THE E2E CHALLENGE, LONG DISTANCE BASICS
Part 4: Role Food Plays, Nutritional Demands, and Practical Advice

Before getting down to some practical advice, it may prove helpful to review the role that the basic food components play in the overall makeup of the body, and advantageous to understand the nutritional demands that occur on the body as a result of physical exertion.

Role that food components play:

The basic components that the body requires from food are *water, energy and nutrients*.

Water

Water is the most important component in our diet. Hydration allows the body to maintain structural and biochemical integrity, and maintains a proper body temperature, preventing overheating through perspiration. Water "lubricates" muscular fibres and joints. This lubricating action also helps reduce lipid deposits: it is the water that splits up the nutrients inside our body, passing them through the cell membranes for delivery to every part of our body.

Without sufficient water, delivering of nutrients will be impeded and fatigue will set in causing performance to suffer. Even small amounts of water will affect performance.

Energy

Energy is required for metabolic processes, for growth, and to support physical activity.
The body's energy sources are carbohydrates and fats, discussed further in this document.

Sedentary normal-weight women typically consume 1400 to 2000 kcal/day, their male counterparts 2200 to 2800 kcal/day. From published reports on cyclists in the Tour de France and from other observations, it is estimated that cyclists participating in long distance multistage tours require 3000 to 7000 kcal/day.
The large variation in energy requirement indicates the need for individual assessment (weight monitoring); but clearly, the more intensive your cycling, and the longer it lasts, the larger your total energy expenditure.
The energy demands of several hours of strenuous riding per day need to be met with increased food intake. Inadequate food intake will lead to decreased physical performance, weight loss, and fatigue.

Nutrients

The term "nutrients" refers to vitamins, minerals, proteins, carbohydrates, fats, fibre and a host of other substances.

The body can manufacture many of the resources it needs to survive, however, vitamins, minerals, essential amino acids, and fatty acids cannot be manufactured, hence they must be supplied in our food to support proper health.

Vitamins and Minerals

A balanced diet should meet all the requirements of the cyclist. Nutritional studies indicate that there is no significant increase in the vitamin requirement of the athlete as a result of energy expenditure.

Proper electrolyte replacement (sodium and potassium salts) is necessary. Sodium is required in order to maintain an ideal plasmatic volume before, during and after a session. If only plain water is drunk, the urine flow increases thus hindering the re-hydration process.

Proteins

Food proteins are necessary for the synthesis of the body's skeletal (muscle, skin, etc.) and biochemical (enzymes, hormones, etc.) proteins.

Proteins are not a good source of energy; in fact they produce many toxic substances when they are converted to the simple sugars needed for the body's energy demand.

All indications are that increased levels of exercise do not cause a significant increase in the body's daily protein requirement (estimated to be 0.8 gm/kg of body weight).

Carbohydrates

Carbohydrates are divided into two groups - simple and complex - and serve as one of the body's two main sources of energy (fats are the other main source).

Simple carbohydrates are better known as sugars, examples being fructose, glucose (also called dextrose), sucrose (table sugar) and lactose (milk sugar).
The brain requires glucose for proper functioning and this necessitates a carbohydrate source. The simple sugars are quite easily broken down to help satisfy energy and brain demands and for this reason they are an ideal food during racing and training.

Complex carbohydrates include starches and pectins that are multi-linked chains of glucose. Breads and pastas are rich sources of complex carbohydrates.
Complex sugars require a longer time to break down into their glucose sub units and are more suited before and after riding to help meet the body's energy requirements.

Fats

Fats are twice as dense in calories as carbohydrates (9 kcal/gm versus 4 kcal/gm) but they are more slowly retrieved from their storage units (triglycerides) than carbohydrates (glycogen). Recent studies indicate that caffeine may help speed up the retrieval of fats and this would be of benefit on long rides.

Fats are either saturated or unsaturated and most nutritional experts agree that unsaturated, plant-based varieties are healthier. Animal fats are saturated (and may contain cholesterol), while plant based fats such as corn, are unsaturated.

Unsaturated fats are necessary to supply essential fatty acids and should be included in the diet to represent about 25% of the total caloric intake.

Nutritional demands occuring as a result of racing and training:

In racing and training, basically our bodies function in three separate phases. These phases are *building, recovery, and performance*. Each of these requires different nutritional considerations.

Building

Building refers to increasing the body's ability to perform physiological processes. An example being the gearing up of enzyme systems necessary for protein synthesis, which results in an increase in muscle mass, oxygen transport, etc. These systems require amino acids, the building blocks of proteins. Hence, it is important to eat a diet that contains quality proteins - fish, red meat, milk and eggs being excellent sources.

