

# SALT: TASTE & HEALTH CONSIDERATIONS

By Henk Hoogenkamp

For years, it seemed that marketing low-sodium foods was a thing of the past, when suddenly low-sodium and reduced-sodium food re-appeared in the limelight. That change is partly due to the Centers for Disease Control and Prevention (CDC) and the Institute of Medicine, along with proactive food companies that have weighed in on the urgent need for sodium reduction.

Salt is an essential nutrient for the human body. The big question is, "how much?" Sodium, potassium, and calcium salts are essential for all nerve cell activity, muscle movement, as well as the osmotic balance of the body fluids. Since the beginning of agriculture and farming 8000 years ago, salt consumption has remained relatively stable. In the last 50 years, however, the use of salt has skyrocketed primarily due to the significant increase in the consumption of processed foods and meats.

Salt (sodium chloride and potassium chloride) is essential for human health and development, particularly for regulating the body's electrolyte balance, preventing dehydration, and maintaining cellular functions.

However, excessive sodium intake can be considered a key component of the diet that is related to high blood pressure and its many subsequent medical conditions. There has been a profound change around the world in risk factors associated with death since 1990. Back then, the biggest risk factors were child and maternal malnutrition, unsafe water, and

lack of sanitation. The situation has now changed drastically and at a global level. The most important contributors to the overall burden of diet are high sugar, low fruit, low vegetables, low wholegrain, low nuts and seeds, as well as high sodium.

Dietary sodium reduction is important for those with hypertension, heart conditions, and certain types of kidney and liver ailments. Certain ethnic groups and older people might want to restrict their salt intake. Most people consume far more than the 5g per day recommended by the WHO. An average table salt intake of 8g to 12g is quite normal in Western countries - an amount that has not changed in a decade.

## The Social Status

It is critically important to reformulate processed foods and significantly reduce high levels of salt. However, it is true that increasingly people of all socio-demographic status are consuming more of highly processed foods.

Convincing evidence shows that there is an association between salt intake, income, and educational status. People of a low-income background typically eat more salt than those with higher incomes, which can subsequently contribute to a lower life expectancy. The health benefits of lower salt foods have not reached those who need it most. Perhaps the only way to stop unhealthy salty junk food is

for Governments to interfere and mandate specific salt levels for certain food or food categories

## Children and Adults Alike

In the US, nearly 90 percent of young adults aged 19 and over eat more sodium per day than recommended by the 2015-2020 Dietary Guidelines for Americans. The Dietary Guidelines



for Americans recommends adults consume less than 2,300 mg per day of sodium, which is the upper limit for people ages 14 and older set by the Institute of Medicine.

Salt consumption by Chinese adults is consistently ranking above 10g a day. This is over double

the recommended limit of 5g (Queen Mary University, London, July 2019). The recommendations are lower for children younger than 14. These recommendations are in contrast with the Lancet publication August 2018, advising a moderate sodium intake range of 3 to 5g/day (3,000 - 5,000mg/day). Lowering sodium intake from average levels of 3,000 - 5,000mg/day, will not result in a benefit against cardiovascular disease or mortality, and might even be harmful.

It is also true that increased salt consumption in children can contribute to raising blood pressure, subsequently predisposing them to high blood pressure and diabetes type 2 as adults later in life.

### Monitoring Salt

On a molecular weight basis, sodium chloride is 39.34 percent sodium and 60.66 percent chloride. For example, 100g of NaCl contains 39,34g Na and 60,66g Cl. Table salt is the most common and consists of one atom sodium combined with one atom of chlorine representing an equal amount of ions. It is the general term for a compound from the neutralization reaction of an acid and a base. These ionic compounds dissociate completely in water. The US Food and Drug Administration (FDA) standards allow regular table salt to contain up to 2 percent additives like anti-caking agents and processing aids.

From a government point of view, regulating salt is more complicated than it might seem. Many traditional foods like pickles have high salt levels, which will make mandatory federal standards difficult to implement. Most

probably, a voluntary initiative to reduce sodium is the smart way forward.

Policymakers tend to take a precautionary approach in recommending a uniform sodium intake across the population. Salt reduction generally bodes well for the at-risk or subgroups. To balance the discussion, there are downsides of cutting salt intake: it also tends to increase levels of cholesterol, triglycerides, and hormones.

The effects of increasing sodium intake on raising blood pressure become worse as sodium intake rises above 5g per day, especially among people who already have high blood pressure or who are older than 55. While there has been much focus on reducing salt intake, an important and often ignored approach to lower blood pressure is increasing the amount of potassium consumed. Sodium is an important contributor to high blood pressure, one of the leading causes of heart attack and stroke.

