

CHALLENGE FAMILY NUTRITION GUIDE

by Professor Asker Jeukendrup



**CHALLENGE
FAMILY**





NUTRITION: THE FOURTH DISCIPLINE

Nutrition affects most aspects of our training and racing. It is without doubt one of the most important aspects of race preparation. Yet, athletes typically spend far more time thinking about training than about nutrition. Hours and hours are spent in the pool, on the bike, and on the trails. Far less time is spent on careful nutrition planning.

Nutrition is sometimes called the fourth discipline, and rightly so. Nutrition can be the fine line between winning and not even finishing a

race. Athletes will often discuss nutrition-related issues when they have not performed their best: "I ran out of energy on the bike", "my stomach was churning for the last 2km", or "I tried a new gel I hadn't used in training".

Although nutrition is often considered complex, it is in fact simple if we stick to the science and make evidence-based decisions. This guide will give you the background information and guide you to a successful nutrition strategy.

RACE AND TRAINING ARE NOT THE SAME?

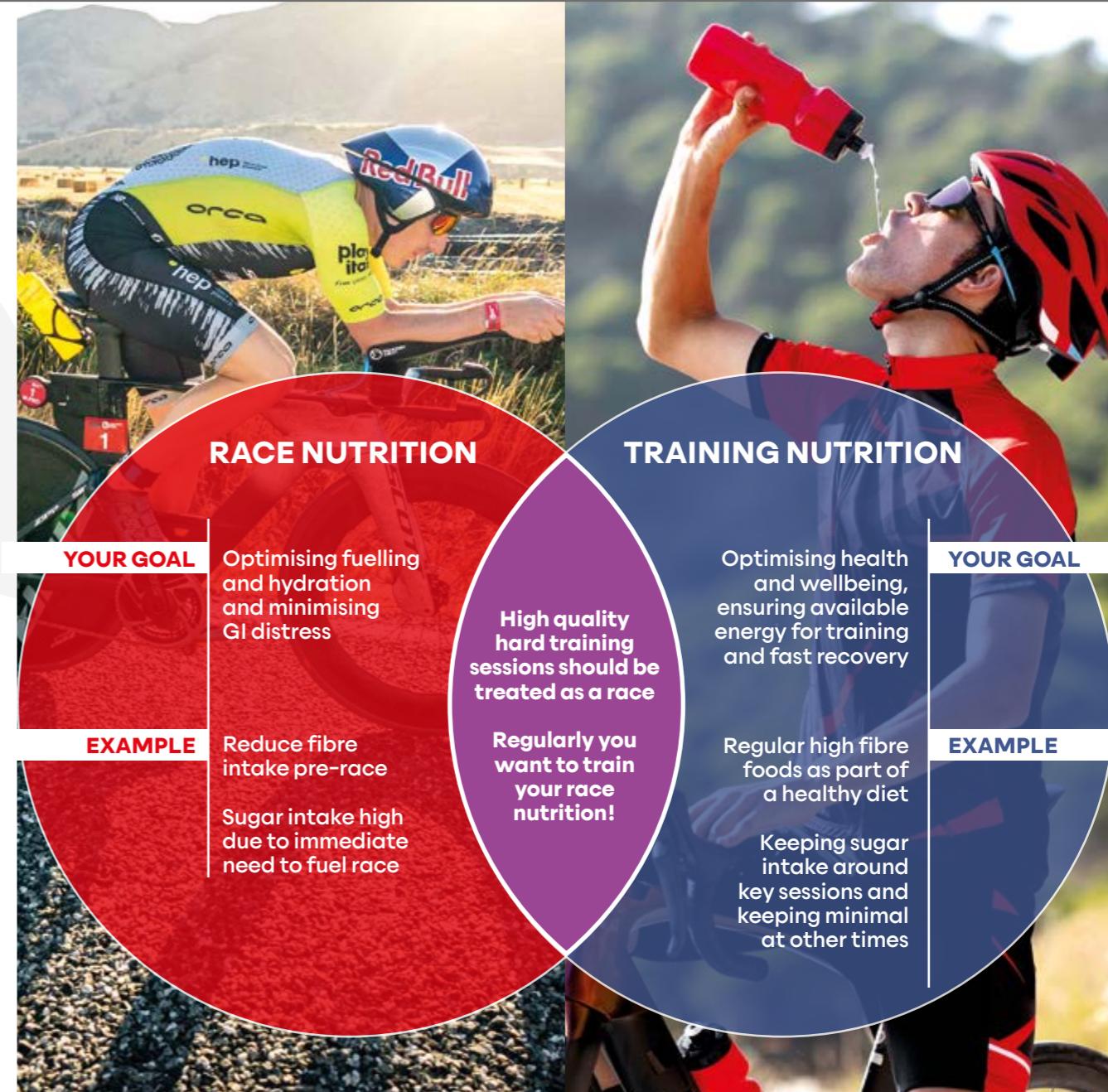
First, it is important to distinguish the goals of race nutrition and training nutrition. Race nutrition is all about performance – how can we go faster on race day? Training nutrition may not always be about performance; it is about promoting training adaptations, health, and supporting specific training goals. This means that nutrition recommendations may be different around race and during training days.

