

TWO WHITE ENEMIES: SALT AND SUGAR

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Introduction to the theme

Humans have had a long and beneficial relationship with salt, sugar, and fat that dates back to the origin of the species. Salt is essential for fluid balance, sugar provides the energy for physical and mental activity while fats of various types make up most of the mass of the brain. Their ability to “flavorize” a vast array of foods, this trio of ingredients became a culinary treasure and used around the world to create those wonderful foods we have come to associate with important historical events, indispensable elements in religious rituals, feasts, festivals as well as those sweet memories from our youth. By the mid 1900s, this trio of salt, sugar, fat took on a new psychosensory dimension when the processed food industry discovered that these ingredients could be formulated to produce a state of satiety, pleasure, and hedonia in those who consumed them [1]. A vast array of craveable chips, dry sweetened cereals, candies, cookies, fried foods, and even spaghetti sauces became wildly popular among consumers, particularly children, and profits for processed food companies soared. Of course, as interest and consumption of craveable foods surged, interest and consumption of more traditional, home cooked cuisine that included fresh fruits, vegetables, and whole grains began to wane. Interestingly, the introduction of sugar substitutes and government recommendations to lower the intake of sugar and salt has produced only slight reductions in recent years. It has been speculated by some in the fields of nutrition and biomedical research that these craveable foods can dysregulate the brain’s food reward system by increasing dopamine production, thus making them addictive. By 1999, the leaders of some of the largest processed-food companies in the U.S. met privately to discuss disturbing data that associated the consumption of craveable foods with an upturn in the rates of obesity, Type 2 diabetes, and cardiovascular disease. Equally disturbing was the finding that the rates of these diseases were higher in certain racial/ethnic populations suggesting strong genetic components in how people perceive the foods they eat (i.e., taste and smell) as well as how these foods interact with their physiology and metabolism. These findings spawned the new field of nutritional genomics that provided evidence for diet genome interactions and genetic variations called single nucleotide polymorphism (SNPs). Some of these SNPs explained why certain individuals are “super tasters” for sugar while others prefer umami flavors. Nutritional genomics also helped explain why some people gain weight while others lose weight on the same isocaloric diet. These are just some of the exciting challenges facing food science and technology today. Addressing salt, sugar, and fat issue the “science of food” way is sure to produce the products and responses that will deliver those benefits of health and longevity that we all desire.



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1. CONSUMPTION OF SALT: PROS AND CONS

Abstract: Common salt as NaCl is essential to life; therefore about 15% of the salt requirement comes from naturally occurring sources in foods. We need, about 200 to 280 milligrams sodium is all a person needs to keep their body systems in good working order, less than this we cannot remain healthy. The human body requires a small amount of sodium to conduct nerve impulses, contract and relax muscles, and maintain the proper balance of water and minerals. On the other hand, the average permissible limits are about 4,000 to 6,000 milligrams of sodium per day! Low sodium levels in the body can lead to muscle cramps, nausea, vomiting and dizziness. Eventually, lack of salt can lead to shock, coma and death. Those with the most dire need for salt will typically have lower blood pressure. An ideal blood pressure would be close to 115/75. Someone with a lower blood pressure may need salt and will likely be light-headed when they go from kneeling to standing. Urine pH can also indicate a need for salt. The common value for urine pH is 6.0–7.5 for most people, but any value within the 4.5–8.0 range is generally not a cause for concern [2]. However, most people are consuming six to eight times more salt than they need. No wonder so many people today are afflicted with conditions associated with excessive salt intake like high blood pressure, fluid retention, muscle cramps, and even kidney problems and heart disease.

Himalayan salt is believed by many to be a healthier alternative to common table salt, or sodium chloride. Though mined like rock salt, Himalayan pink salt is technically a sea salt. Salt is an essential nutrient required for many biological processes that has seasoned our dinners for thousands of years. On the other hand, black salt has antioxidant properties and has surprisingly low sodium levels. It also contains important minerals like iron, calcium, and magnesium, which are essential to healthy bodies. Black salt stimulates bile production in the liver, and helps control heartburn and bloating. Avoiding processed foods and preparing your own meals from fresh whole ingredients is the best way to make sure you are not getting too much salt in your diet.

Keywords: Important diet constituent, Sodium, Cardiac health, Brain functions

INTRODUCTION

Some theorize that salt was as important to our history lessons like all other achievements of man. Some religions still use salt in religious ceremonies such as house warming ceremonies, weddings and religious rituals as a token or recognition of past rituals. Salt is considered to be a very auspicious substance in Hindu mythology since any food offerings to God is never without turmeric and salt.

We love salt, because: 1. It regulates the water content throughout our body. 2. Promotes a healthy pH balance in our body cells, particularly the brain cells. 3. Promotes blood sugar health and helps to reduce the signs of aging. 4. Assists in the generation of hydroelectric energy in form of channels in cells in our body. 5. Helps in absorption of food particles through our intestinal tract. 6. Supports respiratory health. 7. Promotes sinus health. 8. Prevents muscle cramps. 9. Promotes bone strength. 10. Regulates sleep - it naturally promotes sleep. 11. Supports libido.

12. Promotes vascular health. 13. Essential nutrient for the regulation of our blood pressure. 14. Regulates neurotransmission.

Humans have always eaten salt since it is indispensable to sustain life. Salt falls under the category of vital nutrient and is necessary for the body to function. Salt the dietary mineral composed primarily of sodium chloride that is essential for animal life, but can be toxic to many land plants. Salt flavor is one of the basic tastes, making salt the oldest, most ubiquitous food seasoning. Salt is also an important earliest form of food preservative, and without it many billions would have starved or perished from eating rotten meat.

Solnitsata, the earliest known town in Europe, was built around a salt production facility located near Bulgaria, saluted by archaeologists to have accumulated wealth by supplying salt throughout the Balkans. Salt was of high value to Jews, Greeks, Tamils, Chinese, Hittites and other

people of antiquity. Aside from being a contributing factor in the development of civilization, salt was also used in the military practice of salting the earth by various people, beginning with the Assyrians.