Moderation and a balanced approach are likely to have the greatest benefits in lowering blood pressure. This can be achieved through moderation in salt intake combined with eating fruits and vegetables. Rates of strokes, cardiovascular death, and total mortality decreases with increasing potassium intake, and thus diets rich in vegetables and fruits that are naturally high in potassium will serve as a protection mechanism. Additional translational research activities are needed to determine the acceptable range of sodium intake for optimal health. This evaluation should include research that indicates health risks for people who consume too much

sodium, as well as health risks from consuming too little sodium.

It should be pointed out that too low sodium intake also has other associated effects, including adverse elevations of certain hormones that are associated with increased risk of death and cardiovascular diseases. Those with the lowest risk of death and cardiovascular events are people who consume moderate amounts of sodium intake -3,000mg to 6,000mg per day- with an increased risk above and below that average (New England Journal of Medicine, August 14, 2014). For healthy people, salt reduction might indeed be a double-edged sword.

Instead of reducing sodium intake in all populations, sodium reduction strategies should focus on consumer segments with high levels of sodium consumption exceeding 5,000mg/day. Perhaps the best way forward is to generally ease up on sodium restriction, and focus on improving overall diet quality instead.

To be on the safe side, there is strong evidence that population-wide salt reduction may be associated with lower incidence of heart disease and stroke. For now, the sodium reduction debate among academics continues.

### Sodium: In Everything and More

Before sodium intake can be reduced, it is essential to know the sources. Salt is probably the oldest and the most widely-used food additive. Although salt addition to food is of great culinary importance, it can cause numerous health problems if consumed in excess. Too high consumption is associated with

high blood pressure, obesity, cardiovascular disease, and osteoporosis.

Traditionally, the savory and zesty food products, such as soups, seasonings, canned vegetables, noodles, and pizza, contain high levels of sodium. Balancing consumer demands for healthier food with consumer's taste can be a complicated exercise. During the last few years the legacy food companies have struggled with slowing sales as consumers increasingly shun over-processed packaged food that they perceive as unhealthy. Especially millennials who are attracted to natural and locally-sourced foods are accelerating the shift. On top of that, legacy food companies want to be perceived as proactively changing the product formulas to gain strategic marketing positions and to avoid government implemented sugar taxes and salt cap regulations. This is a careful scripted exercise, as these food companies don't want to do anything that might cause consumers to stop purchasing their brands.

Reducing salt (sodium chloride) in processed food and processed meat products are easier said than done. The majority of the salt eaten comes from the salt hidden in processed foods, such as bread, pasta, pizza, soups, and canned vegetables. And yes, also plant-based meat alternative products often contain excessive levels of salt.

Many times, when the taste and flavor of food falls flat, the answer lays in adjusting the salt level. No question that salt has a greater impact on flavor than any other ingredient. As a matter of fact, the relationship of salt to

food is multidimensional: it has its own distinctive taste, and it simultaneously balances and enhances the flavor of other ingredients.

### Clean and Green

Health advocates and medical experts are now often challenging time-tested additives and ingredients like salt, phosphate, and nitrite. The removal of these components might have unwanted technological side effects, such as the increased risk of oxidative rancidity, unattractive discoloration, and shorter shelf life.

Evaporating water from saltwater brine produces all salt crystals. Common (table) salt often contains iodine (which makes it taste slightly metallic) and an anti-caking agent (i.e. silicones) to prevent clumps. For flavor purity, kosher or sea salts are better taste options.

In order to meet consumers' expectations for clean labels, it is now quite common in the US to use a blend of sea salt and celery powder in premium processed meat products like hotdogs and bacon. Such a blend can eliminate the need for synthetic curing agents like nitrates and nitrites. The latter -of course- depends on the specific legislative rulemaking. By replacing these chemical artificial additives with natural alternatives, people can expect greater transparency when it comes to what's in the food they eat.

### Salt Sources

Processed foods, not the saltshaker, are obviously the source of most of the dietary salt consumed on a daily basis. An estimated 70 percent of total dietary sodium chloride (NaCl) intake comes from processed foods, such as

canned soups, bread, snack foods, deli meats, cheese, condiments and - surprisingly - muffins and donuts. To be fair, sodium is not only added to boost flavor but also to improve texture and leavening.

As a reference: sodium found naturally in food is only 14.2 percent of the daily dietary intake, followed by 5.6 percent added while preparing at home, and 4.9 percent via the salt shaker. Sodium in home tap water, dietary supplements and antacids contribute less than 0.5 percent. (American Heart Association Journal Circulation, May 2017).

