SPORTS DRINK CONSIDERATIONS

By: Peter Cummings

Information from this report is from the Presentation of the same name by Larry Armstrong Ph.D., FACSM, at the 2006 USA Cycling Coaching Summit in Colorado Springs, CO.

Dr. Armstrong started the discussion reviewing the negative consequences of dehydration on physiological responses (see the report *Hydration Concerns and Strategies* - these negative consequences can occur at dehydration levels as low as 2-3% loss of body mass). These consequences include a decrease in sweat rate (resulting in a lack of cooling), core body temperature increases, plasma volume decrease (resulting in increased HR), decreased stroke volume (each heart beat produces less flow), decreased cardiac output, and decrease in blood pressure.

Dr. Armstrong then moved on to discuss nutritional basics for endurance athletes including the fact that carbohydrates must meet the needs of training by replacing the glycogen that was stored in the liver and muscles prior to each exercise bout. Also stated is the fact that the timing, composition and amount of food and fluid can profoundly affect exercise performance and the athlete's ability to recover from both volume and intensity of exercise. At this point, Dr Armstrong emphasized the need for athletes to adopt very specific nutritional strategies and that while he feels nutritional supplementation is necessary it cannot replace an inadequate diet or poor food choices. So, what are his recommendations?

1.) When exercise lasts longer than 50-60 mins and is of high intensity, using a diet high in carbohydrates prior to workouts will enhance performance. Since most of our workouts are of this nature a diet high in carbohydrate is a must.

2.) Athletes must match fluid intake with Sweat Loss as closely as possible. Keeping in mind that maximal gastric emptying rate is somewhere between 0.8 and 1.3 liters/hour while maximum sweat rates have been measured at 1.5 to 3.0 liters/hour. To do this you must know your sweat rate (to be discussed later in report).

So, adequate carbohydrate and fluid is paramount to optimal endurance performance. By addressing these issues you are trying to minimize the increase in core body temperature, reduce the cardiovascular strain of dehydration and sustain your endurance performance.

Knowing that sweat rates can be greater than gastric emptying identifies a serious issue. For example, if you are an athlete that has a sweat of say 2.0 liters/hour (which is common) and a gastric emptying rate of 1 liter/hour (average) you would be unable to replace HALF of the fluids you are losing every hour!! This also highlights the importance of beginning an exercise session in a state of adequate hydration. If you start in a hole the effects of dehydration will hit sooner. In the above example, if that athlete weighed approximately 150 lbs and they are dehydrating at a rate of 1 liter/hour or about 2 lbs./hour they are heading towards performance drop offs after just two and half hours of riding and that is drinking at THEIR CAPCITY! If they came in slightly under-hydrated then it could happen in as little as 2 hours. Consider that this athlete might be under-hydrated, possibly from a long airline flight to head out to training camp in the Las Vegas Desert and hasn't acclimated to the heat yet. If you read the report on *Hydration Concerns and Strategies for Endurance Athletes,* you know that it will take that athlete a minimum of 3-5 days to even start showing signs of acclimating. This athlete is very delicate and possibly dangerous situation for a full two weeks.

Aside from gastric emptying, there is the factor of absorption. **Optimal absorption occurs when the water contains carbohydrates and sodium. Specifically, the carbohydrates need to be at approximately 6-8% and contains a minimum of 100-200mgs of sodium per 8 oz.** As for the use of protein in sports drinks Dr. Armstrong reserved a definitive answer instead discussing 2 conflicting studies on the subject. It seemed as though he was interested in the protein equation in energy drinks. The discussion then moved onto carbohydrates and energy needs during exercise.

Dr. Armstrong then highlighted the important considerations of all factors in choosing and using sports drinks. He mentioned that the need for carbohydrate in the athlete's diet and sports drink is undeniable. Also, maintaining Plasma volume with water and electrolytes is a major factor in performance and that an individual's palatability of the sports drink highly influences how much the athlete will drink. He also mentioned an interesting fact that tastes change during exercise. This should be considered by athletes exercising longer than 2 hours. They might prefer different drinks at different times during training or events due to this.

