



THE GREAT SALT DEBATE

Do you need to take supplementary salt to replace sweat losses? It's a highly contentious question. David Bradford explores the arguments for and against

Sports science is becoming ever more concerned with physiological uniqueness — how we're all subtly but significantly different from one another. A 'one size fits all' training and nutrition plan doesn't cut the mustard any more. Fully realising one's own unique quota of potential requires an individually tailored plan. With regard to food, it's obvious: a diet perfect for one cyclist may be totally unsuitable for another. So, what about drinking? Do the same rules apply to us all, or do we each need a personalised hydration plan using special drinks precisely formulated with added electrolytes?

There are arguments for and against personalised hydration and supplementary salt. Those in favour endorse measuring the saltiness of your sweat and subsequently matching intake to losses, to guard against a shortfall. Those in the 'against' camp contend that opting for salt-free drinks is not only the simplest but also the wisest approach because running out of sodium is not a genuine risk. To assess both sides, we need to understand the basics of hydration.

The body's cells absorb fluid via the process of osmosis: crudely put, water molecules move from relatively unsalty (hypotonic) places into saltier (hypertonic) places until inside and outside are equally salty (isotonic). We lose salt through sweat, but sweat is more watery than salty (hypotonic), so we lose proportionally more water than salt. As we sweat out water, the fluids inside the body become saltier, which triggers thirst; we drink and, hey presto, our body's fluid balance is restored. The question is: can adding salt to our drinks help maintain *optimum* hydration and enhance sporting performance?

The Golden Rule of Hydration

DRINK TO THIRST

There is broad scientific consensus that drinking more than thirst prompts you to drink is unnecessary and potentially dangerous. Whereas over-hydration can be lethal, mild dehydration doesn't even impede performance. Want proof? Elite marathon runners lose as much as 10 per cent of their body weight — mostly water — during a race *without slowing down*.

Yes, adding salt can boost performance

As with food, your liquid intake — the quantity and ingredients of your water bottles — should be determined by your own specific needs. That's the message from Precision Hydration (www.myh2pro.com), a UK company that has, over the past three years, been extracting and analysing sweat from hundreds of sportspeople from a multitude of different disciplines. In doing so, they have found that the sodium concentration in sweat — sweat's saltiness — varies greatly from one athlete to another.

Sodium in sweat is measured in millimoles per litre (mmol/l), and the concentrations recorded in Performance Hydration's tests has ranged from 15 to 93mmol/l. In other words, your sweat might be considerably saltier (or considerably less salty) than the sweat streaking down the face of your rivals. Does this matter and, if so, why?

Many athletes who compete in long-distance events such as ultra-marathons, long stage races and Ironman events believe that using electrolyte tablets helps prevent them from depleting their body's salt supply, allowing them to keep sweating heavily for hours with no ill effects.

SALTY SWEATERS

"If you are a salty sweater, in the 60-85mmol/l range," says Precision Hydration's Andy Blow, "there is a growing body of testimonial evidence to suggest that, during long events, you will benefit from replacing the salt you're losing."

Though the body is able to regulate salt losses through hormonal control (see 'The case against'), there is some evidence to suggest that sweat sodium concentration is fixed genetically via a protein called CFTR*.

I submitted myself to a sweat test at Precision Hydration, which revealed that I am a member of the exclusive salty sweaters club, with a salt sodium concentration of 60mmol/l. This means I lose 1,228mg salt in every litre of sweat — far more than I sprinkle on my post-race chips! Blow advises salty sweaters like me to use H2Pro 1000 tablets to pre-load before races, and H2Pro 500 during races — in each case drinking to thirst — which deliver 1,000mg/l and 500mg/l of sodium respectively. I can't claim to have properly tested this protocol; my races generally last no longer than 80 minutes, so neither dehydration nor salt depletion is a serious risk for me.

For those whose sweat sodium concentration is in the low range



(20-40mmol/l) Performance Hydration prescribes its 250 or 500 tablets for pre-loading, and salt-free drinks while competing. It's important to avoid consuming too much salt, as excessive intake is associated with water retention (see case study) and high blood pressure. The theory behind pre-loading with sodium — supported by some studies but not universally accepted — is that it ensures the body has a plentiful supply at the beginning of a race. It's thought that pre-loading can also increase blood volume, which is associated with reduced physiological stress, lower heart rate and longer time to exhaustion, ie, better performance. Another touted benefit of beginning a (long) race with a 'full tank' of sodium is that it reduces the risk of hyponatraemia or 'water intoxication', a dangerous condition where sodium levels fall and the body becomes 'flooded' with water.

