

7: Nutrition for Endurance Performance

The placebo effect does have its place in performance, but doesn't have its place in this paper!

Marketing

Health & performance supplements do not have to go through strict testing before they go on the market. BE CAREFUL! Energy bars, sports drinks & vitamin supplements are a HUGE market – don't believe everything you read!!

Individual Differences & Practicing Nutrition

You will respond to nutrients differently than someone else, so read the information, think about it, experiment with it, and make your own conclusions.

Practice your nutrition – during training and lower priority races. Never try something new in a race without having tried it beforehand.

Short Versus Long Events

You do not need fluid nor food during events less than 1 hr. (Assuming that you have adequate fuel & fluid stores before the event). You do need hydration & nutrition for training & racing over 1 hr.

Carbohydrates, Protein and Endurance

You need carbohydrates to fuel your body during endurance events over 1 hr. Atkins diets are not effective for endurance training or performance.

Protein is an important nutrient for muscle tissue repair. Under normal circumstances it is not used for fuel. Researchers have experimented with using protein together with carbohydrates in recovery drinks as it is hypothesized that protein would enhance replenishment of glycogen stores. The research has not 100% supported this hypothesis, however many nutritionists recommend using protein with recovery nutrition.

Insufficient carbohydrate ingestion during and after training suppresses the immune system – following the carbohydrate recommendations below will prevent this suppression and therefore enhance immunity(5).

Fructose (fruit sugar) is more difficult to digest during a race, and can cause abdominal distress. Glucose is a preferred sugar to fructose for this reason (7).

The food you eat is a combination of carbohydrate (carbs), fat & protein, vitamins, minerals & fluid. Scientists have assigned a glycemic index to foods, giving athletes an indication of how quickly they are digested & used to provide fuel. (See Table 2)

Table 1. Carbohydrate Recommendations for Maximal Performance & Recovery

Pre-Event	During Event	Post-Event
<p>2-4 hours prior:</p> <ul style="list-style-type: none"> • 140-330 g carbs Low-moderate GI, small protein/fat; low fiber <p>30-60 minutes prior:</p> <ul style="list-style-type: none"> *After warm up High GI foods* 	<ul style="list-style-type: none"> • 0.5 - 1.2 g/kg/hr High GI foods/sports drinks *taken approximately every 15 minutes *In Olympic Triathlon, most fuel on bike *In Ironman & ultradistance, fuel on bike/run *eg for 70 kg person = 35 – 84 g/hr *0.5 – 1.2 is a big range – start experimenting at the high range (1.2 g/kg/hr) and see if you can tolerate it. If you can, stick to that – the more energy the better! 	<p>Most important for staged races and during heavy training periods</p> <ul style="list-style-type: none"> • 1.2g/kg weight within 30-90 mins & every hour for 4-6 hrs High GI foods/sports drinks *Include protein but minimal fat for 1-2 hrs – (fat slows digestion) Eg. for 70 kg person: 960 g from 30 – 90 mins post-race then 960 g/hour for next 3 ½ hrs.

You will find the grams of carbohydrates listed on sports drinks & bars, as well as on various processed foods you purchase. Try and see what works for you!

Table 2. The Glycemic Index of Some Common Foods

High GI (85% or higher)	Medium GI (60-85%)	Low GI (<60%)
Glucose Sucrose Corn syrup Maple syrup Honey Bagels Candy Corn flakes Carrots Crackers Potatoes Raisins Bread (white) Sports drinks	Bananas All-bran cereal Grapes Oatmeal Orange juice Pasta Rice Whole grain rye bread Corn Baked beans Potato chips	Fructose Apples Applesauce Cherries Kidney beans Lentils Navy beans Chick peas Dates Figs Peaches Plums Ice cream, milk, yogurt Tomato soup

Glycemic Index

Glycemic index (GI) is the measure of the rise in blood glucose after the food is ingested compared to equal amounts of pure glucose. High GI foods will replenish blood glucose & muscle glycogen faster than low GI foods.

GI depends on the type of sugar (sucrose, glucose, fructose, maltodextrin, maltose), protein, fat, & fiber. Fat, protein & fiber slow down gastric emptying.

Normally, ingesting a high GI food will raise blood sugar levels, which in turn elicits an insulin response. This is felt as a “high” followed by a “low” as your blood becomes hypoglycemic. It is believed that the insulin spike & subsequent hypoglycemia following ingestion of high GI carbs is negated once you have warmed up or are racing...Therefore most athletes can consume high GI foods after their warm up and while racing without “bonking”.

Fluids & Electrolytes

You can empty approximately 1 L of fluid per hour through the gut. It absorbs fluid better if there is some fluid already in there. You need to practice training with fluid in your stomach to be able to tolerate it.

Research has shown that energy drinks up to a concentration of 4-5% glucose with sodium are absorbed more rapidly than water alone. If the concentration is above 6% it is absorbed slower, but provides more energy. Under normal race circumstances it is recommended to ingest a 6-8% concentration drink (most commercial sports drinks); if dehydration is a concern you could keep your drinks at 4-5% concentration (7).

