Hydration Guide

Dehydration and depletion of the body's carbohydrate stores are two factors that will limit prolonged exercise.

Seven Rules of Hydration

1. The rate of passage of fluid from your stomach into your small intestine depends on how much fluid is actually in your stomach. If there is lots of fluid there, fluid flow from stomach to intestine is like a springtime flood; if there is little fluid, the movement resembles a lightly dripping tap.

   Therefore, to increase stomach-intestinal flow (and overall absorption of water) you need to put a fair amount of liquid in your stomach just before you begin your exercise. In fact, 10-12 ounces of fluid is a good start. This will feel uncomfortable at first, so practise funnelling this amount of beverage into your "tank" several times before trying in an actual competition.

2. To sustain a rapid movement of fluid into your small intestine during your exertions, take three to four sips of beverage every 10 minutes if possible, or five to six swallows every 15 minutes.

3. If you are going to be exercising for less than 60 minutes, do not worry about including carbohydrate in your drink; plain water is fine. For more prolonged efforts, however, you will want the carbohydrate.

4. Years of research have suggested that the correct concentration of carbohydrate in your drink is about 6 to 8%. Most commercial sports drinks fall within this range, and you can make your own 6% drink by mixing five tablespoons of table sugar with each litre of water that you use. A bit of sodium boosts absorption; one-third teaspoon of salt per litre of water is about right.

5. A 6% "simple sugar" drink will empty from your stomach at about the same rate as a fancy 6% "glucose polymer" beverage, so don't fall for the idea that the latter can boost water absorption or enhance your performance more than the former, and don't pay more for the glucose-polymer concoction.

6. Contrary to what you've heard, cold drinks aren't absorbed into your body more quickly than warm ones. However, cold drinks are often more palatable than warm ones during exercise, so if coldness helps you to drink large quantities of fluid while you exert yourself, then keep your drinks cool.

7. Swilling drinks during exercise does NOT increase your risk of digestive-system problems. In actuality, most gut disorders that arise during exercise are caused by dehydration, not from taking in fluid. Dehydration induces nausea and discomfort by reducing blood flow to the digestive system, so by all means keep drinking!

Dehydration

Sweating is the way in which the body maintains its core temperature at 37°C. This results in the loss of body fluid and electrolytes and if unchecked will lead to dehydration and eventually circulatory collapse and heat stroke. The typical effect of fluid loss on the body is:

% body weight lost as sweat	*Physiological Effect*
2%	Impaired performance
4%	Capacity for muscular work declines
5%	Heat exhaustion
7%	Hallucinations
10%	Circulatory collapse and heat stroke

Electrolytes - serve three general functions in the body:

- Many are essential minerals.
- They control osmosis of water between body compartments.
- They help maintain the acid-base balance required for normal cellular activities.

The sweat that evaporates from the skin contains a variety of electrolytes. The electrolyte composition of sweat is variable but comprises of the following components: Sodium, Potassium, Calcium, Magnesium, Chloride, Bicarbonate, Phosphate, Sulphate. A litre of sweat typically contains 0.02g Calcium, 0.05g Magnesium, 1.15g Sodium, 0.23g Potassium and 1.48g Chloride. This composition will vary from person to person.

Carbohydrate - stored as glucose in the liver and muscles and is the most efficient source of energy as it requires less oxygen to be burnt than either protein or fat.

The normal body stores of carbohydrate in a typical athlete are:

- 70kg male athlete - Liver glycogen 90g and muscle glycogen 400g
- 60kg female athlete - Liver glycogen 70g and muscle glycogen 300g.

During exercise there is in an increased uptake of blood glucose by the muscles and to prevent blood glucose levels falling, the liver produces glucose from the liver stores and lactate. During hard exercise, carbohydrate can be depleted at a rate of 3-4 grams per minute. If this is sustained for 2 hours or more, a very large fraction of the total body carbohydrate stores will be exhausted and if not checked will result in reduced performance. Recovery of the muscle and liver glycogen stores after exercise normally requires 24-48 hours for complete recovery.

