disappointing number of race experiences are summarized as 'sick and on the side of the road.' Dr Jeff Shilt explains the science behind successful race day nutrition.

GI (gastrointestinal) shutdown is a remarkably common problem among athletes who experience difficulties at the Ironman distance. After extensive preparation and the enormous expense to compete at the event, we are derailed by the one system we likely have given little thought to during the time leading up to the event. Yet a significant number of athletes are unable to race to their potential because of nutritional or gastrointestinal issues on game day.

In order to fully understand the problem, I think it is helpful to discuss the physiology of nutrition during endurance events.

Why your gut shuts down

Most people maintain normal gastric emptying and intestinal motility by remaining below a heart rate which corresponds to less than 70% VO₂ max effort. If you don't use physiologic testing to facilitate training, this corresponds to approximately 80% of your maximum heart rate or the effort commonly referred to as 'steady'.

Both science and personal experience suggest that intermittent high periods of exertion (surges) slow your gastric absorption and intestinal motility more than a higher average constant heart rate without surges. In other words, an average hr of 140 that includes several periods of 170, will shut your gut down more than a steady average hr of 145.

The delivery mode of your nutrition plays an important role as well. Many people have different types of nutrition on the course: liquids, solids, gels. If your choice is not the nutritional smorgasbord, a common practice is to create a bottle with a highly concentrated solution. If this method works for you, then that is great. But be careful. Many people fail to dilute the concentrated drink adequately.

Historically, many scientific studies show that the ideal drink concentration should approximate a 6-10% solution. What may be confusing is that different phrases are used to describe energy replacement drinks in terms of the amount of carbohydrates contained in the drink. In truth, the key to concentrated solutions is adequately balancing osmolality. Whereas percentage concentration is a measure of the atoms per unit volume of a given substance (in this case, all of the 'stuff' diluted in the water), osmolality is the concentration of the osmotically active particles dissolved in the solution.

Osmolality, then, is what the body 'reads' to determine absorption rates. The intestines absorb solutions when osmolality is nearly the same found naturally in the body (isotonic), or



approximately 300 mOsm/kg. If a solution is significantly less than this (hypotonic solution), your digestion is slowed to allow the body to add electrolytes until it reaches 300mOsm. If the solution is significantly higher than 300 mOsm (hypertonic), then the body absorbs water from your system to dilute it. In either case, the digestive system is slowed more than a nearly isotonic solution. A few companies optimize osmolality in their product. **InfinIT** works great for me as it allows customization of the osmolality, taste, electrolyte content, and other additives while eliminating the guesswork from the equation. This is particularly appealing as it seems that people demonstrate different abilities to absorb nutrition, despite the reported scientific norms noted above. Therefore, starting with an isotonic solution and customizing to your needs is beneficial.

Fluids are important too

Minimizing fluid loss is equally important. It has been shown that dehydration of 4-6% will slow gastric emptying. Therefore, monitor your average weight loss during training rides on days with weather similar to your anticipated race conditions so that you can determine your rate of fluid loss. Keep in mind that caloric replacement and fluid replacement aren't the same. Replenish fluid loss above and beyond your caloric replacement drink.

Nutritional content plays a key role as well. If you can eat steak and a milkshake during the race, then more power to you. But, if you've read this far, you either fear or have experienced nutritional issues and may find these next few points helpful. Your GI tract doesn't consider all calories equal. Protein and lactose containing foods delay transit time and slow absorption. Large doses of fruits, vegetables, and high fibre foods may have the opposite effect – but just as undesirable. Therefore, avoid these food types 24 hours before race day and during the race.

How much to eat?

As far as caloric intake per hour goes, this is highly variable. A common goal is to consume 200-300 calories/hour during the bike and significantly less on the run. I believe your race and run performance will go up as you are able to **SUCCESSFULLY** take in more calories. 'Successfully' is the important concept; it isn't 'take in calories at all cost.' If your digestive tract is not absorbing, then continued intake can make things worse. Belching and reflux can be a sign things are backing up. Flatus or passing gas is usually a sign that the digestive tract is moving things in the right direction. We've all experienced passing those athletes!

There is evidence to support that increasing caloric absorption is trainable. However, my experience indicates that athletes able to accomplish this are very disciplined on the bike and keep their heart rates steady and aerobic.

Here is an exercise to try over the next few weeks - although, for some of you, this may be something you try before you *next* Ironman race...

Plan a 'big day' training session to determine the heart rate you can digest food. Begin with a long continuous swim, holding the 100 m pace you expect to race. Then, eat a huge amount of food, including milk and lots of protein immediately prior to riding at the highest heart rate you plan to hit during the race. Take in your normal drink at your hourly caloric goal rate



during the race. The key to this exercise is to create a 'full' feeling in your gut before you begin the ride. This assimilates what can happen to the majority of triathletes who come to the sport with no swim background and typically swim with a high heart rate swallowing air during the first discipline. The subsequent mad dash through T1 only aggravates the condition. By recreating this scenario, you will gain some idea of how hard you can go and keep the GI system rolling. This can be a healthy reality check prior to your key race day.

My top tips

Here are some tips to consider if you have stomach problems during a race:

1. SLOW DOWN - this is key. As your heart rate rises, blood is shunted from your intestines, effectively slowing absorption.
2. Avoid high effort/heart rate surges. Lactate accumulation in the blood slows gastric emptying.
3. Remain adequately hydrated. The total volume of liquid ingested counts and includes both sports drink and water, being mindful to dilute gels and concentrated solutions with adequate amounts of plain water.
4. Wait the appropriate time for your intestines to wake up after swimming before taking in calories. This is confirmed when you are passing flatus, as opposed to belching.
5. Urinate - a full, distended bladder can increase the distension in your abdomen.
6. Loosen up the race belt and drawstring of shorts from around your abdomen.
7. Optimize the osmolality of your drink.
8. Unless you have prior success, avoid protein, lactose and fruits/vegetables on race day and the preceding 24 hours.

Hope this is helpful, and best of luck in your upcoming races.

Dr Shilt is currently an Associate Professor of Orthopaedic Surgery at Wake Forest University in Winston-Salem, North Carolina. After joining the faculty at [Wake Forest University](#), he started doing triathlons in 2000. His first Ironman was in Brazil in 2003, finishing in 11:29. That day challenged him to approach triathlon more seriously... Four years, six Ironman races, three epic camps and one Kona slot later he finished IM Brazil 2006 in 9:54.

Dr Shilt is currently on the Endurance Corner Team with Gordo Byrn in Boulder, CO establishing a Human Performance Institute and is a contributor to the Gordoworld Alternative Perspectives. His particular expertise is working with athletes with biomechanical or medical issues and helping successful professionals balance the demands of training with work/life demands.