For example, athletes who often experience gastro-intestinal (stomach) problems are advised to reduce fibre intake in close proximity to a race. In contrast, during periods of training, athletes are advised to have a high fibre intake as this will promote good gut function and overall health.

We will discuss RACE NUTRITION first, followed by TRAINING NUTRITION.



RACING AND TRAINING REQUIRE DIFFERENT NUTRITION





RACE NUTRITION

What is important when considering race nutrition?

MAIN NUTRITION CONSIDERATIONS FOR RACING

1 RUNNING OUT OF FUEL

We have all experienced this sensation in training or racing. Suddenly the power in our legs disappears. We may feel dizzy and even nauseous. Although we may still be able to finish, we have to go much slower. When this happens, it is often related to running out of fuel.

2 DEHYDRATION

The faster we run and the more power we produce on the bike, the more heat is produced. To account for this heat, production, we sweat in order to stay cool. In hot conditions, sweating may be the only way we can cool down our bodies. However, when we lose too much sweat and become dehydrated it becomes harder to maintain body temperature. Some degree of dehydration is unlikely to be a problem but losing $\geq 3\%$ of your body weight, your performance may be affected.



3 GI-PROBLEMS

The third reason why athletes struggle during races (or training) is that their gut starts to play up. Apart from the discomfort, which can range from mild to extreme, it becomes difficult to eat and drink and that can affect performance later in the race.

BACK TO BASICS

FUELS

The body uses two main fuels: carbohydrates and fat. Even the leanest athlete has sufficient fat to sustain the longest races, but carbohydrate reserves are limited. Yet, carbohydrates is the most important fuel as it is necessary for higher intensity exercise: it is the performance fuel. Carbohydrates can deliver energy faster to the muscles than fats.



Carbohydrates is the performance fuel

Unfortunately, carbohydrate stores can normally support only 2-3 hours of exercise (dependent on the intensity). Carbohydrates is stored in the body as glycogen in the muscle and in liver. In the muscle we have roughly 500-800 grams and it is possible to run out of carbohydrates in less than 2 hours. Running out of fuel is often called "bonking" or referred to as "hitting the wall".



Carbohydrates stores are small and therefore need to be topped up

HITTING THE WALL

Many athletes have experienced hitting the wall or bonking. Suddenly all energy seems to flow away, accompanied by dizziness, sometimes nausea and it becomes impossible to maintain a good pace. Marathon runners refer to this as hitting the wall and typically occurs around the 32km (20 mile) mark during the marathon. The reason this happens

is that the body has run out of carbohydrates and has to continue with fats as the main fuel. There are a few simple strategies that can delay, or completely prevent this from happening. First ensuring you start the race with optimal glycogen stores and secondly topping up during the race (using drinks, gels and/or solid foods).

FUELS OF AN ATHLETE

PREVENTING RUNNING OUT OF ENERGY:



MAKE SURE MUSCLE GLYCOGEN STORES ARE FULL:
carb loading



LIVER GLYCOGEN STORES FULL:
breakfast

Lower Intensity Fuel Store:
We don't need to worry about the „FAT“ Tank. This will not be limiting.



CARBO-LOADING

In order to start a race with optimal glycogen stores it is important to eat carbohydrate-rich foods the day or days before the race. Usually, training is much reduced the days before the race, and carbohydrates intake should be increased. Traditionally this has been called carbo-loading. You are essentially filling up

your muscle glycogen stores. Below are some examples of good carbohydrate sources before race day. Although it is important to have a relatively high carbohydrates intake, it is also important that you realize that carbo-loading is not the same as overeating!

GOOD CARBOHYDRATE SOURCES FOR RACE DAY

COOKED FRUITS, APPLE SAUCE/FRUIT BLENDS

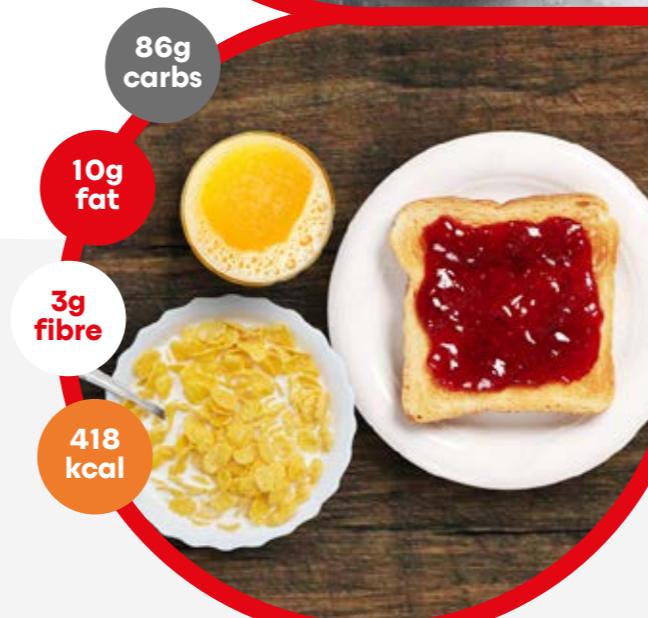
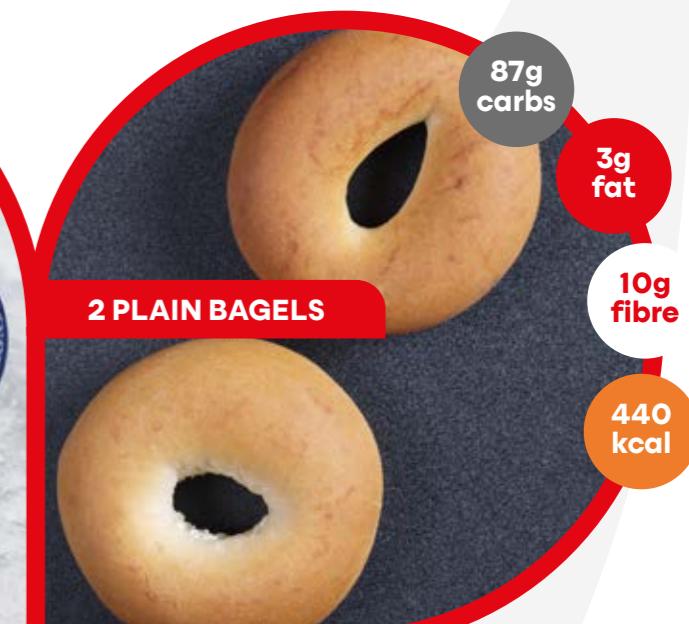
SYRUP**RIPE BANANAS****HONEY****COOKED CEREALS****RICE CAKES****LEAN MEAT****PANCAKES****PULP-FREE JUICE****COOKED POTATOES****REFINED GRAINS (white rice)****COOKED VEGGIES (no seeds)****CORN/RICE BASED CEREALS****WHITE BREAD, BAGELS (no seeded breads)**