Avoid dehydration during competition - you will limit gastric distress. Many people blame gastric distress (diarrhea, vomiting) during long competitions on too much fluid or carbohydrates in their stomach. Alternatively, research has shown that gastric distress is a consequence of dehydration and the stomach “shutting down” (1).

1 L of sweat typically contains: 0.02g calcium; 0.05 g magnesium, 1.15 g sodium; 0.23 g potassium, 1.48 g chloride. Sodium is a key mineral that is easily lost and very important for regulation of the body. A sports drink provides mineral replacement and is important during long races versus drinking water alone (7).

Acclimatized athletes lose less sodium in sweat than non- acclimatized.

Electrolyte replenishment is usually not required in events shorter than 4 hours.

Hyponatraemia is a term to describe an electrolyte imbalance (low blood sodium). It can accompany dehydration and hyperhydration (“flushing” out electrolytes).

Athletes who take non-steroidal anti-inflammatories (NSAIDs) have a higher risk of hyponatraemia during a race (due to NSAID’s effect on renal function) (6).

Many sports drink companies are well researched and contain electrolytes in the recommended concentrations.

Table 2. The Glycemic Index of Some Common Foods

Pre-Event	During Event	Post-Event
Days & Hours prior: • Drink so you are fully hydrated pre-race Include sodium or a pinch of salt so you don't flush out important electrolytes	Fluid Recommendation: • 1 L/hr *250 ml taken approximately every 15 minutes *Refer below to carb & sodium recommendations in fluid	Most important for staged races and during heavy training periods • 1.5 L for every kg weight lost *2-8% carbohydrate solution to aid in glycogen replenishment *1/4 tsp salt/L
15 minutes prior: • 500 ml fluid to create weight in stomach *aids gastric emptying	Carb Recommendation: (*Refer to carb table.) • 6-8% carbohydrate solution (ie. 60 – 80 g carbs dissolved in 1 litre fluid) *Most sports drinks are 6-8% - check the label!	To measure fluid loss: Weigh yourself naked before event, then weigh yourself towel dried & naked after event.
	Sodium Recommendation: (For events longer than 3-4 hrs) • 1 g sodium/hour *either in drink or taken via foods (there is 1 g Na in 2.5 g salt) *eg. 2 pretzels/hour; 5-6 powerbars/hour, 10 pks powergels/hour.	To measure sweat rate: Weigh yourself naked before event: weigh yourself towel-dried & naked after event. Subtract 1 kg for every L fluid you have drunk

Supplements & Performance Enhancers

This is a paper in itself!!! Supplements are a big business - if you believe everything you read you will be very confused. I have introduced a few that you may have heard about.

Vitamins

Vitamin C & E are recommended supplements for endurance athletes. Numerous studies have shown that Vitamin C is effective in reducing viral infections in endurance athletes. Vitamin E is also recommended as an antioxidant.
 Recommended Vitamin C Dose: 300 – 1000 mg
 Recommended Vitamin E Dose: 400 – 800 IU (International Units). You may need to check with your Doctor before supplementing Vitamin E.

Caffeine

Caffeine has shown to be helpful in endurance training & performance. Some people respond better than others.
 Pros: Increases fat metabolism (saves glycogen); decreases ratings of pain & perceived exertion & muscular fatigue, increases cognitive processes & alertness. Cons: May cause dehydration (research is split); stomach distress; irregular heart beats; headaches, gastrointestinal cramps; inhibit absorption of thiamin, calcium & iron. 200-400 mg dosage required for significant effects (2-4 cups perked coffee; 8-20 cups tea; 3 ½ colas.)

Branched Chain Amino Acids (BCAAs)

Leucine, isoleucine & valine are amino acids making up tissue protein in the body. They must be obtained through external sources because the body doesn't synthesize them. They will be obtained through a balanced diet. Supplementing is believed to help endurance athletes through many avenues; maintaining immune system & muscle mass on stage races, reducing central nervous system fatigue, and promoting the use of fat while conserving glycogen. It is recommended to only supplement during periods of heavy training or competition, as excessive supplementation may cause an amino acid imbalance.

Medium Chain Triglycerides (MCT)

These are processed fats that are quickly absorbed and used for energy, sparing glycogen stores. They are believed to be helpful in races longer than 3 hours and have not yet been linked to any long term negative side effects.
 Sodium Phosphate

It is believed that sodium phosphate helps hemoglobin to more completely unload their stores of oxygen into the muscle and has been linked to increases in aerobic power. It can lead to upset stomach, and is recommended to take only a few times per year.

Glycerol

Glycerol is thought to promote your body to hold onto fluid stores, helping to prevent dehydration during a race. It has been used successfully by many ultra-distance athletes during hot races. It needs to be tested thoroughly both by the athlete prior to taking it during a competition, and by sport scientists - supplementation has been known to cause headaches & nausea.

A Final Word:

I have a hard time delving into sports nutrition because nutrition for peak performance can be a separate entity than nutrition for optimal health. I recommend that your normal diet is filled with whole (non-processed) foods; free-range meat, fruit & vegetables free from steroids, pesticides & other potential health hazards. Think about what you are putting into your body and the possible side-effects it may have!

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