Important things to remember regarding water:
Approximately 63% of entire body mass is water
Greater than 50% of Blood Plasma is water
Water is the medium for biochemical and metabolic reactions
Thermoregulation of the body is regulated using water and the body is highly sensitive to dehydration
Water is used to control the highly sensitive acid-base balance of the body

Important things to remember regarding carbohydrate and glycogen:
At different intensities, energy expenditure is different. Carbohydrate usage in road races 2 hours and longer is approximately 50% and increases in shorter more intense races.
Glycogen used during exercise is stored in LIMITED quantities in the liver, muscles and blood.
During exercise and racing, glycogen is depleted no matter how good the nutritional strategies are.
Glycogen re-synthesis is highest IMMEDIATELY following exercise (up to 2 hours post exercise – more on this in a later report).
Glycogen storage and hydration status correlate highly.

Importance of Sodium and Chloride (salt) in body function:
In extra-cellular fluid, Sodium and Chloride compose over 80% of osmotically active particles and extra-cellular fluid volume is ESSENTIAL in exercise performance.
Salt levels in sweat loss differ in athlete to athlete and due to things like genetics, diet and heat acclimatization.
Salt levels in sweat range from 0.8 grams/liter up to 4.0 grams/liter and the average American's salt consumption is 3-8 grams/day.

Hypothetical Sweat and Salt loss of athlete - Sweat rate -1.5 l/hr, salt concentration -2.5 grams/l. During a race/training session of 3 hours in length total sweat lost is 4.5 liters, total salt lost 11.25 grams. With only an average salt intake this athlete is at risk of hyponatremia if they only use water or a sports drink with low levels of sodium (note- 3 liters, or six water bottles, of Gatorade only provides 450 mg of sodium per liter for a total of 1.3 grams, leaving this athlete 1.5 liters

dehydrated and 10.9 grams of sodium light). Note - it would take an additional 5 liters of sports drink to replace that much sodium.
TAKE HOME MESSAGE - if you are an athlete your diet must supply your sodium needs. Salt your foods.

Sports Drink and carbohydrate Recommendations:
1.) Experiment and try to perfect sports drinks (and Food) strategies during training prior to use in events.

2.) If you are a triathlete, identify the drinks that will be provided by the race directors. Use them during training to verify they work for you. If their sports drink don't work for you make alternate plans.

3.) 1 hour prior to competition, drink 2 cups of sports drink and consume 80-100 grams of carbohydrates, energy bars are a good choice.

4.) During Competition (and training) consume 40-60 grams of carbohydrate per hour to support carbohydrate metabolism (if workout is less than an hour then no carbs are needed). Set a timer on your sports watch to verify you are keeping pace with pre-determined fluid and carb loading pattern.

5.) Know your sweat rate (it changes) - weigh yourself nude prior to exercise and again after. By knowing your fluid consumption and your weight loss you can determine your sweat rate by dividing this amount and time. You will also know how much fluid you need to replace lost fluid.

Example - Athlete lost 2.5 pounds over a two hour ride and consumed 2 regular size water bottles. Remember, a pint is a pound the world around. This athlete lost 2.5 pints even though they drank almost 3 pints. This athlete actually lost 5.5 pounds (or pints) during the 2 hours or 2.75 pints/hour. They just happened to replace 3 pints while they were exercising. Remember after exercise replace 125-150% of weight lost, 3.75 pints in this case (2.5 pounds + 50%), to compensate for excess urine output after exercise and be sure to include a small amount of sodium for retention and to avoid hyponatremia.

6.) Warning - You can also over hydrate. Too much water without sodium for retention can lead to hyponatremia. Be sure to replace fluid, sodium and carbohydrates following exercise. The primary cause of Hyponatremia is fluid overload AND whole body sodium deficiency.

7.) Caffeine unless consumed in large amounts (6-8 cups/day) does NOT dehydrate you.

8.) Realize that a weight loss greater than 1% in one day is a sign of dehydration.

9.) Monitor urine output (output should be plentiful) and color. Color should be Straw colored to Very Pale Yellow. Darker urine is a sign of dehydration.

10.) Use adequate salt in your diet since trying to get enough sodium in your sports drink is close to impossible.

11.) Know where the feed zones are and know how to feed. Practice feeding in a feed zone prior to the event.

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