BREAKFAST

When you wake up in the morning your liver glycogen is low. Your body uses liver glycogen overnight, so it is essential to make sure you replenish liver glycogen stores. During your race the liver will provide carbohydrates to maintain your blood sugar and prevent hypoglycemia (low blood sugar, resulting in dizziness, weakness etc). This is where breakfast comes in. You can optimize liver glycogen stores by ingesting 100-200 grams of carbo-

hydrates in the 3-4 hours before the start of your race (though practice this in training before you race). Some athletes find it difficult to eat before a race and they could benefit from obtaining carbohydrates from drinks. Selecting carbohydrate-rich foods that are low in fibre, fat, and protein can reduce stomach problems. This is especially important for athletes who frequently experience stomach discomfort during a race.

BREAKFAST OPTIONS





NUTRITION JUST BEFORE THE RACE

You can continue to top up your liver glycogen stores in the hour before you start. Most of the carbohydrates you ingest here will become available to the muscle during the swim. So, anything that is ingested shortly before the start is part of your nutrition during exercise because it takes time for it to be digested and absorbed. What you pick as your chosen fuel depends on personal preferences as well as the overall nutrition plan.

It is often recommended to take something in the last 10 min before the start. Again, athletes prone to stomach discomfort should opt for easily digested carbohydrate sources. For example, a gel containing 25-30 grams of carbohydrates. Many athletes do not have as much as 100-200g carbs for breakfast pre-race. Pre-race breakfast needs to be practiced in training.

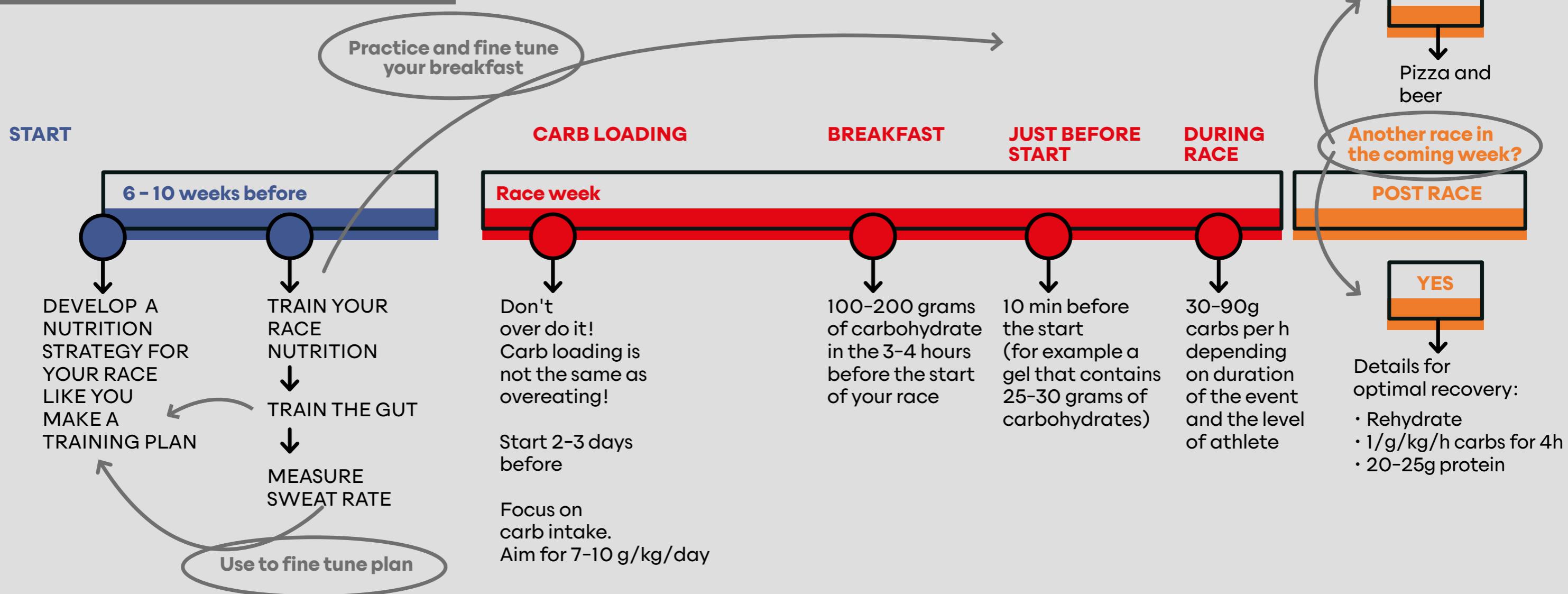
HOW TO DEVELOP YOUR OWN RACE NUTRITION PLAN

