

BONK - PROOF YOUR FUELLING

A cyclist wearing a blue long-sleeved jersey, black shorts, and a white helmet is riding a teal-colored bicycle on a dirt path. The cyclist is leaning forward in a racing posture. The background is a blurred natural setting with dry grass and trees.

Shaken by a personal experience of that dreaded running-on-empty feeling, *Anita Bean* goes in search of fuelling experts to find out what 'bonking' really means and how to avoid it

It was a route I'd done plenty of times before. Normally, I'd stop halfway to have a drink and snack but this time I pushed on. After an hour and half of riding at a brisk pace, I wasn't expecting my legs to feel so tired but I put it down to lack of recovery from a weights workout the previous day. Then, suddenly, without warning, I felt like I was cycling through treacle. Despite mustering up every bit of strength remaining, I had nothing left – the road ahead was starting to blur and I was barely holding a straight line.

What was going on? I felt angry and emotional – with myself, the traffic, the potholes, other cyclists that overtook me. My heart rate was through the roof although I was barely moving. Was I having a heart attack? I pulled over and, with shaking hands, called my husband for help, something I had never done before. It went to voicemail. Tears were running down my face now. Not wanting to attract attention, I got back on my bike and attempted pedalling but managed only a few more metres. My legs felt like jelly. I pulled over again and tried to calm my breathing. That's when I realised what was happening: I was suffering a 'bonk'. Worse still, I had no fuel with me and needed to get home.

'Bonking' – sometimes called 'hitting the wall', 'blowing up' or the 'hunger flats' – is something that every cyclist dreads. One minute you're riding high, the next you're falling hard, your tank empty and your muscles feeling shot to pieces. In a race, bonking certainly means game over – eating or drinking at this stage will not be enough to return you to previous levels of effort. It can also ruin a ride or workout – as I found out. But what is really going on in the body, and how can we steer clear of this horrible experience?

What is bonking?

"In simple terms, a bonk occurs when you've run out of glycogen," explains Dr Asker Jeukendrup, a professor of exercise metabolism and multiple

Ironman finisher. Glycogen is the stored form of glucose (carbohydrate) and is the major fuel source for exercise – it is broken down by the body into glucose and then energy, or ATP. The limitation here is that we can store only enough glycogen for around two to three hours of moderate to high-intensity exercise (i.e. above 65% of your aerobic maximum). Once you've used up all your glycogen, you must rely on fat for fuel.

"There are two aspects to glycogen depletion, and they can happen at the same time," continues Jeukendrup. "Firstly, in the liver. When this happens, blood glucose concentration drops, you start to feel dizzy and very weak, and there's no way you can maintain the same power output. Second, there's glycogen depletion in the muscles, which seriously impairs their ability to exercise." The liver is essentially the body's fuel tank – once it's empty, you're in trouble. "Liver glycogen depletion is catastrophic to exercise performance," says Jeukendrup. "It comes on suddenly – one minute you're fine, the next you're bonking – whereas the fatigue you feel from muscle glycogen happens more gradually."

This confirms the sudden, debilitating fatigue I'd experienced on my ride. Clearly, both my liver and muscle glycogen stores were depleted, most likely because I'd ridden hard that morning on an empty stomach, before breakfast. Liver glycogen stores are liable to run low overnight, particularly if you didn't eat a large meal that evening.

During cycling, both fat and carbohydrate are used to produce energy. Carbohydrate is the body's preferred fuel source for moderate and high-intensity efforts. When the carbs start to run out, why not switch over to fat for energy instead? "It's not that simple. You need to consider the amount of ATP you can produce per minute from fat versus



When your body's glycogen stores run low, your pace will slow to a crawl

carbohydrate," explains Jeukendrup. "Energy from fat is released much more slowly and requires more oxygen to break down compared to glycogen. If your exercise intensity is very low, then you can fuel it mostly from fat and keep going for a long time. But for higher-intensity exercise, you will need some carbohydrate, as you cannot fuel it from fat alone."

The body's store of fat is virtually inexhaustible: a reasonably lean 70kg rider has about 90,000kcal-worth of body fat, which in theory is enough to fuel 2,500km of cycling. However, if you were fuelled solely by fat, progress would be very slow, as Jeukendrup explains. "If you run out of glycogen, energy could not be produced fast enough, and it becomes harder and harder to maintain power output. You'll have to slow down." So, a bonk is really your body's way of slowing you down to the point where sufficient oxygen can be provided from using fat as your primary energy source.

All in the mind?

Then again, perhaps it's not as simple as running out of glycogen and needing to switch to fat. In experiments on subjects who exercise to exhaustion and report feeling like they have nothing left, muscle biopsies have found that they still have 25-50% of their glycogen stores remaining. Is it possible that bonking is, at least in part, a psychological phenomenon?

"It has been suggested that the limiters of performance are all in the brain, a lack of motivation and a perception we are putting too much effort in," says

sports psychologist Dr Josephine Perry. "This means in order to go faster, or be able to continue after bonking, requires additional motivation and anything that makes the effort feel easier, such as smiling, self-talk or distraction.

These can only work for so long, but we do usually have more energy left – accessible through upping motivation and proactively reducing perception of effort."

To avoid the bonk, therefore, a cyclist needs to train themselves mentally and physically to tolerate running low on carbs – even if they never truly empty the tank. If you always keep carb levels topped up, you may become too reliant on plentiful carbs. That's why many elite and professional cyclists undertake low-carb sessions, deliberately restricting carb intake before and during training, which has been shown to increase the body's

ability to burn fats.