The RDA's for vitamins and minerals must also be met but, as with the protein requirement, they are normally quite adequately satisfied in a well balanced diet.

Recovery

Training and racing depletes the body of its energy reserves as well as loss of electrolytes through sweat. Replacing the energy reserves is accomplished through an increased intake of complex carbohydrates (60-70% of total calories) and to a lesser extent fat (25%).

Replenishing lost electrolytes is easily accomplished through the use of the preparations discussed under the section in this document headed “Practically speaking”.

Performance

The performance phase could span 5 to 7 hours, whilst the building and recovery phases are ongoing processes. The requirements of the performance phase are different and primarily concern energy replacement.

Simple sugars such a sucrose, glucose and fructose are the quickest sources of energy and in moderate quantities of about 100 gm/hr (too much can delay fluid absorption in the stomach) are helpful in providing fuel for the body and the brain. Proteins and fats are not recommended because of their slow and energy intensive digestion mechanism.

(Short, one day rides or races of up to one hour in length usually require no special nutritional considerations provided the body's short term energy stores (glycogen) are not depleted which may be the case during multi-day events.)

Normally vitamin and mineral requirements are satisfied during the building and recovery phases, and therefore no additional intake during the performance phase is necessary.

It is clear that the body's requirements are different depending on the phase it is in and some foods are beneficial during one phase but not during another.
Convenience snacks such as Bar One, Mars Bar, and Lunch Bar, contain a lot of energy but low nutrient density (the quantity of nutrients in a food for its accompanying caloric value). In the performance phase they provide quick sources of energy. However, during the building phase they would probably be converted into unwanted fat stores. During the recovery phase, although these snack foods may help replenish energy stores, complex carbohydrates are much more beneficial.

Basically, one must meet nutrient requirements within the constraints of his/her energy demands. Persons with a low daily activity level have a low energy demand and in order to maintain their body weight, must eat high nutrient density foods. A cyclist has an increased energy demand but no significant increase in nutrient requirements. Because of this the cyclist can be less choosy about the foods that are eaten provided he/she bears in mind the phase that the body is in, and realizes his/her specific nutrient and energy requirements that must be met.

Taking into consideration all of the above, a diet emphasizing fruits and vegetables (fresh if possible), whole grain breads, pasta, cereals, milk, eggs, fish and red meat (if so desired) will satisfy long term nutritional demands. These foods need to be combined in such a way that, during the building and recovery phase, about 60-70% of the total calories are coming from carbohydrate sources, 25% from fats and the remainder (about 15%) from proteins.

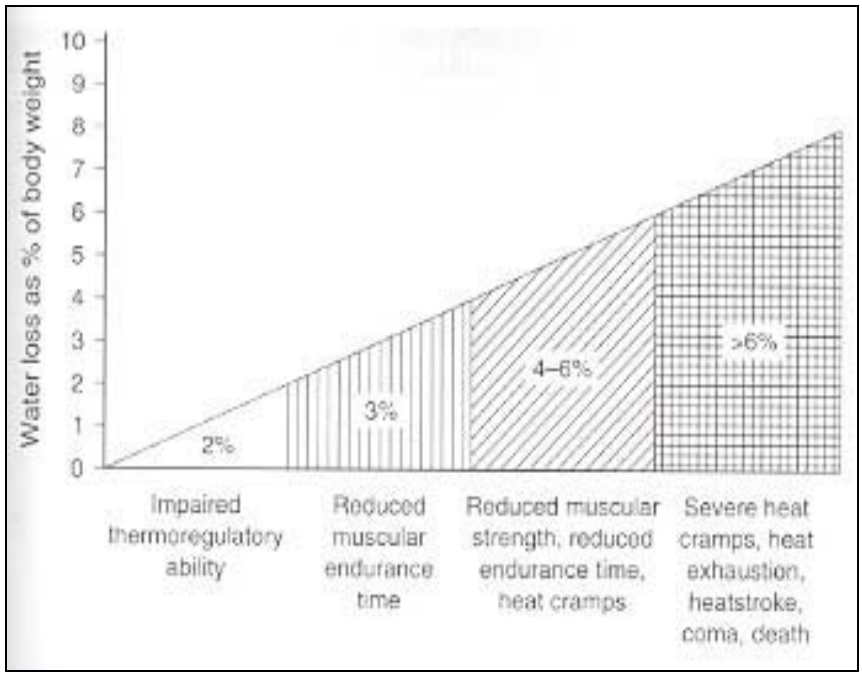
It may be helpful to determine which nutritional requirements you wish to satisfy at each meal. For example, breakfast satisfies part of my nutritional, vitamin and mineral requirement with such foods as porridge and cereal with milk, fruit and nuts. During lunch I meet some of the energy, protein, and to a lesser extent vitamin requirements with such foods as cold meat sandwiches and fruit (banana, apple or pear). Dinner is a big meal, satisfying energy, protein, vitamin and mineral requirements with salads, vegetables, pasta, meat, fish and milk.