### Salt and Junk

The current increase in diet-related diseases requires a repositioning of fat and sodium content in processed food, formulated soft drinks, and most fast foods, including processed meats and formulated plant-based meat alternatives. To be fair and balanced, it needs to be pointed out that sodium chloride is closely intertwined with important sensory properties and functional benefits.

Many world societies', including the UK, US and China are consuming dangerous levels of sodium, most often found in processed or restaurant food. In China, most of the salt is added during their own meal cooking preparations. There is little doubt that eating many types of processed foods can be classified as junk food, the consumption of which can become addictive. Salt and fat are especially pleasing to the mouth-feel. With the addition of crunch and sugar, it becomes hard to control compulsive eating.

There is no doubt that there is a clear and consistent correlation

between marketing of products high in fat, sugar and salt and the dietary habits of (young) people. Curbing exposure to junk food advertisements on TV and streaming platforms can be an effective tool to help people make healthy diet choices, thus contribute to reducing obesity and diseases like diabetes type 2.

### Going Forward

The food and meat industry has been working to reduce levels

In other words, to select a stealth approach.

- ▶ Maintain the salt perception but reduce the sodium and substitute with potassium and small amounts of magnesium.

### A Gradual Decline

Part of the problem is that salt provides important benefits for processed-food manufacturers and meat processors. Salt is a cheap ingredient that is ideally

industry to lower the sodium content in food products overnight. Aside from the fact that consumers are accustomed to a certain flavor profile, many technical hurdles in removing salt from food formulations are still unsolved.

Salt might have a negative perception, but if a product is labeled as “sea salt,” consumers have a very favorable opinion. Sea salt is naturally rich in potassium chloride and other minerals. According to the Innova Database, more consumers are using sea salt at home and new products containing sea salt are routinely being introduced.

### Bring It On

Although most consumers believe that low-sodium products are inferior in taste, it is true that taste preferences may change as the amount of salt is gradually changed over time.

There are a few solutions to decrease sodium content without notably changing salt perception:

- ▶ Using smaller salt microspheres can make more sodium available in the mouth for tasting. Only some 30 percent of salt is perceived when food is eaten; the balance is simply swallowed. When smaller microspheres are used, the surface area increases substantially while it dissolves faster and improves the interaction with the tongue, thus, obtaining a greater salt perception.

- ▶ Combining sodium chloride with aromas like vanilla extracts may boost the salt perception. This is also true when typical umami compounds, such as soy sauce, green tea, and Parmesan are used to simulate salt enhancement.



of salt (sodium chloride) over the last ten years. There is much more to be done to achieve the new nutritional and regulatory targets for further reduction. There are two distinct approaches to accomplish sodium reduction:

- ▶ A gradual reduction in the perception of saltiness by consumer.

suitable to extend shelf life. It also enhances flavor, improves texture, and serves as an ideal masking agent for bitterness. An added problem is that many people would say no when asked if salt reduction or elimination means switching to an alternative synthetic or chemical additive. It is unrealistic to expect the food

▶ A sodium-and-potassium combination can be used in the same crystal or grain. Such a combination performs just like regular salt with little or no bitterness.

The typical food supply in the Western world makes it difficult for consumers to choose lower sodium foods. Of the average daily intake of 3,800mg a day, about 70-80 percent comes from commercially-prepared and purchased foods. This number equals a total daily salt intake of 7,6g.

### Sodium Intoxication: The Medical View of Prehypertension

Pre-hypertension is the grey area between normal (under 120/80mm/Hg) and high (over 139/89mgHg), which is also a reason for concern. The condition especially affects an increasing number of young people. Studies indicate that in the ageing Western countries, nearly a quarter of women ages 20 to 44 are pre-hypertensive.

There is a strong correlation between salt intake and blood pressure. In nearly all cases, a low sodium diet shows an almost immediate decline in blood pressure. Salt is a contributor to high blood pressure, which has been linked to higher risk of heart attack, brain hemorrhages or stroke -the leading causes of preventable death. Hypertension -known as high blood pressure- affects more than one in three adults' aged 25 and over worldwide. This equals about one billion adults.

There is a genetic disposition to develop hypertension. High salt intake, high-calorie foods, lack of physical activity, and alcohol

consumption all play an important and decisive role in the increase in hypertension. Associated with hypertension are increased risks of developing kidney failure and blindness.

### Renaissance Potassium

The importance of minerals in the daily diet is enjoying a renaissance with a twist -this time, there is more than just anecdotal evidence, with strong scientific confirmation giving new impetus to the important role of potassium. People in the last few decennia have not only over-consumed sodium, but have also under-consumed potassium. The scientific data supported by EFSA and FDA recommends this mineral to maintain normal blood pressure, muscular, and neurological functions in the body.