Race nutrition requires a bit of planning. During longer races your target carbohydrates intake should be higher than shorter races. In races over 2 hours you can benefit from consuming roughly 60 grams of carbohydrates per hour. In events longer than three hours it is worth considering even higher intake. However, this effect can only be achieved if you use specific carbohydrate blends (for example, glucose + fructose). It is beyond the scope of this guide to discuss this in more detail but you can find more information on www.mysportscience.com.

It is important to study what is available on course and develop a plan that takes into account foods and drinks you will collect on course and foods and drinks you will have to bring yourself.

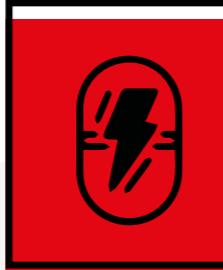
There are many factors that influence exact fluid and carbohydrates needs. Use **CORE**  (fuelthecore.com) to get some science-based help with your personalised fuelling plan! This software platform will ask you for some essential information to personalise your nutrition plan and will then give you a detailed plan for your race (or training).

NUTRITION STARTS WEEKS BEFORE THE EVENT!





DRINKS, GELS OR BARS?

Sport Drink	High Carb Drink	Gel	Chews	Bars
				
<ul style="list-style-type: none"> 6-7% carbohydrate. This means that the drink contains 60-70 grams of carbohydrates per liter of fluid. A regular sports bottle of 600ml (20 oz.) will therefore deliver roughly 35 grams of carbohydrates This drink is especially advised in hot conditions 	<ul style="list-style-type: none"> 8-15% carbohydrate. This means that the drink contains 80-150 grams of carbohydrates per liter of fluid. A regular sports bottle of 600ml (20 oz.) will therefore deliver roughly 50-90 grams of carbohydrate. If these drinks contain caffeine they are typically referred to as energy drinks. This is a really good solution for cooler conditions or when it is more difficult to carry other carbohydrates sources such as gels and bars 	<ul style="list-style-type: none"> A concentrated source of carbohydrate containing anything between 16-40 g per gel Gels can be compact and thicker consistency or more liquid and larger in volume Gels are easy to carry, convenient, quick source of carbohydrates that have high value in small volume. Always take with water. 	<ul style="list-style-type: none"> Chews provide between 3-5g per chew. Although each chew has good carbohydrates amount, you would need to consume (chew!) 5-10 to get 30g carbohydrates. They are good choice if you like something to chew on and something in your stomach They are harder to take if working at higher intensities. 	<ul style="list-style-type: none"> There is a large variety of bars to choose from It is important to be aware of its nutritional composition. Any consumption of fat, fibre or protein will slow the absorption of carbohydrates down Bars are good for longer, lower intensity events and to get a more settled feeling in the stomach. Again chewing can be hard if fatigued or working at high intensity

BARS

Solid foods usually provide more carbohydrates per unit of weight and are therefore a very effective energy source to carry. It is recommended to select energy bars that are low in fat, fibre and protein as these ingredients will slow down gastric emptying and may contribute to stomach problems. Solid food is great

in preventing an empty feeling in the stomach that many athletes experience during later stages of a race. It comes down to personal preference whether you want to chew food during a race or not. Some athletes struggle to chew food during a race and prefer to get their carbohydrates from gels or drinks.

GELS

Gels are a compact form energy. A small volume of fluid with a relatively large amount of carbohydrates. Gels typically deliver 20-25 grams of carbohydrates and come in many different flavours. Gels may be caffeinated

or non-caffeinated. It is important to realize that gels need to be ingested with sufficient water to make sure gastric emptying is fast and no stomach problems develop.

CARBOHYDRATE DRINKS

Carbohydrate drinks typically contain carbohydrates in concentrations of 6-7%. This means that the drink contains 60-70 grams of carbohydrates per liter of fluid. A regular sports bottle of 600ml (20 oz.) will therefore

deliver roughly 35 grams of carbohydrates. A sports drink also contains some sodium (and other electrolytes) which can be beneficial for the absorption of fluid (as we will see under hydration).

WHAT DRINKS, GELS AND BARS TO CHOOSE...

This depends on factors like practicalities, preferences and tolerance. If you want to make use of the nutrition offered by race organizers, it is usually recommended to also

train with that brand. If you are planning to take in more than 60 grams of carbohydrates per hour, check that the ratio of glucose:fructose is 2:1 or similar.