CRAMP CONTROL

The most common reason athletes take salt tablets, though, is because they believe it prevents cramps. Science has yet to prove the link between sodium and cramp prevention, though a review of the literature (Bergeron, 2008) cites studies in which lower serum sodium levels have been reported

Precision Hydration suggests replacing salt during long events

in cramping athletes compared to non-cramping control groups. And of course it's impossible to ignore the wealth of anecdotal evidence from formerly cramp-prone people who proclaim, "Salt worked for me!"

* 'Low abundance of sweat duct Cl-channel CFTR in both healthy and cystic fibrosis athletes with exceptionally salty sweat during exercise,' Brown, Haack et al, 2011.

CASE STUDY

'SALT WORKED FOR ME!'

Andrew Berry attributes his international-level success as a veteran triathlete to the plan prescribed for him by Precision Hydration

"Having trained for two years to try and win a place in Team GB [65-69 age-group], I was suffering with increasing cramp problems during and after training, so I contacted Precision Hydration. "The sodium concentration of my sweat was measured as 36mmol/l, and I was given a hydration protocol designed to replace the salts I lose in sweat. It worked! The cramps completely stopped within about two weeks of me following the protocol, which was fundamental to my being able to improve my performance and train harder.

"At Hyde Park in September, I finished eighth in my age group in the ITU World Championships Sprint Triathlon. I definitely could not have achieved what I have, or the increased level of training required, without Precision Hydration's input."





THE CASE AGAINST **No, adding salt is totally unnecessary**

Scientist and author Professor Tim Noakes recently published *Waterlogged*, a hefty tome in which he tackles the issue of over-hydration among athletes by making a thoroughgoing case for drinking to thirst and no more. Most relevant here, though, is his chapter devoted to salt balance in the body.

I emailed Noakes to ask his view on sweat-testing as a basis for individually tailoring sodium intake to match sweat losses.

His reply was categorical: "The theory [of matching intake to losses] is completely bogus. Humans have a very low requirement for salt — about 2g per day maximum — even when doing vigorous exercise... The level of [sodium] intake determines the level of output... If you measure output [sweat], you might say that this athlete is putting out a lot of sodium and therefore needs to take in more, when in fact it is the input that drives the output."

HORMONAL HELP

Noakes expands on this view in *Waterlogged*, citing the work of scientist Jerome Conn, who more than 60 years ago showed that, when sodium intake is reduced, the body is able to compensate by reducing sweat and urinary salt losses via a hormone that ultimately became known as aldosterone. Salt losses through the skin, Conn concluded, can be reduced by as much as 95 per cent, meaning the body can adapt to sodium intake as low as 6g per

day, even when exercising for "many hours a day in heat".

The average daily consumption of sodium in the developed world is around 9g per day, leading Noakes to declare that we already ingest far more salt than we need, even those of us who routinely sweat heavily for prolonged periods. He concludes: "To suggest that the body cannot sustain long-term exercise in the heat without ingesting supplementary sodium ignores not only our biological design but also reams of research proving otherwise."

CASE STUDY

SALT TABLETS LEFT ME 4KG OVERWEIGHT

Former pro Dan Lloyd blames salt tablets for causing him to pile on unwelcome body weight during his debut Grand Tour

"It was 2009, my first Grand Tour, the Giro d'Italia, and in the lead-up I was especially cautious about getting myself fully hydrated, using electrolyte drinks as well as sodium tablets. I was worried about blowing up, so I wanted to do everything in my power to prevent that.

"Well, about halfway through the race, I was weighed, and my weight had increased by 4kg — a huge amount. Obviously, I hadn't put on any fat or muscle weight. It was fluid retention. The extra sodium meant I was retaining more water than I needed.

"I've since had a sweat test with Precision Hydration, which showed my sweat has a low concentration of sodium, so I've less need than others to consume extra salt. The fact my sweat contains relatively little sodium may also explain why I never experienced cramps."



But what about all those people who say that adding salt resolved their cramping problems? Again, Noakes is categorical, arguing that cramps cannot feasibly be caused by sodium deficiency because sodium levels in the body are a "protected variable" — they fall only when the body's control mechanism is knocked out of kilter in cases of hyponatraemia, and "people suffering from [hyponatraemia] do not complain of muscle cramps".

He goes on to contend that current scientific understanding indicates a 'mystery store' of sodium — a reserve not yet pinpointed but which can be accessed when sodium losses increase, ie during exercise — and which negates the need for supplementary salt.

SECRET SODIUM

For the same reasons, Noakes dismisses the notion that supplementary sodium can help prevent hyponatraemia; sodium levels are protected by the body's homeostatic control, he asserts, and this control is overwhelmed only when a greatly excessive quantity of water is ingested (drinking beyond thirst).

Hang on, though; if cramps aren't caused by salt deficiency, what is the cause? According to Noakes, exercise-associated cramping is another area where science does not yet have all the answers, but is most likely caused by muscular fatigue and/or other neuromuscular factors.