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The salt fix

We have a new target in our war against dietary sodium, and this one is much more palatable, finds **Graham Lawton**

I HAVE high blood pressure and have been taking medicine to control it for years. It recently spiked again and my doctor tweaked my prescription. But I have also been taking matters into my own hands, limiting how much salt I eat, plus a bit of self-medication with an off-the-shelf supplement. My blood pressure is back under control.

You might think that it was the medication and my salty sacrifice that did the trick. They almost certainly played a part. But my supplement of choice – potassium – may have actually done the heavy lifting.

High blood pressure, or hypertension, is the world's most common cause of death. And while there is little doubt that excess dietary salt (sodium chloride) can elevate blood pressure and that most people would benefit from eating less, many of us struggle to do so. We urgently need a better solution, and growing evidence suggests we may have one in potassium.

"Potassium is really important," says Bruce Neal at the George Institute for Global Health in Sydney, Australia. "There's no doubt that potassium will lower blood pressure."

Understanding exactly how it works, how much we should consume and its effect on blood pressure is of growing interest to researchers, who are starting to realise the huge impact it could have in fighting our global battle against cardiovascular disease. Have we finally discovered a more palatable way of satisfying salt cravings that won't damage our health?

According to the NCD Risk Factor Collaboration, which provides data on non-communicable diseases, around 1.2 billion adults worldwide have high blood pressure and more than 10 million people a year die as a result, mainly through cardiovascular and kidney disease.

The causes of hypertension remain largely uncertain, but its consequences are clear. When blood pressure is high – above 130/80 millimetres of mercury (mmHg) – the heart has to pump harder, arteries get stretched and battered and the kidneys have to work at a higher rate to filter the blood. Over the long term, this causes irreparable damage to the organs and blood vessels. Most cases are idiopathic, meaning of unknown cause, but one risk factor has been clearly identified: excess intake of salt.

Not everyone is sensitive to salt, but for the 50 per cent of the population who are, there is a linear relationship between sodium intake and blood pressure. Salt sensitivity is partly genetic and also more common in older people, women, African Americans and those with insulin resistance or chronic kidney disease.

For them, each extra gram of sodium chloride per day (which equates to 2.5 grams of table salt) increases blood pressure by an average of 2.1 mmHg. The rise is even greater in people who already have hypertension and the over-60s. Around 30 to 50 per cent of people with hypertension are salt-sensitive.

Unsurprisingly, reducing dietary sodium causes blood pressure to fall. But salt reduction strategies have faced many challenges. In the early 2000s, a team led by Lawrence Appel at Johns Hopkins University in Maryland ran a short trial of an intervention called Dietary Approaches to Stop Hypertension (DASH). Over 30 days, volunteers ate a diet either high, medium or low in sodium and had their blood pressure monitored. Those on the low-sodium regime – with less than 3 grams of salt per day – saw their blood pressure fall by an average of 6.7 mmHg compared with the high-sodium intake. That was true whether they were hypertensive or not.

The DASH study was highly influential, according to Franz Messerli at the University Hospital of Bern in Switzerland. Numerous bodies, including the World Health Organization, now recommend eating no more than 2 grams of sodium per day,which is roughly 5 grams of regular table salt. That is about a 40 per cent reduction on the intake from the average Western diet of 8.7 grams a day.

However, doubts remained over the wisdom of salt reduction. Some naysayers pointed out that the change in blood pressure per gram of salt is small and that around half of people aren't salt-sensitive. They also claimed there was evidence suggesting that eating too little sodium is worse for health than eating too much.

Controversial advice

DASH didn't put that controversy to bed. So in 2014, Neal and his colleagues at the George Institute decided to get to the heart of the matter. They approached communities in rural China and invited them to join a vast clinical trial called the Salt Substitute and Stroke Study (SSaSS). They got 600 villages on board, and within each recruited around 35 men and women in late middle age, most with a history of hypertension or stroke. There were 20,995 participants in total.