Napoleon takes the credit for creating the first “canned” foods with lots of salt for his army, in order to keep them alive while marching towards Russia. Modern day refrigeration has taken the place of salt to cure meat. More than 5 centuries salt cod is produced in Canada, Iceland, and Norway, a major traditional ingredient of the cuisine of many countries around the Atlantic. Traditional preservation by natural wind and Sun dry was replaced with aid of electric heaters. A long interesting history lies to be associated with this edible salt.

Edible salt is white, pale pink or light gray (due to mineral content) crystalline solid obtained from sea water or rock deposits. On our table in the present day this salt may be unrefined salt (sea salt), refined salt (table salt), and iodized salt which is a commercial product having 99.9% pure sodium chloride (NaCl), with 2,132 mg to 2,350 mg of sodium per level teaspoon. Multi-vitamin supplemented with iodine is essential if iodized salt is reduced in diet to make sure enough iodine is available to our body. Himalayan salt is believed by many to be a healthier alternative to common table salt, or sodium chloride. On the other hand, black salt has antioxidant properties and has surprisingly low sodium levels. It also contains important minerals like iron, calcium, and magnesium, which are essential to healthy bodies. Black salt stimulates bile production in the liver, and helps control heartburn and bloating.

The ionic forms of sodium and chloride are indispensable for the survival of all known living creatures, including humans. Sodium ions are involved in brain functions whereas chloride helps protecting against infection, helps digestion, absorption of potassium and helps carry carbon dioxide to the lungs.

Recommended salt intake: A little but not too much: Salt is of course a vital nutrient necessary for the coordination of the body functions. In some countries where families cook their own food they control salt intake according their taste and requirement but in countries like the UK, Ireland and the USA, over 80 per cent of salt intake comes from processed food, and people therefore do not realize quantity they are consuming. The study,

published in the American Heart Association’s journal found that reducing salt intake from 9.7 to 6.5 grams per day reduced average blood pressure from 146/91 to 141/88 mm Hg within six weeks.

Recent data Johnson et al.. [3], on salt intake levels in India show consumption is around 11g. per day, the source being mainly from added salt, higher than the World Health Organization’s (WHO) recommended intake of 5 g per day. The study recommended urgent action to implement a program to achieve the WHO salt reduction target of 30% reduction by 2025. The data here suggest the focus needs to be on changing the consumer’s behaviour on low sodium and salt substitution. One reason why salt intake is high in India is because of the tropical climate, where people lose a lot of salt in the form of sweating.

Apart from supporting vital functions to sustain life, salt gives taste and flavour to our food. Even mother’s milk has a low percent of salt. Over consumption of salt increases the risk of cardiac problems, including, high blood pressure, and hypertension. Many times heart diseases can be fatal. Nevertheless, the evidence for harm caused by excess salt is not irrefutable. Recently Dutch scientists [3] have developed a new technology to enable up to 25 per cent reduction of salt in food products without loss of taste or adding other additives.

Special issues for infants and children: Data relating to salt intake to long-term health outcomes for infants and children are limited. It is inadvisable for children to develop a preference for a high salt diet. Although a small amount of salt is needed in the diet, salt can be very dangerous for infants and should not be added to infant foods. Paediatric Group of the British Dietetic Association linked the increasing prevalence of obesity among young people, exacerbating concerns about high blood pressure and reinforces the need to tackle other contributory factors, including salt [4].

Unfortunately, older infants who are given some solid food comes in precooked form in western world in addition to milk, salt quantities cannot be controlled. In India this trend is creeping in and almost adapted by rich parents for their infants. For infants, the sodium content of breast milk provides about 0.3–0.4g per day of salt. The ability to excrete sodium in the first six months of life is limited and the sodium content of infant formulae is subject to regulation.

Table 1: RNIs for sodium for children

Age	Sodium RNI mg/d (mmol/d)
0–3 months	9 (210)
4–6 months	12 (280)
7–9 months	14 (320)
10–12 months	50 (1200)
1–3 years	22(500)
4–6 years	30 (700)
7–10 years	
11–14 years	70 (1600)

The reference nutrient intakes for sodium, for infants and children over 7 months of age were set using a factorial method to estimate sodium requirements at different stages of growth. Data on the intake of salt among infants and children are derived from the National Diet and Nutrition Survey of pre-school children (1.5 – 4.5 years) and young people (4 –18 years).

Data on 24-hour urinary sodium excretion are not available and salt intake was estimated from recorded food consumption. These figures will be an underestimate as they do not include the addition of salt during cooking or at the table. The epidemiological survey indicated that more than one half of the parents of pre-school children report adding salt when cooking their child's food and 63% of young people (4–18 years) add salt during cooking or at the table. The mean estimated salt intake of pre-school children is 3.8g per day of salt and 6.1g per day among school-age children. Among school-age children salt intake increases with age, in absolute terms, from 4.9g per day of salt in 4 to 6-year-olds to 6.9g per day of salt in 15 to 18-year-olds. However, expressed in relation to the RNI, salt intakes in 4 to 6 year olds and pre-school children are proportionally the highest indicating the fact that at this stage of life, children are transferring to adult-type diets and there is a sharp rise in salt intake. As for adults, the major sources of sodium in the diets of young people (4–18 years) are cereals (approximately 40%). Meat and meat products account for a further 20–25% of sodium intake.

Studies on the impact of salt on blood pressure in infants and children are limited. Blood pressure is lower in children than adults and no clinical guidelines exist for the diagnosis of hypertension. Further research is needed to assess the level of salt in children's diet, which may influence blood pressure independently of other factors. Nevertheless, it would be inadvisable for children to develop a preference

for salt, given the evidence to suggest a link between salt intake and blood pressure in adults. Scientific Advisory Committee on Nutrition [5] has set salt intake targets for infants and children on the same basis as for adults, at 50% above the RNI (Table 1).

According to SACN analysis, the researchers projected that reducing average teenage salt consumption from the current nine grams a day to six grams a day would have many measurable health benefits by the time they reached the age of 50. Benefits included a 7 to 12 percent reduction in coronary heart disease, an 8 eight to 14 percent reduction in heart attacks, a 5 to 8 percent reduction in stroke, and a 5 to 9 percent reduction in death from any cause.

