

Friend or foe?

Salt's reputation as a health hazard has recently taken a pounding. **Graham Lawton** sifts through the evidence

ON MY dining table at home sits a container of small, white crystals. One of my daily rituals is to grind some of these crystals onto food; occasionally I dab a finger onto one and pop it into my mouth. They taste metallic and mineral, like the ocean.

Like many people, salt is a routine part of my diet. And yet this mineral that I so casually sprinkle onto my food could kill me. Not immediately, but if I carry on like this, it may well get me in the end.

The World Health Organization says the world is in the grip of a "crisis" of non-infectious diseases. Salt is one of the main culprits because of its effect on blood pressure. Only one substance gives the WHO greater cause for concern, and that is tobacco.

For the past 40 years, doctors around the world have been waging a war on salt. In some places they have been very successful. "All politicians and public health people say we've got to do something about it," says Graham MacGregor, professor of cardiovascular medicine at the Wolfson Institute of Preventive Medicine in London and director of World Action on Salt and Health.

And yet in recent months something has shifted. You might call it a sea change. Headlines have appeared questioning the benefits of eating less salt. Some have claimed salt reduction is positively harmful; even *Scientific American* declared: "It's time to end the war on salt." What is going on? Can four decades of health advice really be wrong?

Salt – or more accurately its constituent ions sodium and chloride – is a vital nutrient.

Sodium and chloride help maintain fluid balance and sodium is one of the ions nerve cells use to create electrical impulses.

The typical food available to our hunter-gatherer ancestors would have been low in salt so we have evolved an exquisite system for detecting it in our diet. One of our five types of taste bud is dedicated to salt, the only one tuned to a single chemical. Unlike energy, our bodies cannot readily store salt and so we are experts at hanging on to it, largely through a recycling unit in the kidneys. It is possible to survive perfectly well on very little salt.

Until recently most humans ate no salt other than what was naturally in their food, amounting to less than half a gram a day. Pure salt only entered the food chain around 5000 years ago when the Chinese discovered it could be used to preserve food.

Salt has since played a leading role in human history. It assisted the transition to settled communities and became one of the world's most valued commodities.

Although we no longer have to rely on salt to keep food from spoiling our appetite for it is undiminished. Most people eat much more salt than they need. While US dietary guidelines set an adequate intake of 3.75 grams a day, the average westerner eats about 8 grams; in some parts of Asia, 12 is the norm.

Despite a widespread belief that we have an innate liking for salt, this appetite appears to be learned. People living in traditional societies, such as the highlanders of Papua New Guinea, have no access to pure salt and find it repulsive, but if they move to the city





they quickly take to it. As with chilli and caffeine, it seems we can learn to love the intrinsically aversive flavour of salt.

And like an addictive drug, the more you eat the more you crave, as salt receptors on the tongue become desensitised by overuse. Once in this habituated state, unsalted foods taste bland and uninteresting. It can take several weeks of salt withdrawal for taste preferences to return to normal.

It doesn't help that today's diet is full of salt. Around three quarters of the salt we eat is added to food before it even reaches our plates, not only in the obvious culprits like cured meat and smoked fish but also concealed in breakfast cereal, biscuits, cheese, yoghurts, cake, soup and sauces. Even bread is surprisingly salty.

There is a multitude of reasons why processed food is so laden with salt. As well as prolonging shelf-life, it makes cheap ingredients taste better and masks the bitter flavours that often result from industrial cooking processes. It can be injected into meat to make it hold more water, thus allowing water to be sold for the price of meat. It improves the appearance, texture and even the smell of the final products. And it makes you thirsty, boosting sales of drinks.

This effortless consumption of salt horrifies doctors. Our kidneys can excrete some excess salt but even so, people who consistently eat more than about half a gram a day – that is, practically all of us – build up excess sodium. To keep fluid concentrations stable, our bodies retain extra water. “We’re all sloshing ➤

around with a litre or a litre and a half compared with what we would be if we were on our evolutionary salt intake,” says MacGregor.

An inevitable consequence of this excess fluid is a rise in blood pressure. Exactly how is not clear. Nor is the reason why some people are more sensitive than others. But the fact that it does is uncontroversial.

