

NUTRITION AND HYDRATION FOR CYCLISTS

Nutrition and hydration is a really important aspect of cycling that many people either neglect or are unsure about what is required.

Correct nutrition and hydration is key to good performance, particularly for endurance cycling events of over 2 hours.

The bodies energy sources

Glycogen

The body stores the predominant endurance energy source, known as glycogen, in the muscles and liver. The volume of the store varies between individuals but is generally equivalent to around 1500 to 2000 calories. This is roughly sufficient for around 1.5 to 2.5 hours of moderate pace cycling. Depending on the level of fitness, glycogen stores can be increased or placed where they are more easily available, by training but also by correct diet and eating habits.

Glycogen can be used for supplying energy at quite high rates, possibly up to 1000 calories per hour.

There is a finite amount of glycogen that the body can store and this can only be fully replaced over a period of several days. Glycogen stores cannot be refilled during cycling

Fat

Fat in particular can be a very important source of energy during endurance exercise. Gram for gram it contains over twice as many calories as glycogen but it can only be metabolised at a much slower rate, typically around 150 to 300 calories per hour. There are usually sufficient fat reserves in the body to supply energy for several days of cycling. A typical cyclist could have over 100,000 calories of fat reserves.

The rate at which fat can be broken down, known as lipolysis, and used as fuel depends on the nature of the training undertaken. There has long been talk of the fat burning zone and this is usually accepted to be exercise at around 60 to 75% of maximum heart rate. However, the burning of fat may only become most effective if glycogen stores are not replenished during exercise. In other words, if carbohydrate drinks or other foods are being used during exercise, in sufficient quantities, along with the bodies glycogen stores, to fuel the exercise, fat burning requirements will be low. Therefore, training should take place within the correct heart rate zone, either with low glycogen stores or without additional fuel sources. In this way and over time the body can be 'programmed' to burn fat.

This has the added benefit during events of preserving glycogen stores, which can be particularly important for endurance rides over 2 hours. The adaptation to fat burning can also lead to fat reserves being redistributed around the body, typically within working muscles, where it is more readily available.

Protein

This is the building material for bones and muscles. It is usually used as an energy source during the late stages of long or strenuous rides. It can fuel up to 10% of energy requirement but can lead to short term muscle wastage.

Training to be energy efficient

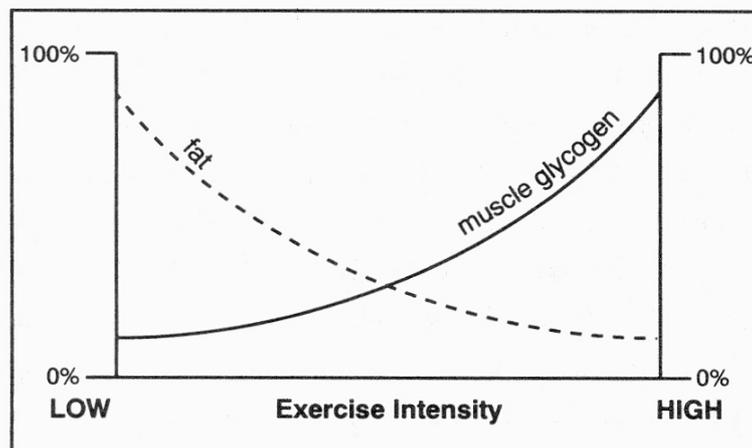
The correct training makes the body more efficient in its energy use. As mentioned above the body can be 'programmed' to use proportionately more fat as a fuel and therefore preserve glycogen stores, by working in the fat burning zone, training at times of the day when glycogen levels are low or without providing energy drinks/food during rides up to 3 or 4 hours. This form of training can take many months and should be done gradually.

The correct race strategy can also make a difference to energy efficiency. Racing up hills or riding at high intensity will burn more glycogen and less fat, so glycogen stores will be depleted quicker. Try and keep in the 60 to 75% heart rate zone where the fat/glycogen mix will be more efficient.

Energy usage during exercise

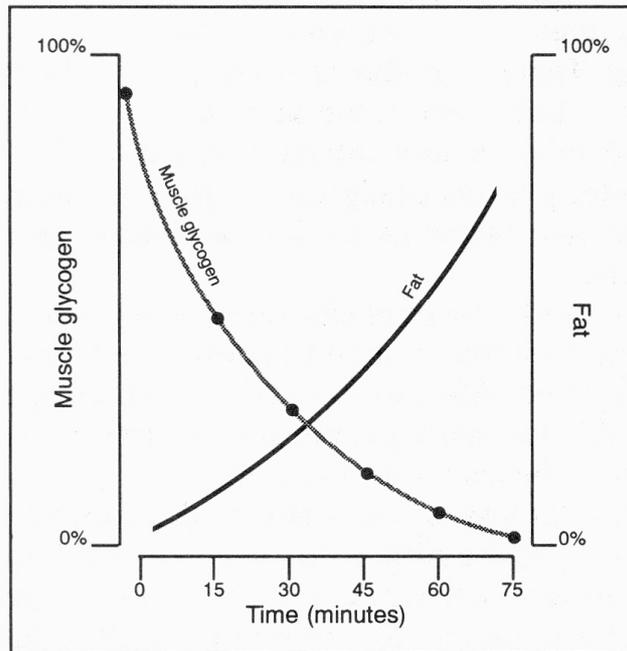
This depends on the duration and intensity, the individuals fitness level, diet and nutritional status.

