STUDIO 7 MULTI SPORT

# Coach-Athlete Q&A

**A look at some coach-replies to common questions by topic.**

## Fluids, Calories, Electrolytes – A Short Primer on Proper Fueling

**By: Steve Born**

Although the topic of how to properly fuel the body during endurance exercise is a subject that requires much more than a paragraph or two, there are some key things that endurance athletes should know and apply, which I believe will yield tremendous benefits.

Dr. Bill Misner, the head of R&D at E-CAPS/Hammer Nutrition states: " To suggest that fluids, sodium, and fuels-induced glycogen replenishment can happen at the same rate as it is spent during exercise is simply not true. Endurance exercise beyond 1-2 hours is a deficit spending entity, with proportionate return or replenishment always in arrears. The endurance exercise outcome is to postpone fatigue, not to replace all the fuel, fluids, and electrolytes lost during the event. It can't be done, though many of us have tried."

What this means, in regards to fluids, calories, and electrolytes/sodium, is that the body cannot be replenished at the same rate that it becomes depleted. Yes, the body needs your assistance in replenishing what it loses but that donation must be in amounts that cooperate with normal body mechanisms, not in amounts that override these crucial mechanisms.

### *FLUIDS*

In regards to fluid intake, experts such as Dr. Tim Noakes and Dr. Ian Rogers suggest that a fluid intake between 500-750 milliliters/hr (16.9-25.4 fluid ounces per hour) will fulfill most athlete's hydration requirements under most conditions. I like what Dr. Rogers says: "Like most things in life, balance is the key and the balance is likely to be at a fluid intake not much above 500 milliliters (16.9-25.4 fluid ounces per hour) per hour in most situations, unless predicted losses are very substantial." [Fluid and Electrolyte Balance and Endurance Exercise: What can we learn from recent research? by Ian Rogers @: http://www.wms.org/education/Hyponatremia.htm]

We at E-CAPS/Hammer Nutrition have found that most athletes do very well, under most conditions with a fluid intake of 20-26 ounces per hour (roughly the equivalent of a small to large water bottle). If more fluid intake is found to be necessary (under extreme hot conditions, for example) it will most likely be necessary to increase electrolyte intake as well.

### *CALORIES*

As far as calorie replenishment is concerned, the body has a limit to what it can accept from carbohydrate donation for return to the energy cycle. Researchers such as Coleman, Noakes, and others (in carbohydrate oxidative research) agree that up to 1.0 - 1.1 grams of carbohydrate per minute can be utilized from exogenous (outside) carbohydrate donation. A 1.0 g/carb per minute donation is 240 carbohydrate calories per hour. A 1.1 g/carb per minute donation is 264 carbohydrate calories per hour. Taking into account that some of those calories, approximately 6-23%, are burned/lost during the digestive process, this suggests that for the average athlete the minimum intake is 254.4 calories to obtain 240 calories per hour (1.0 per minute with 6% lost in route) while the absolute upper maximum is 324.72 carbohydrate calories required in order to regenerate 264 carbohydrate calories (1.1 per minute with 23% lost in route).

We take the conservative side and suggest a slightly lower overall dose after finding through trial and error that these higher amounts only induced gastric stress disorders and reduced performance. This is why our common recommendation is approximately 60-70 grams of carbohydrates hourly (240-280 calories). That will, in most situations, and for most athletes, provide enough carbohydrates for energy production (the limit of what the body can metabolize) while taking into account a percentage of those calories being lost/burned during the digestive/metabolic processes.