CAFFEINE

Many athletes use caffeine before or during a race to boost their performance. Although there may be individual differences in tolerance and perception, using caffeine to enhance performance is indeed supported by scientific evidence. Studies have demonstrated that relatively small amounts of caffeine are required to give optimal effects. For example, concentration and alertness have been shown to improve with doses as small as 75mg of caffeine, while consuming 3mg of caffeine per kilogramme body weight has been found to improve endurance performance.



ENERGY DRINKS

Energy drinks can be found on the course of many races. Although not specifically designed for rapid absorption and fluid delivery like sports drinks, energy drinks typically deliver two main components: carbohydrates and caffeine. Athletes who are intending to use caffeine can use energy drinks as an alternative source. The carbohydrate concentration in energy drinks is usually higher than in sports

drinks and therefore the advice is the same as with gels, drink sufficient water with it. One watchout is that energy drinks are usually carbonated and this in turn can cause some gastro-intestinal discomfort for those sensitive to carbonation. Therefore, it is recommended to practice the use of any drinks used on course in training to make sure they can be tolerated well on race days.





HOW TO DEVELOP A PERSONALIZED HYDRATION STRATEGY

THE BEST DRINKING PLAN FOR OPTIMAL HYDRATION

1

$$\text{Volume consumed (L)} = \frac{\text{Weight of bottle(s) before} - \text{Weight of bottle(s) after}}{1000}$$

2

$$\text{Weight loss} = \text{Weight before (kg)} - \text{Weight after (kg)}$$

3

$$\text{Sweat rate (Liters per hour)} = \frac{\text{Weight loss}}{1000} \times 60$$

STEP 1:

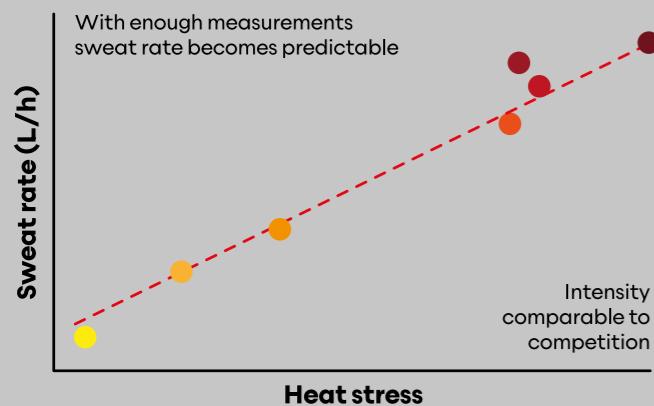
You need to know how much you sweat

This depends on INTENSITY < TEMPERATURE < HUMIDITY CLOTHING

Mimic racing in training and regularly measure body weight before and after training (correcting for fluid and food intake and urinating as accurately as possible)

STEP 2:

With these calculations done for running and cycling in a number of different conditions < estimate your sweat loss on race day. Your best guess will be much better than no guess...



STEP 3:

Determine how much weight loss is acceptable at the finish line. A fluid loss of 2% is no problem (or even 3% in cooler conditions)

For long distance events add 1kg, for half distance 0.5 kg (this is weight loss from fuels)

STEP 4:

Calculate your fluid losses: Expected finish time x expected sweat rate. Subtract acceptable weight loss. This is the volume you need to consume. Divide by finish time to get hourly intake.

STEP 5:

Make a plan for the practical execution. When do you have access to what fluid? How much carbohydrates do you need?



Drink enough but not too much

In order to prevent dehydration it is important to start a race hydrated. Drink at least 500ml the 2 hours before the race, excess water will be eliminated through urine. Double check your urine color is pale. To prevent dehydration during a race, drink at rates similar to your sweat rate. You can easily work out your sweat rate: measure yourself before and after training. Record body weight and correct it

for the amount of fluid consumed (see graphic: How to develop a personalized hydration strategy). If you do this regularly and in different conditions (hot and cold weather conditions), you will get a good idea of your sweat rate. Your target for fluid intake should help you to lose no more than 3% body weight. Drinking to thirst can in some cases achieve this goal as well.

More is not always better

It is even more important not to drink too much. Apart from the negative effects of increased body weight, there is also the potential to dilute your body sodium and develop hyponatremia (low blood sodium). Hyponatremia is a potentially dangerous condition

with early symptoms that are very similar to those of dehydration. Having knowledge of your weight loss in training and in different conditions will help you to keep your body weight relatively stable, prevent weight gain and serious dehydration.

Improving fluid delivery

Fluid delivery can be accelerated by adding some carbohydrates to water. Fluid delivery will be impaired if highly concentrated carbohydrate solutions are used. Therefore, if you are using gels, make sure to drink enough water to avoid highly concentrated stomach contents. The same is true for solid foods, such as energy bars.



Electrolytes

There is a lot of hype about electrolytes. There is no doubt that electrolytes play an important role during exercise. But this doesn't necessarily mean that we need to consume a large amount of electrolytes during exercise. Athletes popping salt tablets has become very common but there is no research to support this practice. All is explained in a series of blogs on **mysportscience.com**. Whether you need to pay attention to salt intake depends mainly on three things:

- 1) Exercise longer than four hours (less than four hours you don't need to worry)
- 2) High sweat sodium concentration (your sweat has more than average sodium amounts)
- 3) Your drink plan involves drinking more than 70% of your fluid losses (especially for those sweating a lot this is often not possible). For example: if you sweat 2 L/h, it is unlikely that you could drink more than 1.4L/h!)