Essential dietary minerals: The body needs many essential minerals classified into major minerals (macrominerals) including calcium, phosphorus, sodium, potassium and magnesium and trace minerals (microminerals) such as copper, zinc, iron, iodine, cobalt, chromium, selenium, nickel and tin. Though these two groups of minerals are equally important, trace minerals are needed in smaller amounts than major minerals. Their requirements are for growth, repair and regulation of vital body functions. Some sources state that sixteen dietary minerals are required to support human biochemical processes by serving structural and functional roles as well as electrolytes: Sometimes a distinction is drawn between this category and micronutrients. Most of the dietary minerals are of relatively low atomic weight.

The following elements in their compound form play important roles in biological processes, such as, enzyme reactions in the body. Insufficiency as well as excess also has a profound expression in the human physiology (Table 2).

Baking soda (Sodium bicarbonate): Sodium is a major mineral that is found in all the body fluids. Baking soda has approximately 821 mg to 980 mg of sodium per teaspoon. Baking soda is one of the essential ingredient of leaven breads, cakes, vegetarian cooking at restaurants, and in antacids. Replacement for good baking soda is available from Healthy Heart Market called Ener-G from Calcium Carbonate and works well by using three times the normal amount (from any given recipe). Other trace nutrients known to be essential in tiny amounts include

Table 2: showing the elements in their compound form playing an important role in biological processes.

Dietary element	RDA/AI (mg/day)	Function(s)	Food sources	Insufficiency	Excess
Sulfur	Relatively large quantities of sulfur are required, but there is no RDA, as the sulfur is obtained from and used for amino acids, and therefore should be adequate in any diet containing enough protein.	A component of organic compounds such as some amino acids and some vitamins.	High Protein foods like: meats, poultry, fish, milk, legumes, nuts, eggs, fish (some of the amino acids that make up protein contain sulfur)	none reported	none reported
Potassium	4700 mg/day	A systemic electrolyte and is essential in coregulating ATP with sodium.	Meat, milk, fresh fruits and vegetables, whole grains, legumes, potato skin, tomatoes, bananas, papayas, lentils, dry beans, avocados, yams, soybeans, spinach, chard, sweet potato, turmeric.	hypokalemia	hyperkalemia
Chlorine	2300 mg/day	Needed for production of hydrochloric acid in the stomach and in cellular pump functions.	Table salt (sodium chloride) is the main dietary source, soy sauce; large amounts in processed foods; small amounts in milk, meats, breads, and vegetables	hypochloremia	hyperchloremia
Sodium	1500 mg/day	A systemic electrolyte and is essential in coregulating ATP with potassium. Needed for proper fluid balance, nerve transmission, and muscle contraction	Table salt (sodium chloride, the main source), sea vegetables, milk, and spinach. soy sauce; large amounts in processed foods; small amounts in milk, breads, vegetables, and unprocessed meats	hyponatremia	hypernatremia
Calcium	1300 mg/day	Needed for heart and digestive system health, supports synthesis and function of blood cells. Important for healthy bones and teeth; helps muscles relax and contract; important in nerve functioning, blood clotting, blood pressure regulation, immune system health	Dairy products, eggs, canned fish with bones (salmon, sardines), green leafy vegetables, nuts, seeds, tofu, thyme, oregano, dill, cinnamon.	hypocalcaemia	hypercalcaemia
Phosphorus	700 mg/day	A component of bones (see apatite), cells, in energy processing, in DNA and ATP (as phosphate) and many other functions. Important for healthy bones and teeth; found in every cell; part of the system that maintains acid-base balance	Red meat, dairy foods, fish, bread, rice, oats. In biological contexts, usually seen as phosphate. Meat, fish, poultry, eggs, milk, processed foods (including sodas)	hypophosphatemia	hyperphosphatemia
Magnesium	420 mg/day	Required for processing ATP and for bones, needed for making protein, muscle contraction, nerve	Raw nuts, soybeans, cocoa mass, spinach, chard, sea food, vegetables, tomatoes, halibut, beans, ginger, cumin, cloves. seeds; legumes; chocolate; artichokes; "hard"	hypomagnesemia magnesium deficiency	hypermagnesemia

continue on next page

Copper	0.900 mg/day	Required component of many redox enzymes, including cytochrome c oxidase.	Mushrooms, spinach, greens, seeds, raw cashews, raw walnuts, tempeh, barley.	copper deficiency	copper toxicity
Iodine	0.150 mg/day	Required not only for the synthesis of thyroid hormones, thyroxine and triiodothyronine and to prevent goiter, but also, probably as an antioxidant, for extrathyroidal organs as mammary and salivary glands and for gastric mucosa and immune system (thymus):Iodine in biology	Sea vegetables, iodized salt, eggs. Alternate but inconsistent sources of iodine: strawberries, mozzarella cheese, yogurt, milk, fish, shellfish.	iodine deficiency	iodism
Selenium	0.055 mg/day	Essential to activity of antioxidant enzymes like glutathione peroxidase.	Brazil nuts, cold water wild fish (cod, halibut, salmon), tuna, lamb, turkey, calf liver, mustard, mushrooms, barley, cheese, garlic, tofu, seeds.	selenium deficiency	selenosis

nickel, silicon, vanadium, and cobalt [6].The secret is to put it into the batter just before putting the recipe into the oven. It begins working right away and will “tire” if it stays out of the oven during preparation time.

Baking powder: Baking powder is used mostly to leaven quick breads and cakes which contains 320 mg to 480 mg of sodium per teaspoon. Yeast may be substituted for baking powder. Replacement brand called Featherweight from Potassium Chloride has only 13.2 mg of sodium per tablespoon, available from health food stores or Healthy Heart Market. Some may refer to KCl as “Potassium Salt” though it is not a salt. Featherweight has to be to evaluated if you are monitoring your potassium more closely before using it. Again, it takes three times the normal amount for any given recipe that you may try to convert. Mixing featherweight thoroughly into the batter immediately prior to placing into oven is essential.

Monosodium glutamate (MSG): A dangerous form of sodium for asthma or migraine headache patients. Used to season dishes at home, restaurant and hotel, added in packaged, canned and frozen foods. MSG is used extensively in Chinese restaurants, and often is the flavor ingredient in foods that advertise “Natural Flavoursings.”