Practically speaking

Fluid intake:

You lose up to 12 cups of water from the body through breathing, urinating and sweating. If you exercise in hot weather, you could easily double that amount.

The graph shows the effects of various levels of dehydration on cycling performance.



Lack of fluid is a common cause of fatigue and headaches. It can lead to more serious conditions such as heat stroke but is easy to prevent if a few precautions are followed.

Drink 500 ml of fluids two hours prior to doing the training session/race and give your body the necessary time to absorb the water and release the excess fluids.

Drink small amounts regularly whilst you cycle. Don't wait until you feel thirsty, as it will be too late. Sip every 15 to 20 minutes or more frequently if the climate is particularly hot or dry.

You should carry at least one bottle or *bidon* on your bike. Two bidons are ideal. Some people find a CamelBak useful as it holds more and keeps fluid cool.

If the temperature on the day of the training session/race is high, make sure you add 2-3 g of sodium chloride per litre of water.

The sodium quantity inside the fluids taken after the effort during re-supplementation may be more important than during the effort. It's a good idea to add 1-2 g of sodium chloride (common cooking salt) per litre.

Check your weight before and after training sessions in order to evaluate your hydration level and to know the quantity of fluid you need to re-supplement your body with.

Sports drinks are designed to replace lost fluids and salts in the body (sweat holds small quantities of potassium, magnesium, calcium and iron). Some riders find that after four or so hours the sports drink requires dilution and carry one sports mix and one fresh water bottle. Experiment before the event to find out what suits you.

Be sure to have correct hydration during meals: fluids will be easily absorbed. Clear and copious urine indicates proper hydration.

Fuel-up before you ride:

It is best to start out fuelled by complex carbohydrates so don't skip breakfast. Porridge, and bread are good foods for the cyclist. Let breakfast digest for an hour or so before riding.

Don't eat anything heavy such as a sirloin steak within 2 to 4 hours before a big ride. If you do you will suffer difficulty in digestion as when you ride your body's blood flow is in the main diverted from your stomach to your leg muscles.

Avoid eating something sugary within an hour of so of a ride as this will create an insulin reaction that depletes your body of blood sugar, just when it needs it most.

Replenish your muscle glycogen when you ride:

Your body converts carbohydrates directly into glycogen, which is stored in your liver and muscles. Your glycogen reserves can sustain your blood sugar for about two hours of brisk riding or hills. When you deplete this glycogen you will "bonk" and be unable to maintain your pace. While riding less vigorously, this period will be extended as your body will burn fat in place of carbohydrates. The only solution to bonking is to eat carbohydrate-rich foods as you ride.

Stick with easily digestible foods; eat often during a ride and wash food down with water (this will prevent your stomach drawing water out of the rest of your body to process its contents). Avoid fats as they tax the body's digestive system, and don't consume large meals whilst cycling as more blood will go to your stomach, weakening your legs and causing indigestion.

Bananas, raisins, fruitcake, jam sandwiches, boiled potatoes, and energy bars are good cycling foods. Stay away from high-fat, high-protein energy bars. (PowerBar is excellent)
The regularity of your eating will depend upon the amount of energy that you are burning; eat regularly to avoid large swings in your blood sugar. You may need to eat a small amount as frequently as every 30 minutes.
If you do bonk, eat fruit, fruitcake, or energy bars, and drink energy drinks. Your body will process the sugars and carbohydrates into glucose that your cells can use. Try to avoid sugars, rather favour complex carbohydrates with lower glycemic indexes (GIs).

Glycemic Indexes of Common Foods

The glycemic index (GI) indicates the effect of carbohydrate on blood glucose (sugar) levels. It compares the rise in blood sugar after a certain food is ingested with the rise in blood sugar after an equivalent amount of pure glucose, with a 100% GI, is ingested.

When you eat any food with a high GI, you experience a rapid rise in blood sugar level, which causes your pancreas to secrete a greater amount of insulin. This is beneficial during recovery because high GI foods replenish glycogen more rapidly than low GI foods.

Many simple sugars, as well as breads and cereals, have high GIs. These foods replenish muscle glycogen stores rapidly because they cause an immediate rise in blood glucose, which stimulates insulin to speed glycogen synthesis and storage.