It is the effect on blood pressure that causes problems. High blood pressure is one of the main risk factors for cardiovascular disease; even small increases raise your risk of having a stroke. “Everything that lowers blood pressure works. There’s no argument,” says MacGregor.

For this reason, salt reduction has become one of the most important public health targets in the west. Dietary guidelines vary, but generally recommend eating no more than 5 to 6 grams of salt a day. And these levels are far from ideal – they are merely what is considered realistic in a world awash with salt.

Try calculating your own salt intake and you’ll soon learn how hard it is to meet even this modest target. I worked out my daily total and found that I eat around 8 grams a day.

In theory, salt is an easy target for action. If food manufacturers slowly reduced the salt content of their products, everyone would eat less salt and nobody would even notice as their taste buds gradually resensitised.

Staunch defender

In the UK, this kind of salt reduction was first mooted in 1994 but hastily shelved after protests from food manufacturers. In the intervening years lobbying by scientists, public health groups and bodies such as the Food Standards Agency gradually turned the tide – not least by raising public awareness – and now the industry is broadly reconciled to modest salt reductions. Elsewhere the picture is more mixed, with US manufacturers especially truculent. The most vigorous defender of the status quo is the Salt Institute,

a trade body based in Alexandria, Virginia, representing 48 producers and sellers of sodium chloride. The institute has a long history of trumpeting any research that goes against the orthodoxy and picking holes in the evidence against salt.

So what is the evidence? Over the years dozens of studies have been done and while the findings are far from uniform, the general direction of travel is clear.

One approach is to look for a link between how much salt people eat when left to their own devices and their rates of heart attacks and strokes. Over the years many such studies have been done. In 2009, cardiologist Francesco Cappuccio of the University of Warwick, UK, pooled all the data and found a strong relationship between a salty diet and cardiovascular disease (*BMJ*, vol 339, p b4567).

Another way is to intervene directly in people’s diets – take two groups of people, get one of them to eat less salt for a while and see

what the outcome is. These trials take more work than observational studies but several have been done. The biggest managed to get thousands of people to cut down on salt by about 2 grams a day for up to four years and saw a 25 per cent fall in cardiovascular disease (*BMJ*, vol 334, p 885).

Or you can look at whole countries, taking the before-and-after approach. Fifty years ago northern Japan had one of the world’s biggest appetites for salt – an average of 18 grams a day per person – and shockingly high numbers of strokes. The government implemented a salt reduction programme and by the late 1960s average salt consumption had fallen by 4 grams a day and stroke deaths were down by 80 per cent. Finland, another salt-guzzling nation, achieved similar gains in the 1970s.

However, the evidence is not always so clear. In July the Salt Institute was presented with its biggest PR coup for years when the Cochrane Collaboration, an internationally renowned



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Well seasoned

Typical salt content of some common processed foods. Recommended upper limit per day is 5.75 grams in the US





One of the world's most controversial crystals

only just slipped below statistical significance. Far from casting doubt on salt reduction, some argued that the findings supported it.

The Cochrane report wasn't the end of it. Last month Alderman's journal published a further meta-analysis purporting to show that salt reduction could actually be harmful (doi:10.1038/ajh.2011.210). It concluded that while cutting salt lowered blood pressure, blood levels of certain hormones and lipids were increased, which could theoretically raise cardiovascular risk.

But many of the studies included in the analysis lasted just a few days and involved big salt reductions. MacGregor accepts that sudden and steep salt reduction can lead to counterproductive hormonal changes, but says that modest reductions, say from 8 to 6 grams, do not. "There's no evidence whatsoever that a modest reduction does any harm," he says.

One lesson from these latest studies is that headlines can be misleading; the devil is in the detail. That is why the salt reducers talk about the "totality of the evidence". Nutrition science is notoriously hard. You need large numbers of people to detect the outcome of small dietary changes and there are so many confounding factors that sometimes paradoxical results pop up.