Disodium phosphate: Used in processed cheeses and some quick cooking cereals.

Potassium: Two products used in cooking low

sodium meals for low sodium diets are Featherweight Baking Powder and Herb-ox Low-Sodium bullion (broth) as well as a few other substitute broths. Featherweight uses Potassium Bicarbonate, while Herb-Ox uses Potassium Chloride. Potassium does not increase sodium levels but an increase in potassium in your diet should be discussed with your doctor first. However, potassium works with sodium in our bodies to regulate the body’s waste balance, and normalize heart rhythms. Potassium aids in clear thinking by sending oxygen to the brain; preserves proper alkalinity of body fluids; stimulates the kidneys to eliminate poisonous body wastes; assists in reducing high blood pressure; promotes healthy skin. Potassium must be balanced though too much or too little can cause harm to your system. Symptoms of too little potassium include, poor reflexes, nervous disorders, respiratory failure, cardiac arrest and muscle damage.

Health effects of Salt:

SEM image of a grain of table salt: Unrefined salt contains all four cationic electrolytes (sodium, potassium, magnesium, and calcium), needed for optimal bodily function.

Too much or too little salt in the diet can lead to muscle cramps, dizziness, or electrolyte disturbance, which can cause neurological problems, or be fatal. Drinking too much water, with insufficient salt intake, puts a person at risk of water intoxication (hyponatremia).

Salt is sometimes used as a health aid, such as in treatment of dysautonomia (A nervous system diseases). However, some scientists believe that excess salt intake has no significant role in hypertension and coronary heart disease, as adults' kidneys are able to remove excess salt. It is now also believed that excess salt consumption is not linked to exercise-induced asthma.

Evidence supports the link between excess salt consumption and a number of conditions including:

- * **Heart burn.**
- * **Osteoporosis:** One report shows that a high salt diet does reduce bone density in women, though sufficient data to draw firm conclusions is wanting.
- * **Gastric cancer** (stomach cancer) is associated with high levels of sodium.
- * **Hypertension** (high blood pressure).
- * **Left ventricular hypertrophy (cardiac enlargement):** Excessive salt combined with an inadequate intake of water, can cause hyponatremia. It can exacerbate renal disease.
- * **Edema (oedema):** A decrease in salt intake has been suggested to treat oedema (fluid retention).
- * **Duodenal ulcers and gastric ulcers.**
- * **Death:** Ingestion of large amounts of salt in a short time (about 1 g per kg of body weight) can be fatal.
- * **Surprising signs if eating too much salt:** Puffiness, Bloating, Excessive thirst, Trouble sleeping, Chapped lips, Acne, Poor gut health etc [7].

The risk for disease due to insufficient or excessive salt intake varies depending on the biochemical status of the individual. Some isolated cultures, such as the Yanomami in South America, have been found to consume little salt, possibly an adaptation originated in the predominantly vegetarian diet of human primate ancestors. However, the low salt diets of the Yanomamo Indians does not result in their low blood pressure (Fig. 1).

Australian researchers have developed a new database detailing the sodium contents of hundreds of processed foods, which may help for future research on sodium consumption as well as the reduction in foods.

Writing in the American Journal of Clinical Nutrition,

Fig.1: Yanomami in South America (Brazil) have no salt in their food.



Sydney-based researchers document data from 7,221 food products in 10 food groups. The highest sodium content of around 1283 milligrams per 100 grams was found in sauces and spreads, followed by processed meats (846 mg per 100 g). In a comparison with maximum target levels established by the UK Food Standards Agency (FSA), seen by many as leading the way in salt reduction initiatives, the Australian researchers report that 63 percent of food categories exceed the FSA targets.

Salt is not but sodium is the killer: Sodium is a silver white, highly reactive alkaline, metallic element, soft and malleable in nature. Many people think of salt and sodium being similar, but they are not. Table salt is 40 percent sodium and 60 percent chloride. It is the sodium portion of salt that is important to people concerned about high blood pressure. Keep in mind some sodium is naturally present in most of our foods (See Table 2.) Most of the sodium in processed foods is added to preserve or as a flavor. Watch out for commercially prepared condiments, sauces and seasonings when preparing and serving foods for you and your family. Many, like those in Table 2, are high in sodium.

Sodium is very much needed: Sodium has an important role in maintaining the water balance within cells because of its capability to pump mineral and water into the cell. In addition, sodium is necessary for maintaining osmotic equilibrium (particularly along with potassium), acid-base equilibrium in transmitting nerve impulses, relaxing muscles, regulation of plasma volume, regulation of extracellular fluid volumes and operates in all the cells of the human body by a mechanism which is ATP (adenosine triphosphate) dependent. Sodium is completely absorbed from the gastro intestinal track. Any extra sodium is excreted

by the kidneys. Consuming excess sodium may lead to edema or water retention. Women who consume excess sodium may be at higher risk for developing osteoporosis even if calcium intake is adequate. Some evidence suggests that for each teaspoon of salt (2,000 mg of sodium) consumed, considerable calcium is excreted in the urine.

Athletes and heavy laborers are sometimes concerned about not getting enough sodium to replace what is lost through perspiration. However, salt tablets are not recommended. They may increase dehydration and actually lower the performance. Sodium losses are easily replenished at the next meal.

The adult human body consists of about 100 g of sodium ions of which about 50% is in the bones, 40% in extra cellular fluid (body fluids) and 10% in soft tissues. On the other hand, potassium pumps the by-products of cellular processes out of the cell, eventually eliminating these “wastes” from the body through urine and sweat. The sodium content which is flushed out in urine is regulated by the kidney but that which is lost by sweating is not controlled. When urine is formed, original glomerular filtrate contains sodium in a quantity of 800 g on a daily basis out of which 99% is reabsorbed. Major quantities of sodium are absorbed in the proximal convoluted tubules by an active process. Water is also absorbed along with sodium. In edema along with water, sodium content of the body is also increased (Fig.2).