In rural China, processed food is largely unavailable and most dietary salt is added during food preparation or at the table. So the researchers gave participants in half of the villages a free supply of low-sodium salt – comprising 75 per cent sodium chloride and 25 per cent potassium chloride – and asked them to use that instead of regular salt for cooking, seasoning and preserving. The other 300 villages carried on as normal without any interventions.

Over the course of more than four-and-a-half years, the researchers tracked the ›

"Adding potassium to your diet is such a low-cost intervention. The potential benefits are huge"

number of strokes, other major cardiovascular events and deaths from all causes, including kidney disease. All three were significantly lower in the low-sodium group. "It's a fantastic study, it shows a huge impact," says Kenji Shibuya at the Tokyo Foundation for Policy Research, a Japanese research-based think tank.

After the results were announced at the 2021 European Society of Cardiology Congress, Bryan Williams at University College London, who is also chief scientific and medical officer at the British Heart Foundation, commented: "Those who doubted the benefits of salt restriction for cardiovascular disease prevention were wrong, the debate stops here."

The debate didn't stop though. More detailed analyses of the results suggested we had missed a trick. While they supported the headline finding that salt substitution reduces the risk of cardiovascular disease, and that sodium reduction is part of the reason why, they also pointed to a more significant factor: potassium.

The idea that potassium has an important influence on blood pressure has been around for a long time. In the 1970s, George Meneely at Vanderbilt University in Tennessee hypothesised that humans evolved to eat much more potassium and much less sodium than we do now, and that the dietary ratio of sodium to potassium was an important factor in blood pressure. Subsequent studies showed that people who consumed more potassium had lower blood pressure, and clinical trials have since confirmed the link. "There's a whole bunch of trials which also suggest that potassium intake is good for you," says Neal.

This beneficial effect in part occurs via a process in the kidneys called the "potassium switch". When potassium levels in the bloodstream are low, the kidneys block excretion of it into urine, which also suppresses sodium excretion. Higher potassium levels, on the other hand, help the kidneys to get rid of excess sodium, which is what a class of medications known as diuretics can do too. "Potassium acts like a natural diuretic," says Swapnil Hiremath at the University of Ottawa in Canada. Potassium also exerts a direct effect on blood pressure by relaxing blood vessels, he says.

A surprising finding

Potassium was a major factor in the SSaSS study. The salt substitute used in the experiment not only lowered the participants' sodium intake, it also increased potassium. In fact, says Messerli, the average reduction in sodium was only 8 per cent, but potassium increased 57 per cent. And here is the twist: when Neal, Liping Huang at the George Institute and their colleagues reanalysed the data from the SSaSS study, they concluded that about three-quarters of the effects were derived from potassium supplementation and only a quarter from sodium reduction.

"Although population-level potassium intake has received less attention than sodium intake as a public health strategy, the results of the recent SSaSS trial might suggest that increasing potassium intake may be of greater importance," says Catriona Reddin at the University of Galway in Ireland.

Lack of dietary potassium is a global problem. Current guidelines advise adults to eat about 3.5 grams per day, but global average intake is 2.25 grams per day and only 14 per cent of the world's population hit the target, says Reddin. The main reason for that is a lack of fresh fruit and vegetables, plus the fact that cooking and processing food can cause potassium to leach out.

As yet, however, none of this evidence has fed through into health advice to lower blood pressure. "Potassium just isn't used in the same way [as sodium], so hasn't been thought about as a target," says Neal.

How to boost your potassium

Cutting down on salt is beneficial for most people, but can be difficult. Consuming more potassium can offset some of the problems that excess salt causes (see main story). Measuring how much potassium is in your diet isn't easy, but most people don't get enough and overdoing it is difficult, unless you have kidney disease. Here are some easy ways to boost your intake to the recommended 3.5 grams per day.