HOW TO MINIMISE STOMACH ISSUES

Seven steps towards preventing gastro-intestinal problems during exercise

MANY ATHLETES DEVELOP GI ISSUES

30-90%

GI

- STUDIES SHOW THAT 30-90% OF ATHLETES DEVELOP SOME SORT OF GI ISSUES
- NOT ALL ISSUES ARE SERIOUS AND AFFECT PERFORMANCE
- MOST ISSUES CAN BE PREVENTED

WHAT

Upper GI symptoms

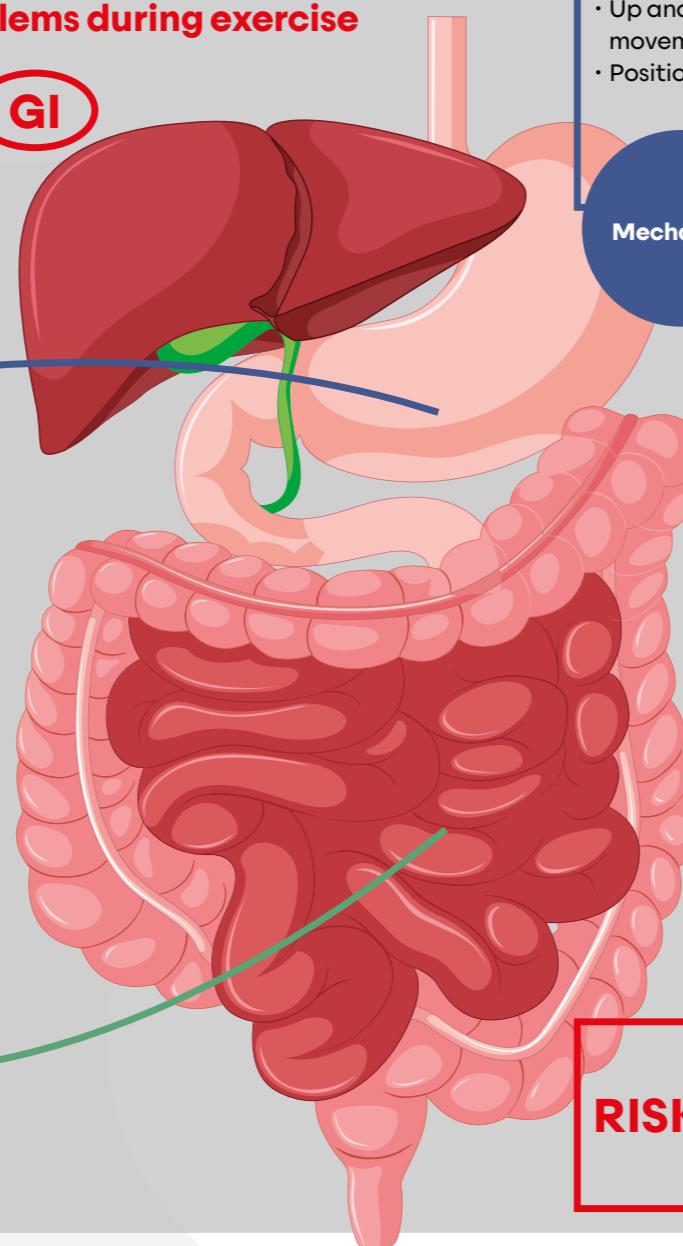
- Belching
- Heartburn
- Bloating
- Stomach cramps
- Urge to vomit
- Vomiting

Lower GI symptoms

- Flatulence
- Urge to defecate
- Intestinal cramps
- Loose stool
- Diarrhea
- Bleeding

Other

- Nausea
- Dizziness
- Stitch?



WHY

- Up and down movements in running
- Position on bike

- Reduce blood flow to intestine
- Stress hormones

Mechanical

Physiological

CAUSES OF GI ISSUES

Nutritional

- High fat
- High fiber
- High protein
- Concentrated carbohydrate solutions
- Large volumes

RISK FACTORS

- Heat
- Dehydration
- Female athlete
- Previous GI problems
- Longer races

HOW DO I MINIMISE THE RISK OF GETTING STOMACH PROBLEMS?

- Make training with carbohydrate part of your routine (at least once a week)
- Avoid milk products day before
- Avoid fibre rich food days before
- Avoid aspirin and non-steroidal anti-inflammatory drugs (NSAIDs) such as ibuprofen
- Train your race nutrition
- Avoid high fat and high protein foods day before
- Avoid dehydration