Figure 1: Fuel mixture and exercise intensity



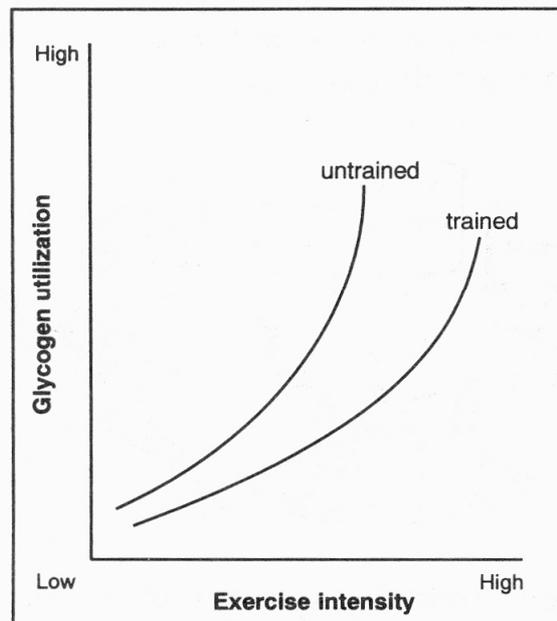
This graph shows that a higher proportion of fat is burned at lower intensity exercise and proportionately more glycogen at higher intensities.

Figure 2: Fuel mixture and exercise duration



This graph shows that as you continue to exercise aerobically you use proportionately more fat and less carbohydrate as the body makes every effort to conserve glycogen. However, fat cannot be used as a fuel on its own. It needs glycogen to be available as well.

Figure 3: Trained people use less glycogen and more fat



This graph shows that, with training, less glycogen is required to fuel exercise at the same intensity.

Energy values

For the various energy sources, 1g provides:-

- Carbohydrate – 4 calories
- Fat – 9 calories
- Protein – 4 calories

Fat is the most concentrated form of energy, but it is not necessarily the best because it cannot be metabolised fast enough in the body to provide energy at a rate required during cycling.

Fuelling during exercise

While the body can burn glycogen at a high rate, there is a limit to the amount of carbohydrate that the body can absorb during exercise, through energy drinks and food. Typically this is around 250 calories per hour. So if you are burning calories at 700 an hour, on a moderate paced cycle ride for example, your glycogen stores could be depleted by around 450 calories per hour. Eating and drinking the maximum amount of carbohydrates during a ride can extend the time that you can ride by around 2 hours. However, by training the body to burn fat more efficiently, the depletion of glycogen stores will take place at a much slower rate, meaning that you could continue to ride for even longer.

There have been a number of recent advances in energy drink formulation, which has led to greater carbohydrate absorption capacity. New energy drinks typically contain fructose for rapid absorption and there are some drinks that state that they can provide over 300 calories per hour.

It should be noted that taking a maximum concentration energy drink and energy gels at the same time may not provide extra energy, as the carbs in the gels require dilution before they can be absorbed into the body. Ideally you would use either a low concentration energy drink or water with gels. Excess carbohydrate ingested, over and above the body's ability to absorb it, is usually expelled and can cause short term gastric problems.

Protein is now being added to some energy drinks to reduce muscle damage during endurance rides and to speed recovery.

Energy value of different foods

Calorie guides can be found on-line or in many publications.

It's important to try and use foods which have the highest proportion of calories contained as carbohydrates because fat and protein can be difficult to absorb during cycling.