Sodium restriction in diet is advised to patients suffering from congestive cardiac failure and hypertension. In the early phases of congestive

cardiac failure, hydrostatic pressure in venous side is increased so water is primarily retained in the body. This causes dilution of sodium concentration, which triggers aldosterone secretion normally observed in Cushing’s disease and in prolonged cortisone therapy. This is also known as secondary aldosterinism. During pregnancy, steroid hormone is responsible for sodium retention in the body. In dehydration the blood volume is increased with apparent increase in the concentration of sodium but sodium level in serum is decreased in vomiting, diarrhea, burns, Addison’s disease and in renal tubular acidosis. In severe sweating, sodium may be loss considerably resulting in muscle cramps and headaches.

Requirement of sodium: The requirement of sodium chloride (Table 3) depends upon various factors such as climates, occupation and physical activity levels of individuals such as endurance athletes (exercising > 2 hours in duration have increase sodium levels due to excessive sweat losses). People engaged in hard-work will require a higher quantity of sodium. It is required for glucose exhaustion in the muscles and for the transportation of other neurons in the body across cell membranes. It is used in the treatment of premature ageing, cardio vascular disease, sexual dysfunction and problems related to menopause.

However, hypertensive individuals are recommended to limit their sodium intake < 2,400 mg daily (along with eating a low-fat diet rich in fruits, vegetables, whole grains and low-fat dairy foods) for blood pressure management. The Recommended Daily Allowance (RDA) of sodium adults is about 10 to 15 g per day. No recommended intake has been established, but intakes up to 2.4 grams per day are believed to be adequate for healthy adults.

Fig. 2: Kidney as filtration unit

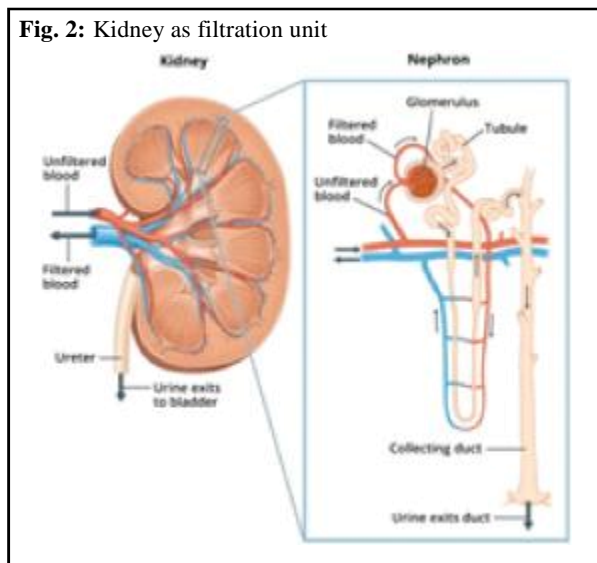


Table 3: RDA committee has set the following minimum daily requirements for healthy people:

Age group	Mini mum sodium requirement (mg/day)
0-0.5 year	120 mg
0.5-1 year	200 mg
1 year	225 mg
2-5 years	300 mg
6-9 years	400 mg
10-18 years	500 mg
Adult	500mg
Pregnant	+69 mg (569 mg)
Lactating	+135 mg (635 mg)

Patients suffering with various ailments or diseases such as diabetes, heart-disease, hypertension, asthma, cancers etc. should consult the physician before taking any nutritional product with sodium. In case of feeling dizzy or nauseated, you must report to your doctor immediately.

Deficiency of sodium: Americans well exceed their sodium intake though minimum physiological requirement for sodium is only 500 mg daily. However, athletes who eat mostly fresh foods and consume water (versus sports drink) during exercise maybe at risk for hyponatremia characterized by lethargy, confusion, muscle twitching, seizures and coma. Hyponatremia may also be due to excessive intake of fluid especially those experiencing renal insufficiency.

Toxicity of sodium: No upper safety limits for sodium have been established because the body generally excretes excess sodium through the kidneys. But health organizations recommend daily consumption of sodium < 2,400 mg per day (about half of that found in the typical American diet).

What conclusion has the medical community come to regarding high-sodium diets?: The medical community has reached a consensus that diets high in sodium are a major cause of high blood pressure as well as pre-hypertension, or blood pressure just short of high blood pressure. This significantly increases the risk of having a heart attack or stroke.

Since 1994, the evidence for an association between dietary salt intakes and blood pressure has increased. The data have been consistent in various study populations and across the age range in adults. Encouraging observation from a large scale study during 2007 has shown that people with high-normal blood pressure who significantly reduced the amount of salt in their diet decreased their chances of developing cardiovascular disease by 25% over the following 10 to 15 years. Their risk of dying from cardiovascular disease decreased by 20%.

About how many people suffer from high blood pressure and pre-hypertension?: Hypertension or elevated blood pressure is a serious medical condition that significantly increases the risks of heart, brain, kidney and other diseases. An estimated 1.13 billion people worldwide have hypertension, most (two-

thirds) living in low and middle-income countries. In 2015, 1 in 4 men and 1 in 5 women had hypertension. Fewer than 1 in 5 people with hypertension have the problem under control. Hypertension is a major cause of premature death worldwide. One of the global targets for non-communicable diseases is to reduce the prevalence of hypertension by 25% by 2025 (baseline 2010).

Blood pressures greater than 140/90 are considered hypertension, while those between 120/80 and 140/90 are considered being pre-hypertension. The risks of heart attack, congestive heart failure, stroke, and end-stage kidney disease increase progressively as blood pressure levels rise above normal levels.

Results from the great India blood pressure survey on the prevalence of hypertension among Indian adults shows an alarming state that around 17.6% of patients with hypertension globally live in India, which suggests an expected large increase in cardiovascular diseases burden in the near future. There is a very high prevalence of hypertension among Indian adults, across all age groups. In addition, there is poor awareness, treatment, and control among those with hypertension. The awareness of high blood pressure was, however, much lower than that reported in similar studies from Canada (83%), the USA (81%), or England (65%) [8,9].

Sodium is a major cause of high blood pressure, more so than obesity or other factors: Although obesity and other factors also contribute to hypertension, excessive sodium intake is one of the most important causes and the cause most amenable to a public health solution. A landmark randomized clinical trial; the Dietary Approaches to Stop Hypertension (DASH) Sodium study demonstrated a clear relationship between habitual sodium intake and blood pressure. The study randomized participants either to the DASH eating plan, which is high in fruits, vegetables and fibre and low in fat, or to the usual American diet.