Gastro-Intestinal Problems

One of the common problems in long distance events is the occurrence of gastro-intestinal problems. Such problems include mild symptoms like gas and burping which are not serious and unlikely to affect performance. Other symptoms like heartburn, diarrhoea and bloody stools, nausea and vomiting and uncomfortable bloating are more serious and can have a major effect on performance and even health. Certain individuals are more prone to develop such symptoms than others

and this is likely dependent on genetics, biomechanics, anatomy, age, diet and/or health. The exact symptoms are highly individual and often circumstantial. Hot weather, nerves, race intensity, duration, dehydration and poor nutrition can exacerbate the issues. Although in some cases it is difficult to completely prevent some of these symptoms, there are several nutritional measures that can be used to minimize the risk. Some of these have already been mentioned: reducing fibre, fat and pro-

tein intake before and during the race, avoiding highly concentrated stomach contents (drinking with gels), practicing pre and during race nutrition, managing fluid intake and so on. It is important to note that when bloating occurs and fluids seem to accumulate in the stomach, there is no point ingesting more fluids. It is important to manage the situation by reducing the intensity a little and giving the stomach some time to pass fluid on to the intestine for absorption. One key method to

reduce stomach problems during a race, is to practice your race nutrition strategy for 6-10 weeks leading up to the event. Either choose your own specific nutrition brand that suits you, or train with products that will be on course. The more you train with carbs, the more you can train your gut to absorb and utilize them....don't be carb-phobic (individuals who avoid carbs seem to develop gastro-intestinal problems more frequently and symptoms are more severe).



TRAINING NUTRITION



TRAIN HIGH AND TRAIN LOW

Some days it is good to train high (train your race nutrition), other days you may want to experiment with training low (this term is used to refer to training with low carbohydrate availability). Making sure that your body can also perform with fat as a fuel. Training sessions that athletes often include are training without breakfast (training with low liver glycogen) or training twice a day with little carbohydrates intake in between (training with

low muscle glycogen). There is evidence that such strategies will enhance the ability to use fat as a fuel. However, it must also be noted that more recovery time is needed; training is harder, and you will be more likely to develop symptoms of overtraining and compromise immune function if done too often. Therefore, these training strategies may not be appropriate for everyone.

GENERAL DIET

Although on some days there should be a focus on training low, other days there should be focus on training high. In general carbohydrates should be a major component of the diet as it supports recovery and the higher intensity part of training. The exact amount of carbo-

hydrates you need to take in depends on the training. If the training uses more muscle and liver glycogen, your carbohydrates intake should increase accordingly. The following table should give an idea of how much carbohydrates should be ingested on a daily basis.

DAILY NEEDS FOR FUEL AND RECOVERY FOR ATHLETES

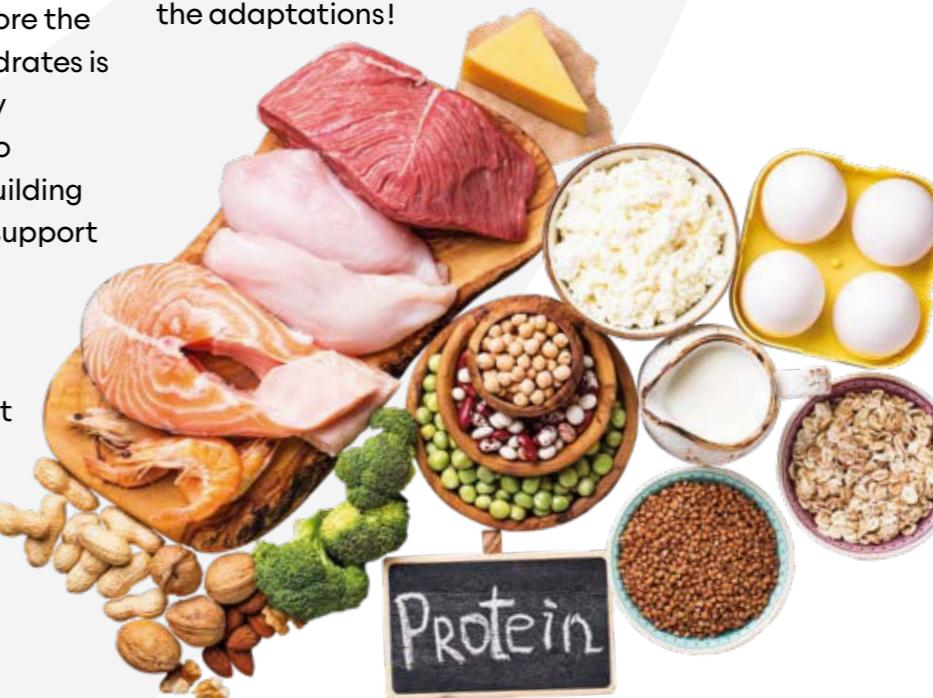
ACTIVITY		Daily carbohydrate intake target
Light	low intensity or skill-based activities	3-5 g/kg/day
Moderate	Moderate exercise program (eg 1h per day)	5-7 g/kg/day
High	Endurance program 1-3h a day moderate-high intensity	6-10 g/kg/day
Very high	Extreme commitment 4-5h a day moderate-high intensity	8-12 g/kg/day

Nutrition and Athletic Performance – Joint Position Statement American College of Sports Medicine, Academy of Nutrition and Dietetics and Dietitians of Canada. MSSE 2016

RECOVERY

Recovery is an extremely important part of the training process. In fact, this is the period in which the body adapts and improves. Training is just the stimulus to start this process. Nutrition plays an important role here too. If we need to recover quickly before the next training session or race, carbohydrates is the most important ingredient, closely followed by water. If we are looking to improve over time and increase the building of new proteins (protein synthesis to support new and improved muscle), protein is the most important ingredient.