Low glycaemic index foods are best. These release sugar into the blood stream at a slower rate which ensures that insulin levels are kept steady. High glycaemic foods

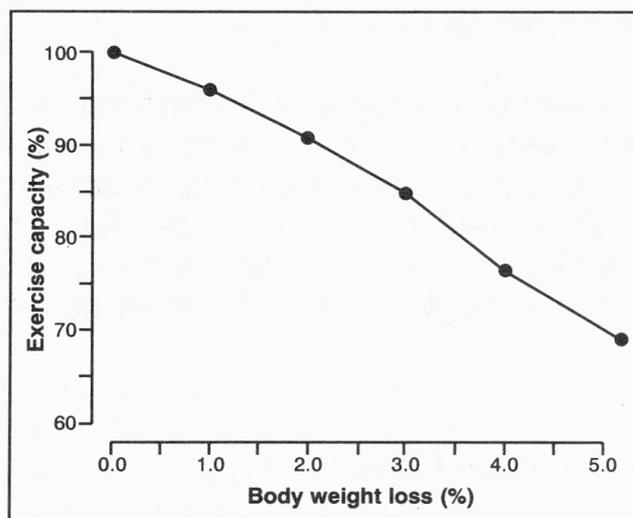
(chocolate etc) can cause insulin spikes to occur which can be problematic to some people.

Glycaemic index is a measure of the speed of carbohydrate absorption and resulting rise in blood sugar.

Hydration

The body requires hydration during exercise, even on cold days or in wet weather.

Figure 1: Fluid loss reduces exercise capacity



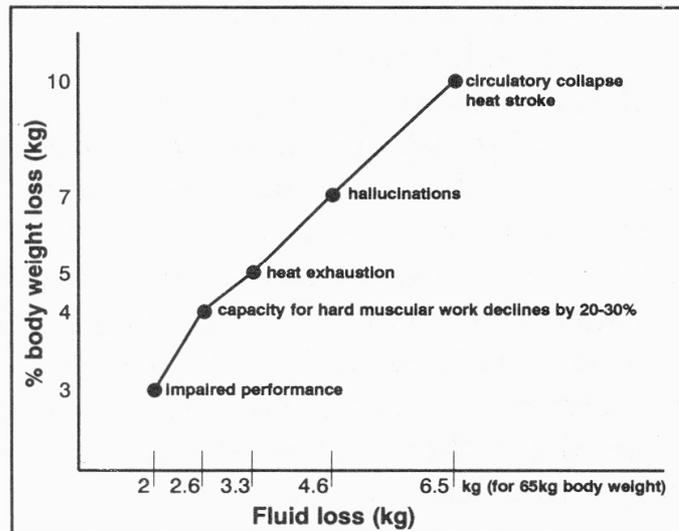
The graph above shows that a drop of just 2% in body water content, equivalent to around 1.5 litres for someone weighing 75kg, can lead to a significant reduction in performance, by around 10%. At 5% loss there is a 30% drop in performance. Above 8% there can be serious health problems.

Dangers of dehydration

Dehydration leads to impaired performance because it places a strain on the circulatory system due to thickening of the blood. This means the heart and lungs have to work harder to supply the necessary oxygen and nutrients to the muscles.

With increased dehydration the bodies ability to sweat is also reduced so body temperature rises, making the situation rapidly worse.

Figure 2: The dangers of dehydration



This graph shows the possible effects of dehydration.

Fluid intake for exercise

You should ensure that you are fully hydrated before you start endurance events. This means making sure you get enough fluid during the 3 or 4 days leading up to an event and staying away from diuretics such as alcohol etc.

During the ride start drinking within first 30 minutes, drink regularly, say every 15 minutes or every 10 minutes if it's a hot day. Do this in training so it becomes a habit. Sip don't gulp.

Ensure that you drink enough for the conditions. On a hot day you will need more but also don't underestimate the amount you need on cold or wet days.

Refuelling after exercise

Its really important to refuel quickly after a ride. Don't be tempted to skip food after a ride because you want to loose weight. Proper training needs a proper diet. Without refuelling of your glycogen stores your ability to train on successive days will be reduced and you may never progress to the level that you require for the event.

After training the length of time it takes to refuel depends on:-

- How depleted glycogen stores are after exercise (training length/intensity)
- The amount and timing of refuelling
- Level of training/fitness

Glycogen stores are replenished by carbohydrates ingested from food. There is an optimum window of opportunity for glycogen replenishment which is typically within 30 minutes of exercise. After this time slot glycogen is replenished at a slower rate.

Protein has been recommended for a number of years as a post exercise drink to speed recovery but it can be problematic to some (the 'Rego' effect is a well known phenomena of chocolate scented flatulence).