Consuming carbohydrate before, during and after exercise will help prevent blood glucose levels falling too low and also help maintain the body's glycogen stores. Many athletes cannot consume food before or during exercise and therefore a formulated drink that will provide carbohydrate is required.

Rehydration

Fluid absorption - There are two main factors that affect the speed at which fluid from a drink gets into the body:

- The speed at which it is emptied from the stomach.
- The rate at which it is absorbed through the walls of the small intestine.

The higher the carbohydrate levels in a drink the slower the rate of stomach emptying. Isotonic drinks with a carbohydrate level of between 6 and 8% are emptied from the stomach at a rate similar to water. Electrolytes, especially sodium and potassium, in a drink will reduce urine output, enable the fluid to empty quickly from the stomach, promote absorption from the intestine and encourage fluid retention.

What's wrong with water? - Drinking plain water causes bloating, suppresses thirst and thus further drinking. It stimulates urine output and therefore is inefficiently retained. A poor choice where high fluid intake is required. Water contains no carbohydrate or electrolytes. In extreme circumstances it can lead to "Water Intoxication" producing two results that can be quite serious.

Sports drinks - There are three types of Sports drink all of which contain various levels of fluid, electrolytes and carbohydrate.

Type	*Content*
Isotonic	Fluid, electrolytes and 6 to 8% carbohydrate
Hypotonic	Fluids, electrolytes and a low level of carbohydrate
Hypertonic	High level of carbohydrate

Which is most suitable?

- *Isotonic* - quickly replaces fluids lost by sweating and supplies a boost of carbohydrate. This drink is the choice for most athletes and team sports. Glucose is the body's preferred source of energy therefore it may be appropriate to consume isotonic drinks where the carbohydrate source is glucose in a concentration of 6% to 8% - e.g. High Five, SiS Go, Boots Isotonic, Lucozade Sport.
- *Hypotonic* - quickly replaces fluids lost by sweating. Suitable for athletes who need fluid without the boost of carbohydrate - jockeys and gymnasts.
- *Hypertonic* - used to supplement daily carbohydrate intake normally after exercise to top up muscle glycogen stores. In ultra distance events high levels of energy are required and hypertonic drinks can be taken during exercise to meet the energy requirements. If used during exercise hypertonic drinks need to be used in conjunction with isotonic drinks to replace fluids.

Want to make your own?

- *Isotonic* - 200ml of orange squash (concentrated orange), 1 litre of water and a pinch of salt (1g). Mix all the ingredients together and keep chilled
- *Hypotonic* - 100ml of orange squash (concentrated orange), 1 litre of water and a pinch of salt (1g). Mix all the ingredients together and keep chilled.
- *Hypertonic* - 400ml of orange squash (concentrated orange), 1 litre of water and a pinch of salt (1g). Mix all the ingredients together and keep chilled.

Calculating personal fluid needs - During an endurance event you should drink just enough to be sure you lose no more than 2% of pre-race weight. This can be achieved in the following way:

- Record your naked body weight immediately before and after a number of training sessions, along with details of distance/duration, clothing and weather conditions
- Add the amount of fluid taken during the session to the amount of weight lost - 1 kilogram (kg) is roughly equivalent to 1 litre of fluid.

After a few weeks you should begin to see some patterns emerging and can calculate your sweat rate per hour. Once you know what your sweat losses are likely to be in any given set of environmental conditions, you can plan your drinking strategy for any particular event

Dental Health - Sports drinks commonly contain citric acid. All acids have an erosive potential but the method of drinking will influence whether or not those acids affect the teeth. Sports drinks should be consumed as quickly as possible, preferably with a straw and not be held or swished around the mouth. *Retaining drinks in the mouth will only increase the risk of erosion*. Refrigerated drinks will have a reduced erosive potential as the acid dissolution constant is temperature dependant and cold drinks are absorbed more quickly.