

## SALT: NOT A SWEET STORY

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**S**odium reduction in food products can be challenging. Salt (sodium chloride) is a highly functional ingredient. It not only makes food taste better, but it also allows a clean label, binds water, inhibits microbial growth, and costs cheap. Sodium in foods comes from multiple sources like bread, pastry, coatings (batters/breading), canned soups, brines, and marinades in processed meat and plant meat products.

What is commonly called salt refers to “table salt” -composed of sodium (40%) and chlorine (60%). Salt provides about 90 percent of the sodium needs in the human diet, thus critical for the body to function by enabling transmission of nerve impulses, playing a role in osmotic regulations, retaining water in the body, as well as assisting in the muscle movement and contractions.

An excessive sodium consumption can increase the risks of cardiovascular diseases, including hypertension. It seemed that marketing low-sodium foods was a thing of the past for years, when suddenly low-sodium and reduced-sodium foods 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 in food and processed (plant) meat products.

### Essential Intake

Salt is an essential nutrient for the human body. The big question is, “How much is needed?” 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 over-processed foods and meats.

Salt (sodium chloride and potassium chloride) is essential for humans, particularly for regulating the body’s electrolyte balance, preventing dehydration, and maintaining cellular functions. 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 8-12 grams - an amount that has not changed in a decade- is quite normal in Western countries.

### The Social Status

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 at the global level. The most important

contributors to the overall burden of diet are high in sugar and sodium but low in fruits, vegetables, whole grains, nuts, and seeds.

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 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.

### 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 of sodium combined with one atom of chlorine representing an equal number 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”. 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- is routinely added to prevent clumping. For flavor purity, sea salts are generally better taste options.

From the government's 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.

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 groups. However, there are downsides of cutting salt intake too much: it tends to increase levels of cholesterol, triglycerides, and hormones. Additional 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 not only consume too much sodium but may also experience health risks from consuming too little sodium.

### Salt Stress

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 the average for healthy people, making salt reduction 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 instead focus on improving overall diet quality.

The effects of increasing sodium intake on raising blood pressure becomes worse as sodium intake

rises above 5g per day. This is especially the case 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 dietary 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, hence, diets rich in vegetables and fruits that are naturally high in potassium will serve as a protection mechanism.

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 the population in general, but not necessarily for certain sub-groups. For now, the sodium reduction debate among academics continues.

### Sodium in China

Salt consumption by Chinese adults is consistently about 11g a day. This is more than double the recommended limit of 5g. These recommendations are lower for children younger than 14. These recommendations are in contrast with the Lancet publication in August 2018, which advised 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 necessarily result in a benefit against cardiovascular disease or mortality and might even be harmful. Even more worrisome is that 3 to 6 year-old Chinese children are eating the maximum amount of salt recommended for adults, while older children eat 9g/day.

Even cutting back modestly on daily salt intake can bring

enormous health benefits. In China, a reduction by just 1 gram per day could prevent over nine million heart attacks and strokes per year. High salt intake causes high blood pressure, which significantly increases the risk of cardiovascular disease.

As it stands, the adult salt intake in China is 11 grams per day and this number can be seen as the highest in the world. Lowering this daily salt intake to the WHO recommended level of 5 grams per day, will only be possible if strict legislative regulations are put in place.

Most of the salt intake in China is added manually during cooking, although rapidly changing socio-demographic conditions of consuming increased amounts of hyper-processed foods has also become part of the problems. China's food industry marketing strategies, including promotion and advertising, should be restricted to only foods that meet healthy salt levels.

### Salt Sources

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. Salt addition to food is of great culinary importance. Traditionally, the savory and zesty food products like bread, donuts, bagels, pasta, soups, seasonings, canned vegetables, noodles, and pizza contain high levels of sodium.

Processed foods, not the saltshaker, are the source of most of the dietary sodium consumed daily. An estimated 70 percent of total dietary sodium chloride (NaCl) intake comes from processed foods like canned soups, bread, snack foods, deli meats, cheese, condiments, and - surprisingly - muffins and donuts. To be fair, sodium is added not only to boost flavor but also to improve texture and leavening.

As a reference: sodium that is naturally present in food is only 14.2 percent of the daily dietary intake, followed by 5.6 percent added while being prepared at home, and 4.9 percent via the saltshaker. Sodium in home tap water, dietary supplements, and antacids contribute less than 0.5 percent. In other words, the largest contributor of the daily sodium intake by far comes from processed food products.