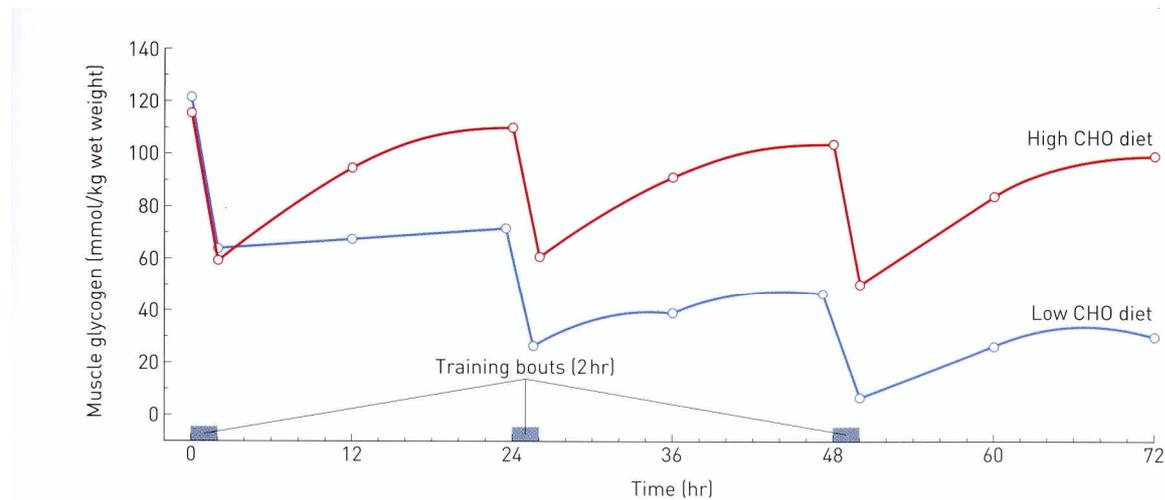


Figure 12.2 The impact of high and low carbohydrate diets on muscle glycogen levels during repeated days exercise. Costill & Miller 1980, IJSM

This graph shows that progressive glycogen depletion can occur during periods of daily training, but the effect can be offset by refuelling with a high carbs diet. Note that there is a slight drop in glycogen levels over time, even with a high carb diet.

Carbo loading

Glycogen stores can take 4 or 5 days to be fully replenished after exercise and this is important when considering race preparation. You want to start an important ride with full glycogen stores, so make sure you eat a high carb diet in the 4 or 5 days before the event. This is known as carbo loading and has been used by athletes for many years. Aim to eat around 1 gram per kilo body weight per day. Energy drinks can be used to supplement carbohydrate foods during this period.

You can stimulate your body to increase carbohydrate stores by doing some short sprint intervals, just enough to get a lactic build up in the muscles. This fits in well with the type of training that is usually done during a taper period before a key event, when long slow rides are reduced but shorter, fairly intense sessions are carried out.

Calculating food and drink requirements for cycling

The first thing to consider is, before any important ride, make sure you arrive on the line well hydrated and with full glycogen stores.

Start eating and drinking early in the ride, say within first 30 minutes. Often you can have a sandwich and an energy drink in the half hour before a ride starts, but this

depends on the likely intensity of the ride. If it's going to be hard from the start, eating so close to the start may not be such a good idea, but drinking would be OK.

The absorption of carbohydrates requires water, so if you are using gels as well as carbohydrate drinks you may risk overloading with carbohydrate which can cause stomach problems. Using a low concentration energy drinks can be useful, especially on a hot day when you need to ensure the hydration aspects are OK without overloading the body with carbs.

Decide in advance how you will supply your food requirements. Sometimes relying on feed stations can be a bit of a lottery. Don't rely on energy drinks, gels or food that you have not tested in training. Energy powders can be measured out in a bag or bought as sachets and just mixed with water at a feed stop. Several gels can be decanted into small gel flasks and mixed with a little water to make it easier to drink.

Here are a selection of my favourite ride foods, together with their calorific values. I've also included the riding time that the energy supplied by these foods will give you, assuming that you would be burning just glycogen at a rate of say 700 calories per hour. Obviously if body fat is also being burned the times will be longer.

- 500ml energy drink – 180 calories (15 minutes)
- Energy gel – 90 calories (8 minutes)
- Energy bar – 150 calories (14 minutes)
- Banana – 150 calories (14 minutes)
- Jam sandwich (2 rounds) – 300 calories (25 minutes)
- Fig roll – 50 calories (5 minutes)
- Fruit cake (slice) – 200 calories (16 minutes)
- Jelly babies – (100 grams) 300 calories (25 minutes)

I usually work out what my energy usage will be and what I need with me to get through to the end of the ride. Don't forget that some of the above foods contain calories that are contained as fat and may not be used as fuel during the ride.

Calculation of food/drink for 6hr ride

Total calories expended during ride = 4200 (700/hour)

Glycogen store in body = 1800

Fat store in body (assume 20% of total) = 840

Deficit = 1560

Energy drinks (3 litres at 500ml/hr) = 1080

Banana = 150

Energy bar = 150

Figure rolls (4) = 200

Total intake = 1580

Using a strategy like this I've managed to get through some long rides where I've burned up to 10,000 calories over a 12 hour ride. You need to work out a strategy that works for you. Get it right in training so that you can be confident that it will work on the big day.