## Simple Sugars vs. Complex Carbohydrates

Another primary factor of importance to endurance athletes is the type of carbohydrate used. We believe the only type that any athlete should consume, especially during exercise, are long-chain (a.k.a. "complex") carbohydrates and never short-chain carbohydrates (a.k.a. "simple sugars"). Energy products containing simple sugars (glucose, sucrose, fructose, dextrose, etc) must be mixed in weak 6-8% solutions in order to match body fluid osmolality and be digested with any efficiency. Solutions mixed at this concentration will only provide 100 or so calories an hour, which is inadequate for maintaining energy production. Once that 6-8% solution concentrate is increased (or if it is consumed with or near a complex carbohydrate product) osmolality is raised and, unless more water and electrolytes are added to the mix (at which point the athlete might very well be flirting with over hydration), that concentrated simple sugar solution will not pass the gastric channels. Even more problematic is that if more fluids and electrolytes are not available the body will recruit these from other areas in the body (areas that critically need these fluids and electrolytes) and divert them to the digestive system to aid in the digestion of this too-concentrated simple sugar mix. Simply put, simple sugar-based drinks or gels have to be mixed and consumed at very dilute (and thus, weak) concentrations in order to be digested with any efficiency. And again, when a simple sugar-based product is used it at properly mixed proportions it cannot provide adequate amounts of calories for energy production.

Complex carbohydrates, however, will match body fluid osmolality, not at a 6-8% solution, but a more concentrated 15-20% solution. Even at this seemingly too-high concentration complex carbohydrates (such as maltodextrins/glucose polymers) will empty the stomach at the same efficient rate as normal body fluids and provide substantially more calories (up to three times more) than simple sugar mixtures will.

To sum up, if the athlete consumes a simple sugar fuel the body will only permit 6-8% of it in solution into circulating serum for fuel replacement. On the other hand, complex carbohydrate fuels are easily and more-rapidly absorbed in a 15-20% solution. More calories are absorbed faster, and are available for energy production, from complex carbohydrates than simple sugar. The higher the simple sugar content, the higher the solution osmolality, the less of it is absorbed immediately. The longer the chain of sugars linked together as a complex carbohydrate the more of it is absorbed in higher solution because its osmolality is closer to that of body fluids. Therefore, the ideal carbohydrate source for athletes is long-chain complex carbohydrates.

## The Need For Protein

When exercise goes into the second hour and beyond, supplemental protein will fulfill the 5-15% energy requirements of the body while also preventing the cannibalization of lean muscle tissue (which, among other things, produces excess amounts of performance-robbing ammonia). Therefore, it makes sense during long exercise sessions or races, to include some protein in the fuel mix. A donation of about 6-11 grams of protein (24-44 calories) will satisfy this 5-15% protein

requirement. We believe that soy protein, with its specific amino acid profile and naturally occurring isoflavones, is an ideal protein source for use during exercise.

***ELECTROLYTES***

Electrolyte replenishment is crucial for maintaining the optimal performance of many of the body's functions such as proper muscular contraction. Far too many athletes forget to replenish electrolytes consistently or mistake "electrolyte replenishment" for "sodium or salt replenishment." Sodium chloride (a.k.a. "salt") is indeed an important component of electrolyte replenishment but it does not fulfill the entire requirements. A satisfactory electrolyte replenishment product needs to include sodium, chloride, calcium, magnesium, and potassium as all these minerals play a key role in the maintenance of these important body functions.

In terms of sodium replenishment, far too many athletes "over salt" their bodies during exercise, with bloating, water retention (edema-like symptoms), and stomach distress being the usual outcome. We want our body to re-circulate adequate amounts of sodium for supporting systemic balance of osmolality, carbohydrate transit across gastric membranes, and nerve transmission for muscle contractions. Too much of a sodium donation neutralizes this re-circulation process and again, may contribute towards those aforementioned, performance-inhibiting problems. The key for electrolyte replenishment, as it is with calories and fluids, is to provide an adequate dose to support bodily functions without overwhelming the body with too much, which will override and neutralize those body functions. Therefore, to satisfy the body's crucial electrolyte requirements, we suggest consistent/hourly replenishment from a balance of electrolytes, which would include a donation of 300-600 mg sodium chloride (a.k.a. "salt").

## Summary

These are some general guidelines that we believe to be very helpful for you. More information regarding the proper fueling of the body, along with information about the Hammer Nutrition line of fuels - Hammer Gel, Sustained Energy, Perpetuem, and Endurolytes - can be found in "The Endurance Athlete's Guide To Success." You can download a free copy at:

www.e-caps.com/downloads/fuelinghandbook.pdf

Click on this link and you'll have 40+ pages of important, science-based, easy-to-read guidelines that you can benefit from immediately.