To put the discussion into perspective: There are physiological consequences to consider when consuming too little sodium. At decreased levels of intake, triglyceride levels increase, as well as insulin resistance and the activity of the sympathetic nervous system. All of these factors can also increase the risk of heart disease. It may be concluded that sodium reduction is an issue of potential harm for subgroup populations, rather than a generalized recommended daily sodium intake.

Contrary to sodium consumption, potassium intake via dietary intake needs boosting. Dietary potassium

can lower blood pressure by blunting the adverse effects of sodium on blood pressure. Besides these important functions, potassium nutrients are also associated with reducing bone loss and preventing the risk of developing kidney stones. Hence, it is likely that the nutraceutical food industry will develop special fortification foods containing tripotassium citrate and potassium gluconate to boost diet absorption of this important natural mineral.



Several factors are correlated with the reduction of blood pressure following increased potassium supplementation. Preferably, increased potassium fortification intake should be done via whole food coupled with a salt (sodium chloride) reduction to achieve the benefits of an optimum sodium/potassium balance. Increasing potassium intake can be obtained by selecting foods like vegetables, fruits (bananas) and nuts.

Dietary potassium intake will not only delay elevated blood pressure levels, but also delay or defer the need for antihypertensive prescription medication. The World Health Organization (WHO) recommends a daily potassium intake of a minimum of 3.5 gram.

### Sidestepping Phosphate

Phosphates are frequently used for technological reasons - as acidifying agents, acidity buffers, emulsifying agents, and for intensifying flavor. Phosphate is present in many processed foods like soft spreadable cheese, meat products, beverages, canned and frozen vegetables and soups, as well as baked goods. Natural phosphate esters are also typically present in protein-rich foods like lean meat, and are broken down slowly in the gut before being reabsorbed into the body.

The huge increase in processed food consumption has triggered the use of added phosphate, and it is estimated to have doubled from 1980 to 2012, from below 500mg a day to 1000mg a day. Most food legislation rules do not require quantification, but simply identify the presence of phosphate or its E-number on the food label. According to the Department of Agriculture data from 2006, the average phosphate intake for American males and females over two years old is 1,334mg. The Recommended Daily Allowance is 1,250 for pre-teens and teenagers and 700mg for adults, with a maximum tolerable level set at 4 grams per day (Emory University, March 2010).

Phosphates that are added in inorganic form to foods like meat; dairy, bakery, and cereals

appear to cause higher spikes in blood phosphorous levels than naturally-occurring (organic) phosphates. Too much phosphate is a concern for people who are healthy, but it is also of special concern to people who already have kidney damage or chronic renal disease. Typically, the most significant increase in blood phosphate levels occurs in people who eat dairy foods and cereal/grain-based foods that contain artificially-added (inorganic) phosphate (American Journal of Clinical Nutrition, July 2015).

Recent research indicates that elevated serum phosphate intake is possibly correlated with mortality in people and may cause organ calcification in renal (kidney) patients -a correlation between high blood phosphate and cardiovascular disease in healthy people (Deutsches Arzteblatt International 2012).

It is expected that phosphate additives used for meat and food manufacturing will regain new discussions. Apparently in Germany, the use of phosphates in processed meat products is strictly regulated and even forbidden in most meat products. In most countries, the use of phosphates is (vaguely) regulated to inclusion levels up to 0.5 percent.

In the processed meat industry worldwide, salt and phosphate are probably the most frequently-used additives in nearly all categories: emulsified, coarse, enhanced, and whole-muscle meat products. Perhaps the time has come for the food and meat industry to label the presence of added phosphate not only qualitatively but also quantitatively.

It is necessary to distinguish between natural (organic)

phosphates and chemically-derived phosphates. Natural or organic phosphates are mainly found in protein-rich foods like meat, fish, eggs, and dairy. These naturally-occurring phosphates are slowly broken down in the gastrointestinal tract and gradually re-absorbed into the bloodstream from the intestines. In a typical diet, about 50 percent of these organic phosphate esters are re-absorbed this way.

In contrast to organic phosphate, industrially-processed foods have much higher levels of added phosphate to obtain certain product modulations and cost advantages. For example, chemically-derived phosphates are used as preservatives; yield-manipulating agents, acidity buffers, and emulsifying support, as well for intensifying flavor and reducing warmed-over-flavor in cooked meat products. Phosphates are also frequently used as "melting salts" in spreadable cheese, not to mention in sodas and many forms of frozen food.

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