The table categorizes some common foods according to their GIs when compared with pure glucose.

High GI (<85)	**Medium GI (60 to 85)**	**Low GI (>60)**
Bagels	Baked beans	Apples
Boiled potatoes	Bananas	Applesauce
Bread, white and whole wheat	Bran cereals	Cherries
Corn syrup	Corn	Chickpeas
Cornflakes	Grape Nuts	Dates
Crackers	Grapes	Figs
Glucose	Melba toast	Fructose
Honey	Oatmeal	Ice cream
Maple syrup	Orange juice	Kidney beans
Molasses	Pasta	Lentils
Raisins	Pineapple	Milk
Rice, white	Potato chips	Peaches
Rice Chex	Rye bread, whole grain	Peanuts
Soda (sweetened with sugar)	Sucrose (white sugar)	Plums
Sport drinks (sweetened with sugar)	Watermelon	Tomato soup
	Yams	Yogurt

Eating after exercise:

Completely replenishing glycogen requires careful attention to nutritional intake in the hours following exercise. Because the body responds to nutrients in different ways after exercise, it is important to balance carbohydrate, protein, and fat in the right proportions. Note that when you eat is just as important as what you eat.

First two hours after exercise:

The type of carbohydrate you consume plays a key role in stimulating insulin response. Some foods and drinks cause a rapid rise in blood sugar level, allowing you to take better advantage of the increased period of insulin sensitivity during the first two hours after training or competition. Select your post-exercise carbohydrate according to its GI, which is an indicator of how quickly your blood sugar will rise after consumption.

If you're like most cyclists, you may find that hard training or racing suppresses your appetite. Even though you know how important it is to consume carbohydrate immediately after exercise, you may be unable to eat solid foods to replenish glycogen rapidly after a workout. Fortunately, if you find that your appetite is suppressed following activity, drinks containing carbohydrate and protein, in addition to their beneficial effects on rehydration, can help you to replenish your stores of glycogen in liver and muscle tissues.

Whether you choose solid foods or liquids, consume your post-ride meal as soon as possible after riding in order to maximize glycogen synthesis. Try to consume 1 gram of carbohydrate for every pound of body weight, and include some protein in the proper 4:1 ratio. For a 150 pound athlete, this means supplementing with roughly 150 grams of carbohydrate and about 40 grams of protein during the first two hours of post-exercise recovery. Remember to minimize fat intake because of its negative effect on gastric emptying.

Two to four hours after exercise:

Consume another meal or a recovery sports drink with the optimum recovery ratio of carbohydrate to protein two to four hours after exercise. Once again, whether the carbohydrate is in solid or liquid form does not seem to be important in terms of glycogen resynthesis.

A high to moderate carbohydrate meal will lead to a rather rapid increase in your blood sugar level, usually within an hour. The meal should be composed of 60 to 65 percent of calories from carbohydrate, 20 to 25 percent from fat, and about 15 to 20 percent from protein. This will increase available glycogen for exercise the next day. After this meal, however, you'll want to consume mostly low to moderate GI foods until your pre-exercise meal the following day.

During and after workouts, it's better to eat foods that cause a rapid rise in blood glucose and an immediate insulin response because they supply quick energy to working and recovering muscles. Other foods, such as fructose, dairy products, and some beans, have low GIs. You would probably not want to choose these foods immediately following exercise because your blood sugar level will not rise as rapidly, making the conversion of glucose to glycogen less efficient.

Remaining 18 hours:

During the remaining 18 hours after training or racing, and before your pre-ride meal, you should eat enough carbohydrate to equal a total intake of about 3 to 5 grams for every pound of body weight. In other words, a 170 pound male would want to consume between

510 and 850 grams of carbohydrate during this period. A 125 pound female, on the other hand, should consume carbohydrate totaling 375 to 625 grams. Again, the meals should include approximately 60 to 65 percent of calories from carbohydrate, 20 to 25 percent from fat, and about 15 to 20 percent from protein.

Bear in mind that fats are contained in most foods and we don't realize that we ingest probably more than sufficient for our requirements, so it is not necessary to supplement your diet with fats as a balanced diet provides adequate amounts.

Taking part in a sport such as cycling will expose the athlete to increased oxidative stress (due to free radicals). A diet rich in fruits and vegetables can be enhanced by the integration of vitamin C (250mg before and after training), and vitamin E (100 to 300 U before physical effort).

References and extracts from:
Serious Cycling (Second Edition), Edmund R. Burke, PhD
Serious Training for Serious Athletes, R H Sleamaker
Various articles by Dr Michele Ferrari
BicycleSource.com