Individuals ate their respective diets at three sodium levels: high (3,300 mg), intermediate (2,400 mg) and low (1,500 mg). A teaspoon of salt contains roughly 2,400 mg of sodium. Reducing sodium from the high level to the low level lowered blood pressure by 8.3/4.4 mm Hg in people with high blood pressure and by 5.6/2.8 mm HG in people with normal blood pressure. Blood pressure reductions would have

Table 4: Quantity of Sodium for comparisons

Little	Low	More
Apple, 1–2 mg	Apple sauce, 1 c.–6 mg	Apple pie, 1/8, frozen--208 mg
Low sodium bread, 1 slice--7 mg	Bread, 1 slice, white--114 mg	Pound cake, 1 slice--171 mg
Vegetable oil, 1 tbsp.--0 mg	Butter, 1 tbsp., unsalted--2 mg	Butter, 1 tbsp., salted--116
Chicken, 1/2 breast--69 mg	Chicken pie, 1, frozen--907 mg	Chicken noodle soup, 1 c.--1,107 mg
Fresh corn, 1 ear--1 mg	Frozen corn, 1 c.--7 mg	Corn flakes, 1 c.--256 mg
Cucumber, 7 slices--2 mg	Sweet pickle, 1--128 mg	Cucumber w/salad dressing--234 mg
Pork, 3 oz.--59 mg	Bacon, 4 slices--548 mg	Frankfurter, 1--639 mg
Lemon, 1--1 mg	Catsup, 1 tbsp.--156 mg	Soy sauce, 1 tbsp.--1,029 mg
Potato, 1--5 mg	Potato chips, 10--200 mg	Mashed potatoes, instant, 1 c.--485 mg
Plain yogurt, 1 c.--105 mg	Milk, 1 c.--122 mg	Buttermilk, 1 c.--257 mg
Steak, 3 oz.--55 mg	Corned beef, 3 oz.--802 mg	Jumbo burger, fast food--990 mg
Tomato, 1--14 mg	Tomato juice, 1 c.--878 mg	Tomato soup, 1 c.--932 mg
Tuna, fresh, 3 oz.--50 mg	Tuna, canned, 3 oz.--384 mg	Tuna pot pie, 1 frozen--715 mg
Peanuts, unsalted, 1 c.--8 mg	Peanut butter, 1 tbsp.--81 mg	Peanut brittle, 1 oz.--145 mg
Low sodium cheddar, 1 oz.--6 mg	Cheddar cheese, 1 oz.--176 mg	Cottage cheese, 1/2 cup--257 mg
Water, 8 oz., tap--12 mg	Club soda, 8 oz.--39 mg	Antacid in water--564 mg

major impacts on mortality as well as on the occurrence of disabling disease resulting in fewer deaths from stroke and coronary heart disease.

WHO recommendations on hypertension: The Institute of Medicine of the National Academy of Sciences, the Department of Agriculture, the Department of Health and Human Services and the World Health Organization have all supported lowering daily sodium intake to no more than 2,400 mg and some of those agencies have said that many people should consume less than 1,500 mg.

Some good tips to consume less sodium on a daily basis:

- * Making recipes from scratch will allow you to avoid much of the salt in your diet.
- * If you do buy any processed foods in the supermarket, select ones that are the lowest in sodium. Products that are labelled “sodium free” or ones that have less than 100 mg per serving are the best.
- * When you go to a restaurant, ask them to prepare your food without adding any salt and to use other spices instead. Most restaurants will agree to do this or will suggest items with low salt.
- * Avoid salting your food.
- * Use spices other than salt when cooking. Examples include pepper, basil, thyme, garlic.
- * Choose snacks low in sodium like fruits and vegetables. Avoid salty snacks such as pretzels and potato chips.

Dietary Sources: Common dietary sources of sodium are often processed food to which salt is added during preparation, such as cheeses, soups and pickles. Additionally, processed, commercially prepared or restaurant foods are generally high in sodium. Other important considerations are healthful eating, maintaining ideal body weight, physical exercise, stress management and the amount of mono- and polyunsaturated fatty acids in the diet. Foods rich in calcium, magnesium and potassium are strongly recommended as protective measures against hypertension.

Salt-Sodium conversions: The link between salt and sodium may be a little hard to understand at first. If you remember that one teaspoon of salt provides 2,000 milligrams of sodium, however, you can estimate the amount of sodium that you add to foods during cooking and preparation, or even at the table 4.

Sodium labelling: Nutrition and ingredient labels (on foods can show you the major sources of sodium in your diet and help you get an idea of your sodium intake. Nutrition labels list the Daily Value (DV) for specific ingredients, including sodium. The sodium content of the food is listed in mg and as a percent of the daily value. The amount of sodium listed per serving includes sodium naturally present in the food as well as sodium added during processing. Ingredients for all foods must be listed on the label, including standardized foods. Ingredients are listed in descending order by weight. Salt is the major, but not the only, source of sodium in food products. Any

ingredient that has sodium, salt or soda as part of its name (monosodium glutamate, baking soda, seasoned salt) contains sodium. Soy sauce and other condiments used as ingredients also contribute sodium. For example ingredients such as Potatoes, vegetable oil, whey, salt, dried milk solids, sour cream, onion salt, monosodium glutamate, dried parsley, lactic acid, sodium citrate, artificial flavors. This food contains four sodium-containing ingredients and salt is the fourth ingredient by weight. Therefore, this product is probably high in sodium.

Table 5: Part of the nutritional label seen on the foods.

- 1/4 tsp. salt = 500 mg sodium
- 1/2 tsp. salt = 1,000 mg sodium
- 3/4 tsp. salt = 1,500 mg sodium
- 1 tsp. salt = 2,000 mg sodium

Specific health claims can be made about sodium for food products that meet certain requirements. For example, “A diet low in sodium may reduce the risk of high blood pressure, a disease associated with many factors.” In order to make a health claim about sodium and hypertension (high blood pressure), the food must be low or very low in sodium.