"Nutrition is not black and white," says Susan Jebb of the UK Medical Research Council's Human Nutrition Research unit in Cambridge. "It's not about one definitive trial, it's about the totality of the evidence. In this case the balance of evidence strongly supports reductions in salt."

There is one way of settling the debate.

"Try calculating your own salt intake and you'll soon learn how hard it is to meet even modest targets"

Take 30,000 people, put half of them on a high-salt diet and half on a low-salt diet for at least five years and see what happens.

Unfortunately, this trial will probably never be done. According to Cappuccio it would be impractically big, prohibitively expensive, and ethically questionable – not to mention hard to achieve in today's salt-saturated world. The salt lobby disagrees. "To say it is too expensive and takes too many people is a bogus argument," says Alderman. "It can be done and it should be done." As for ethics, he asks which is worse: to do the experiment, or to foist salt reduction on everyone without being

body dedicated to assessing medical evidence, published a long-awaited study on salt and cardiovascular disease.

As is usual for Cochrane, the study was a "meta-analysis", pooling the results of all the best-designed randomised controlled trials that have been done, the highest standard of proof in medicine. Seven trials met the quality criteria, with over 6000 subjects in total.

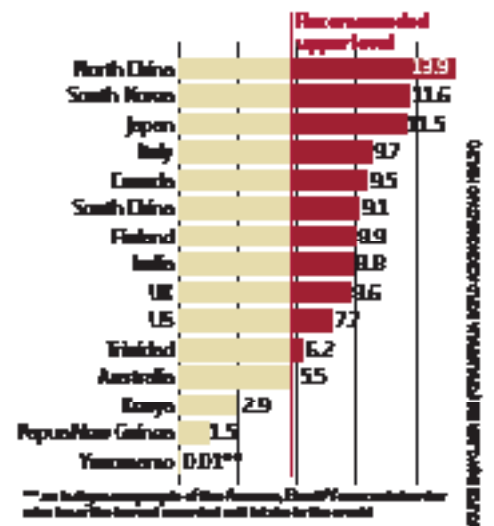
The analysis did show that people who cut back on salt have slightly lower blood pressure and are less likely to die from heart attacks and strokes. But, crucially, the effect on deaths wasn't big enough to be statistically significant. The Cochrane team could not rule out the possibility that the reductions had happened by chance.

The research was published simultaneously by Cochrane and the *American Journal of Hypertension* (vol 24, p 843), whose editor-in-chief Michael Alderman is a long-time critic of salt reduction. In an accompanying editorial (vol 24, p 854), Alderman, who was once a paid consultant for the Salt Institute, repeated his oft-stated claims that there is not enough evidence for salt reduction. Sensing a story, many newspapers ran with his line.

Is Alderman correct? Not surprisingly, MacGregor thinks not. For one thing, he claims the Cochrane study is flawed. When he reanalysed the same data in a slightly different way, he found a reduction that was statistically significant (*The Lancet*, vol 378, p 380). Alderman criticises this as "salami epidemiology", but even in the original analysis the link between salt and death rates

An appetite for salt

National average salt intake (grams of salt per day)



sure it won't do any harm?

But perhaps the salt lobby will be quite happy for the trial never to happen. Demanding definitive proof before taking action sounds reasonable, but if you know that proof will never arrive all you are doing is defending the status quo.

Like the tobacco industry before it, the salt industry inevitably feels threatened by public health campaigns aimed at reducing consumption of its one and only product. And as with tobacco, its best tactic is to spread doubt. "What the Salt Institute wants is the idea that there is disagreement among the experts," says MacGregor. In fact, there are very few independent experts who are against salt reduction.

Even the chief author of the Cochrane study, statistician Rod Taylor at the Peninsula Medical School in Exeter, UK, agrees with MacGregor that the findings lend further support to salt reduction. "Our results do not mean that asking people to reduce their intake of salt is not a good thing," he says.

"We have much stronger evidence for salt than we do for fat, for the benefits of eating fruit and vegetables or losing weight," argues MacGregor. "There has never been a randomised controlled trial of cigarette reduction. Should we not have done anything about cigarettes?"

Of course it would be nice to wipe salt off the list of things you need to worry about. But you may not live to regret it. ■

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