Switch to potassium-enriched salt

Eat more fresh fruits and vegetables, which are the richest dietary source of potassium available and have many other health benefits

Bananas are widely known to be a good source of potassium, but papaya and prunes are also high in it, as are beans, peas, nuts, spinach and sweet potatoes

Consider taking a potassium supplement if it is medically appropriate

You may need to consult your doctor before taking supplements or making major dietary changes.

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Switching to high-potassium salt could lower blood pressure

Another reason for reticence around potassium is a serious health condition called hyperkalemia, or excess potassium in the bloodstream, which can cause sudden death from cardiac arrhythmias. But this is a minuscule risk, says Neal, and one that is hugely offset by the benefits of consuming more potassium. The SSaSS study monitored volunteers for hyperkalemia and found no difference between the two groups. The condition is a particular risk for people with advanced kidney disease because they struggle to excrete potassium. However, they are already advised to avoid salt, says Neal.

Neal and others are now eyeing potassium as a new target in the global battle against hypertension. This is in part an admission of defeat on sodium reduction, which has been attempted repeatedly, but invariably falls short. "The fact is, we have struggled," says Hiremath. "Sodium intake has not budged despite decades of guideline recommendations."

There are various reasons for this. "You've either got to persuade individuals to buy less salty foods or to add less salt to food when they cook, and it just doesn't happen," says Neal. "Or you've got to persuade industry to put less salt in processed foods and there's simply no incentive for them to do that. Or you've got to persuade governments to regulate salt levels, but, in general, the appetite for governments to do that is pretty much zero."

The SSaSS study points to a way to surmount all of those obstacles. Potassium-enriched salt can be used in exactly the same way as regular table salt, in exactly the same quantities, so doesn't require obvious lifestyle changes. A 75 per cent potassium/25 per cent sodium mix tastes very similar to regular salt, with the sodium chloride masking the bitter and metallic taste of potassium chloride.

The price isn't too difficult to swallow, either. In the UK, a version called LoSalt, which is 73 per cent potassium chloride, retails for around £6.30 per kilogram. The same quantity of the cheapest sodium chloride costs £1.17. "It is slightly more expensive than plain sodium chloride, but it's not insanely expensive," says Hiremath.

Public health messaging around potassium chloride is also easier, he says. "Saying 'eat less of this, less of that' is patronising and paternalistic. Potassium allows the message to be, OK, if you cannot decrease salt, add a little bit of potassium in your diet."

The blood-pressure-lowering effect of potassium means that people can continue eating too much sodium chloride but partly offset it with potassium, either in their diet or in supplements (see "How to boost your potassium", left). "People love supplements," says Hiremath. "The fun thing is that you don't have to change your diet. You can eat the same things as before, just add a potassium supplement and that may be enough to reduce your blood pressure."

A simple solution

"Our message is switch," says Neal. Five years after the SSaSS study ended, 93 per cent of people assigned the potassium-rich salt were still using it, he says. "That's staggering."

The biggest win of all would be to persuade restaurants and processed food companies to make the switch too. That would be especially effective in higher-income countries where around 80 per cent of sodium consumption comes from salt added during the industrial manufacturing of foods. However, that will take some doing, says Neal, largely because of the increased cost of using high-potassium salt.

That is where governments come in. Last year, the US Food and Drug Administration changed its rules to permit use of potassium-enriched salt in processed foods. More of the same is needed, says Neal. "I believe we should switch the world salt supply from regular salt to potassium-enriched salt," he says. Something similar has been achieved before with universal iodisation of table salt to prevent foetal and developmental abnormalities, goitre and hyperthyroidism due to lack of dietary iodine. In 1960, around 60 per cent of the global population was deficient in this mineral. Nowadays, thanks to extensive efforts by governments and public health bodies, that problem has largely disappeared.

Governments have a huge incentive to get on board with potassium. Extrapolating the SSaSS result globally suggests that universally switching to potassium-enriched salt would prevent between 6 and 7 million strokes and heart attacks each year, says Neal. "It's such a low-cost intervention. The potential benefits are huge." ▮

Graham Lawton is a staff writer at *New Scientist*