Proteins are essential for repair and adaptation. High quality proteins that contain all the amino acids (the building blocks to make proteins) are best at increasing the synthesis of proteins.





TRAINING YOUR RACE NUTRITION (OR TRAINING THE GUT)

Start to train your nutrition at least six weeks before the race (but ideally even longer [10 weeks]). Choose at least one day a week where the goal of the training is to practice your race nutrition strategy. If your plan is to take on 60 grams of carbohydrates per hour in the race, try to go a little higher in training.

It is ok, if it feels a little uncomfortable in training, your gut can adapt, and you will benefit on race day. When you are training with your race nutrition, or you are training to adapt the intestine to absorb more carbohydrates we refer to this as training high.

HOW TO TRAIN THE GUT FOR RACE DAY?

TRAINING YOUR RACE NUTRITION



1 Race nutrition plan Example 90g/h



2

Find out if you can achieve your race nutrition goal of 90 g/h

3

Pick one day a week that somewhat resembles race day (longest training usually) and practice your race nutrition plan. Evaluate and adjust week after if needed. Build up to race nutrition target or even higher

SUMMARY:

SO THE MOST COMMON NUTRITION ISSUES IN TRIATHLONS ARE:

1. Running out of energy
2. Becoming dehydrated
3. Gastro-intestinal problems

ALL OF THESE ISSUES CAN BE AVOIDED OR REDUCED BY PUTTING IN PLACE A GOOD NUTRITION STRATEGY FOR YOUR RACE:

1. Aim for 30-60 grams of carbohydrates per hour (Or for the more advanced user up to 90 g/h of the right types of carbohydrates)
2. Adjust fluid intake to minimize weight loss to less than 3%
3. Follow the guidelines here to minimize the risk of developing gastro-intestinal problems.
4. Train with your race nutrition plan, train your gut
5. Make sure all parts of your nutrition plan have been practiced in training

TOP TIPS

1. Don't experiment with new products on race day
2. Use the same nutrition products for at least 6 weeks prior to the race
3. Don't be afraid to listen to your gut and when fluids are not emptying from your stomach reduce the intensity temporarily. You will benefit from this later in the race.
4. Hydration during the race is important, but make also sure you don't start the race dehydrated
5. Ingest 20-25 grams of protein in the hour after hard training and at regular (3h) intervals during the day
6. Plan your breakfast on race day well in advance and make sure it is available for you on race day. Don't just show up for breakfast in a hotel on race day without checking.



FURTHER READING



RACE DAY BREAKFAST CONSIDERATIONS



HOW MUCH DO YOU SWEAT?



ELECTROLYTES UNDER INVESTIGATION



ARE ELECTROLYTES IMPORTANT FOR ATHLETES?

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BIOGRAPHY

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Professor Asker Jeukendrup is a leading sports nutritionists and exercise physiologist who spent most of his career at the University of Birmingham (UK) and currently he is a visiting professor at Loughborough University. During his career Professor Jeukendrup authored over 200 research papers and book chapters, several of which have changed the sports nutrition landscape. He is a strong believer in unlocking the power of science to help athletes and teams achieve their goals. During his career he worked with many elite athletes (including Chrissie Wellington and Haile Gebrselassie) to develop personalized nutrition plans to enhance recovery and optimize performance. He is head of Performance Nutrition for Jumbo-Visma Pro Cycling Team and Team NL.

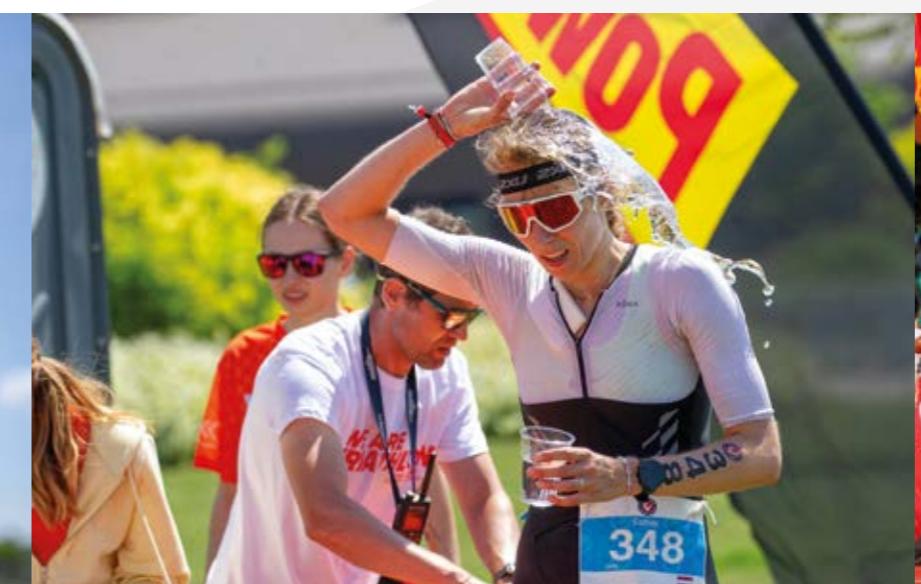
Asker practices what he preaches and is competing in long distance triathlons himself. To date he completed 21 long distance triathlon races.

For more information on sports nutrition please visit

www.mysportscience.com

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