### Mechanisms

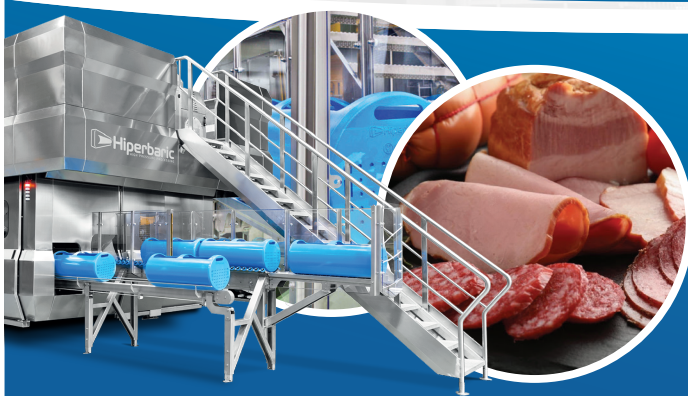
*Salt has multiple roles in processed foods:*

- Taste
- Texture
- Shelf life
- Price

Balancing consumer demands for healthier food with the consumer's taste preferences can be a complicated exercise. During the last few years, the legacy food companies have struggled with declining sales as consumers increasingly shun over-processed packaged food



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### HPP Benefits for Meat Products



**Food Safety**



**Premium Quality**



**Clean Label**



**No Cross Contamination**



**Variety of Packaging**



**New Market Opportunities**

that they perceive as unhealthy. Legacy food companies want to be perceived as proactively changing the product formulas to gain strategic marketing positions and/or avoid government-implemented sugar taxes and salt cap regulations. This is a carefully scripted exercise, knowing that these food companies do not want to do anything that might stop consumers from purchasing their brands.

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

Oftentimes, when the taste and flavor of food falls flat, the answer lays in adjusting the salt level. There is 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 maintains its own distinctive taste, while simultaneously balancing and enhancing the flavor of other ingredients. It also helps that salt is, by far, the cheapest ingredient in the formula.

### Clean and Green

Health advocates and medical experts are often challenging time-tested additives 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, shorter shelf life, as well as less myofibrillar protein solubilization in processed meat and fish products.

To meet the 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

depends on the country-specific legislative policies. By replacing these chemical artificial additives with natural alternatives, people can expect greater transparency when it comes to what is in the food they eat.

### Nitrite: The "No-No Ingredient"

Nitrates and nitrites as well as its chemical reaction compound nitrosamines are increasingly viewed as "no-no". Some proactive food and meat processing companies have removed these additives, even if they are still being allowed as preservatives by most regulatory Agencies.

Nitrosamines are not intentionally added to food and meat products, but rather is the result of a chemical that may form during food and meat preparation such as exposure to direct flames during BBQ cooking and grilling. The dietary presence of nitrosamines may be carcinogenic and genotoxic (may damage DNA).

Scientific data of nitrates and nitrites in products like meat, processed fish, cereals, cacao, milk, vegetables, fermented foods, and spiced foods is still limited. It has become clear, however, that all types of nitrosamines found in food do not have the same potential to cause cancer in humans.

### Nitrite: The Other Side of the Coin

The nitrate and nitrite science spans cell biology and epidemiology that dispel the wrong beliefs about cured meats and confirm the fact that nitrites in processed meat may play an important role in improving health.

Cured meat accounts for only 5 to 10 percent of nitrates and nitrites consumed, while plants like green leafy vegetables account for 90 to 95 percent of nitrates and nitrites consumed. Vegetables also contain supplementary sources of nitric oxide from the nitrogen in soil and fertilizers. Nitric oxide is especially important to cardiovascular health because nitric oxide relaxes and dilates blood vessels, resulting to improved blood pressure. As such, these compounds can be seen as indispensable nutrients since they have an endocrine function of nitric oxide via the formation of S-nitrosoglutathione and inorganic nitrite.

Still, there is a common perception among many people that nitrates, nitrites, and processed cured meat are hazardous to human



health. In the US, food labels carrying the word “uncured” which insinuates that these products are healthier exacerbate this stigma. However, recent clinical studies have clearly demonstrated that dietary consumption of nitrate or nitrite have numerous health benefits, especially related to improved cardiovascular function.

For consumers who have a negative perception of nitrite, a possible healthier alternative that can replace nitrite in processed meat are plant-based micro-compounds and natural flavors. An example is NaNino (Givaudan) that is touted

to use the “nitrite-free” claim not only ensures freshness throughout shelf life but also delivers a cured-like multi-sensory performance in terms of taste and color without the usual associated spoilage risks.

To ease the consumer mistrust and find alternative solutions, there are a number of scientific studies ongoing that are looking for ways to cure meat without adding natural or synthetic nitrite sources. For example, adding amino acid L-arginine, will activate the nitric oxide synthase system to naturally generate nitric oxide and nitrite to cure meat. ●