The following terms describe products that help reduce sodium intake:

- * Sodium free: Less than 5 mg per serving.
 - * Very low sodium: 35 mg or less per serving and, if the serving is 30 g or less or 2 tablespoons or less, per 50 g of the food.
 - * Low sodium: 140 mg or less per serving and, if the serving is 30 g or less or 2 table spoons or less, per 50 g of the food.
 - * Reduced or Less sodium: At least 25 percent less per serving than the reference food.
- One of the Dietary Guidelines for Americans is to avoid too much sodium which can be followed for the eating habits with high sodium. Use the following suggestions as starting points to reduce sodium in your diet.
- * Cover up some of the holes on the salt shaker or take it off the table. Learn to enjoy food’s natural taste.
 - * Use more fresh fruit, vegetables and meat. The more processed the food is, the more sodium it may contain. (Table 2.)

- * Use canola oil or olive oil instead of butter or margarine in cooking.
- * Check food labels for the words salt or sodium. Salt often is used as a preservative or flavouring agent.
- * Season foods with herbs and spices rather than salt (Table 6).
- * Do not use salt substitutes, especially those that contain potassium, without first talking to your doctor.
- * Check with your doctor or pharmacist for the sodium content of medications, especially antacids, cough medicines, laxatives and pain relievers.
- * Try products such as low or reduced sodium to curb sodium intake. Shop carefully. These products can be more expensive. Make sure the reduction in sodium justifies the added cost.
- * Plan meals that contain less sodium. Try new recipes that use less salt and sodium-containing ingredients. Adjust your own recipes by reducing such ingredients a little at a time. Don’t be fooled by recipes that have little or no salt added but call for ingredients like soups, bouillon cubes or condiments that do.
- * Make your own condiments, dressings and sauces and keep sodium-containing ingredients at a minimum (Table:7).
- * Cut back on salt used in cooking pasta, rice, noodles, vegetables and hot cereals.
- Taste your food before you salt it. If, after tasting your food, you must salt it, try one shake instead of two.
- * If using canned food, rinse in water to remove some of the salt before preparing or serving.

Your vitamins and some medications may also have sodium. A Centrum Senior or comparable vitamin contains nearly 61 mg of sodium. In our low sodium lifestyle, that can be more than 10% of a desirable daily intake.

Sodium: too much or too little : A sodium deficiency may accompany extreme water loss, such as in the case of starvation, profuse sweating, or excess vomiting or diarrhea. In this case, symptoms include low blood volume, low blood pressure muscle cramping, high hematocrit (a measure of iron levels in he blood)

Note: Only when weight loss from perspiration

Table 6: Seasoning without your salt shaker with herbs and spices

For Appetizers	
Hors d'oeuvres	Chervil, oregano, paprika, parsley
Cheese dips and spreads	Basil, chervil, dill weed, marjoram, oregano, sage, parsley, summer savory, tarragon
Deviled or stuffed eggs	Curry powder, dill weed, summer savory, tarragon
Dips	Curry powder, oregano, chervil, parsley
Mushrooms	Oregano, marjoram
Seafood cocktails and spreads	Basil, dill weed, thyme, bay leaves, tarragon
For Vegetables	
Asparagus	Lemon peel, thyme
Broccoli	Lemon juice, onion
Brussels sprouts	Lemon juice, mustard
Cabbage	Dill weed, caraway seeds, oregano, lemon juice, vinegar, onion, mustard, marjoram
Carrots	Marjoram, ginger, mint, mace, parsley, nutmeg, sage, unsalted butter, lemon peel, orange peel, thyme, cinnamon
Cauliflower	Rosemary, nutmeg, tarragon, mace
Celery	Dill weed, tarragon
Cucumbers	Rosemary, onion
Green beans	Basil, dill weed, thyme, curry powder, lemon juice, vinegar
Peas	Mint, onion, parsley, basil, chervil, marjoram, sage, rosemary
Potatoes	Bay leaves, chervil, dill weed, mint, parsley, rosemary, paprika, tarragon, mace, nutmeg, unsalted butter, chives
Spinach	Chervil, marjoram, mint, rosemary, mace, nutmeg, lemon, tarragon
Squash	Basil, saffron, ginger, mace, nutmeg, orange peel
Tomatoes	Basil, bay leaves, chervil, tarragon, curry powder, oregano, parsley, sage, cloves
Zucchini	Marjoram, mint, saffron, thyme
For Entrees	
Eggs and cheese	Curry powder, marjoram, mace, parsley flakes, turmeric, basil, oregano, rosemary, garlic, mustard, mace, ginger, curry powder, allspice, lemon juice, pepper
Fish and shellfish	Basil, bay leaves, chervil, marjoram, oregano, parsley, rosemary, sage, tarragon, thyme, lemon peel, celery seed, cumin, saffron, savory, dry mustard
Poultry	Basil, saffron, bay leaves, sage, dill weed, savoury, marjoram, tarragon, oregano, thyme, rosemary, paprika, curry powder, orange peel, cranberries, mushrooms
Pork	Cloves, garlic, ginger, mustard, nutmeg, paprika, sage, rosemary, savoury, thyme, curry powder, oregano, apples
For Fruits and Desserts	
Apples	Allspice, cardamom, ginger, cinnamon, cloves, nutmeg
Bananas	Allspice, ginger, cinnamon, nutmeg
Oranges	Allspice, cinnamon, anise, nutmeg, cloves, ginger, mace, rosemary
Pears	Allspice, cinnamon, nutmeg, anise, mint
Fruit compotes	Basil, rosemary, saffron, thyme
Puddings	Arrowroot, cinnamon, cloves, lemon peel, vanilla bean, ginger, mace, nutmeg, orange peel

exceeds six pounds should sodium losses raise concern. Even then, merely salting foods can remedy the situation. If sodium levels are low, independent of body water loss, water intoxication can result. Symptoms of water intoxication include: mental apathy, muscle twitching, loss of appetite, muscle weakness, poor memory and concentration, loss of appetite, acidosis (a disruption in the body's normal acid-base balance, resulting in a more acidic pH), dehydration

All food products contain a nutrition facts label, which states a food's health considerations: Sodium intake may be a primary factor in the development of high blood pressure (hypertension). About half of the people with hypertension and 30 percent of the general public are described as "salt sensitive." This means that their blood pressures are likely to increase when they eat a high-sodium diet, and conversely, their blood pressures may be lowered

by limiting dietary sodium. Salt sensitivity is difficult to accurately diagnose. Therefore, appropriate sodium recommendations are a subject of great debate among nutrition experts. Some believe that all people should limit their sodium intakes (to 2400 mg/day) to either treat or prevent hypertension, regardless of their present blood pressure level. Others, though, advise that only people with hypertension or those who are believed to be salt sensitive need to limit sodium in their diets.