Does training in a glycogen-depleted state help you avoid bonking when it comes to your long event or race? "While low-carb training can result in some

adaptive responses, there is, in fact, no evidence that it will delay glycogen depletion or prevent bonking," says Dr Sam Impey, lead nutritionist for British Cycling. "Low-carb training is useful for making the body burn fats more readily, improving the ability to train at low intensities for longer periods of time, which is fine if accumulating volume is your goal. But if you want to do high-intensity work or go up hills, there's no evidence low-carb training will delay glycogen depletion." Training too often in a carb-depleted state may even slow you down. "If you do low-carb sessions all the time, you become less efficient at using carbohydrate for fuel, which means during race conditions your performance is compromised," warns Impey.

How to avoid the bonk

More often than not, it's lack of adequate fuelling that causes a cyclist to bonk.

“Your body’s fat stores contain enough energy to fuel, in theory, over 2,000km of riding”

All the training in the world won't help you in those last few kilometres of a race or workout unless you have taken your fuelling seriously. "If you plan to ride for several hours, you should ensure glycogen stores are filled up before setting off, and then take in some carbohydrate during the ride, to slow the rate of glycogen depletion. With fully stocked glycogen stores, you'll likely get further into your ride before feeling tired," explains Impey.

"It's important to start fuelling early enough in the ride, before your glycogen gets depleted"

Carbohydrate loading, which helps increase the muscles' glycogen stores above normal levels, isn't necessary for general training rides but for hard rides and events longer than two or three hours it may benefit your performance by two to three per cent and reduce your chances of bonking. The concept dates from the 1960s and it was originally thought that you needed to deplete your glycogen stores initially before loading them, to achieve 'supercompensation'. It has since been proven that the depletion phase is unnecessary and that simply tapering

your training and increasing your carb intake for a couple of days beforehand is the optimal approach.

"I recommend six to 10g of carbs per kilo of body weight per day, depending on the intensity and duration, for 24 to 48 hours before the ride or race," says

Impey. But this isn't a green light to eat as much pasta as possible. Do that and you'll risk arriving at the race feeling bloated and heavy. It's often enough to simply reduce your training load for several days and eat an extra portion of carbohydrate with your main meals during the last two days before the event, plus plenty of high-carb snacks, such as bananas, toast and flapjacks. On race day, Impey advises eating a meal containing 2g of carbohydrate per kilo of body weight two to three hours before setting off, which tops up liver glycogen stores.

Taking in carbohydrate during the ride tops up blood glucose levels, fuelling your muscles, which may spare liver glycogen and reduce your risk of bonking. Portable snacks such as gels, bars, energy drinks, chews and rice cakes are practical options, depending on the relative intensity and personal preference. But it's important to start fuelling early enough in the ride, before your glycogen



consuming a mixture of glucose (or maltodextrin) and fructose.

Tech help

If all the measuring and timing above sounds a bit daunting, then there are nutrition-planning apps that will help you fuel appropriately for your ride, helping to reduce your risk of bonking. Core (fuelthecore.com), developed by Jeukendrup, gives you a custom nutrition plan based on your weight, sport, activity, goals, and preferred fuels. Hexis (hexis.live), developed by Impey, allows you to create a fuelling plan tailored to the demands of your specific workouts, lifestyle and goals. Another metric you may want to use is blood glucose. Continuous glucose monitors (supersapiens.com) attach to the back of your arm and measure glucose levels in the interstitial fluid – a close proxy for blood glucose. It links to an app that tells you whether your levels are falling or rising, and crucially, whether you need to take on fuel to avert a bonk.

Conclusion

Thankfully, I was close to home when I bonked, so was able to crawl back in one piece. As I recharged on biscuits and tea, I vowed never to make the same mistakes again. It was obvious, in hindsight, that I had neglected to fuel adequately before and during my ride. That said, I didn't appreciate at the time that I hadn't literally run out of glycogen – I still had plenty of energy to draw from my body fat stores, so I should have simply slowed down as soon as I felt the warning signs.

Having learnt about the psychology of bonking, I now know that positive self-talk and even smiling might have helped. Bonking is preventable, and I've learnt the hard way that if you're riding hard for longer than 90 minutes, you will need to stock up on carbs beforehand and may need to top up during your ride. It's also possible to head off a bonk if you recognise the initial signs. You may have lost the chance of a fast race finish or PB-smashing workout, but you can still reach the end of your ride in good shape.

LEARNING THE HARD WAY

'I could barely turn the pedals!'

Double triathlon world champion **Helen Jenkins**, 39, describes her steep learning curve en route to mastering fuelling.

"The bonk is something that every professional cyclist and

triathlete experiences at least once. It can catch you out when you're least expecting it. For me, it happened on my first training camp when I didn't appreciate just how



important it was to fuel properly. I had upped my mileage that week and was doing a bigger workload than I was used to, so I was completely unprepared.

"I saw my power output getting lower and lower, and suddenly I could barely turn the pedals. I was completely out of energy and felt hollowed out. Fortunately, I managed to make it to a convenience store where I bought a flapjack and Coke. Nothing has ever tasted so good!"

"Now, I'm more educated on nutrition. I will always take food with me on rides, whether that's bananas, homemade energy balls, gels or chews. I make sure I eat earlier in a ride whereas previously I would wait until I felt tired or eat when hungry. On long indoor Zwift rides I make sure I have a gel every 20 minutes."

HOW TO KEEP TOPPED UP

Recommended carb intake

Ride duration	Carbohydrate intake
0-45min	None, water only
45-75min	Mouth rinse with carb drink or imbibe very small amounts
1-2 hours	15-30g per hour
2-3 hours	30-60g per hour
>3 hours	60-90g per hour

Source: Jeukendrup, A. 'A step towards personalised sports nutrition: carbohydrate intake during exercise'. *Sports Med.* 2014 May;44 Suppl 1(Suppl 1):S25-33.