Lifestyle measures to reduce hypertension

- * Maintain normal weight for adults (body mass index 20–25kg/m²).
 - * Reduce sodium intake to <100 mmol/day (<6g salt or <2.4g sodium/day).
 - * Limit alcohol consumption to 3 units sodium concentration to a value exceeding 145 mmol/L its/ day for men and 2 units/day for women,.
 - * Engage in regular aerobic physical exercise (brisk walking rather than weight lifting) for 30 minutes per day, ideally on most of days of the week but at least on three days of the week.
 - * Consume at least five portions/day of fruit and vegetables.
 - * Reduce the intake of total and saturated fat.
- kidney stones: Increasing dietary salt intake might raise the risk of kidney stones by increasing urinary calcium excretion.

Salt reduces effects of blood pressure drugs:

Blood Sodium does not indicate what we are ingesting or the sodium we are concerned about unless we get too little or far too much. The kidneys keep the blood sodium constant within narrow limits, and they do it by dumping all surplus sodium into the urine. That is why a blood test tells you nothing about your sodium intake except that you are getting enough. A 24-hour urine collection may reveal that your sodium intake is excessive and that your kidneys are doing a lot of work to get rid of it. When the kidneys want help they have the ability to raise your blood pressure? The sodium leaves faster when they do that. Continued high dietary intakes of salt may make people resistant to blood pressure-lowering drugs, says a new study that provides “additional support of efforts to reduce salt content in foods”.

Up to 30 per cent of people with high blood pressure (hypertension) fail to respond to anti-hypertensive medications, a condition known as resistant

Table 7: Some high-sodium condiments.

Onion salt	Baking soda
Celery salt	Monosodium glutamate (msg)
Garlic salt	Soy sauce
Seasoned salt	Steak sauce
Meat tenderizer	Barbeque sauce
Bouillon	Catsup
Baking powder	

hypertension [10]. Consuming a diet high in salt, despite medication, may contribute to this condition,

according to findings published in Hypertension.

This is the first study to assess the effects of low dietary salt ingestion in subjects with resistant hypertension,” wrote the researchers, led by Eduardo Pimenta from the Hypertensive Unit at the Princess Alexandra Hospital in Brisbane, Australia [11]. “Taking into consideration that 75 per cent of the daily intake of sodium in Westernized countries is from salt added during commercial processing of foods or during food preparation by restaurants, reductions in the sodium content in the food supply would be a critical component to achieve lower levels of sodium intake,” they added.

Pimenta and his co-workers recruited 12 people with resistant hypertension and randomly assigned them to receive either a low (about 3 grams of salt per day) or high sodium diets (about 15 g of salt per day) for seven days. This was followed by a two week washout period, and the participants were then crossed over to the other group [11].

All of the participants were taking an average of 3.4 anti-hypertensive medications, and had an average blood pressure of 145.8/83.9 mmHg. The low salt diet was associated with a 22.7 and 9.1 mmHg decrease in systolic and diastolic blood pressure, respectively, compared to the high-salt diet, despite the continued taking of the medication.

The data demonstrated that patients with resistant hypertension benefit from intensive dietary salt restriction and provide rationale for inclusion of specific recommendations in dietary guidelines regarding salt intake for the treatment of resistant hypertension.

Salted foods may increase cancer risk: A study with almost 80,000 men and women showed that salted foods like salted fish Roe were associated with a 15 per cent increase in total cancer, while high sodium intake was associated with a 20 per cent increase in cardiovascular disease (CVD) risk,

according to the findings published in the American Journal of Clinical Nutrition [12]. A pilot prospective cohort study to simultaneously examine associations between sodium and salted foods and the risk of cancer and CVD was done. Manami Inoue from the National Cancer Centre, Tokyo supported the notion that sodium and salted foods have differential influences on the development of cancer and CVD [13].

Inoue and co-workers examined the influence of salt and salt-preserved foods on the risk of CVD or cancer in 77,500 Japanese men and women aged between 45 and 74. Dietary patterns were estimated using a 138-item food frequency questionnaire. During the course of their follow-up, 2,066 cases of CVD and 4,476 cases of cancer were diagnosed. The most common forms of cancer documented were gastric, colorectal, and lung cancer.

Statistical analysis showed that people with the highest intakes of sodium – 6,844 milligrams, equivalent to about 17 grams of salt, had a 19 per cent higher risk of cardiovascular disease, compared to people with the lowest average intakes, 3,084 milligrams of sodium, equivalent to about 7 grams of salt.

Sodium and salt itself was not associated with cancer risk, but the consumption of salted foods such as pickled vegetables, dried and salted fish Roe were linked to a higher risk of gastric and colorectal cancer. One possible explanation, associations of cancer with specific foods with high salt concentrations, such as salted fish Roe, may be due to the presence of carcinogens called N-nitroso compound these foods have, which may be formed from nitrate or nitrite preservatives. According to Inoue and co-workers “An additional, inseparable explanation is the destruction of the gastric mucosal barrier by a high intragastric salt concentration, which leads to inflammation, diffuse erosion, and degeneration.

A new study from Ireland observed that commercial lasagne produced with reduced salt levels and salt substitutes scored higher on consumer tests than the ‘normal’ salt version. Salt reductions of up to 29 per cent were achieved by Irish scientists without affecting the overall taste and saltiness of the finished product, while formulation with salt substitutes like potassium chloride (KCl) could reduce salt levels even further without compromising consumer

acceptability, salty taste and sensory preference for the meal.

The research also provides a fill up for salt substitute producers and suppliers since concerns related to bitter tastes associated with the use of KCl-based salt substitutes. The results, published in the Journal of Food service, show the potential for food formulators to meet the stringent demands of national initiatives to reduce the salt content of their products [14].

In combination with researchers from the University of Limerick, Mitchell and her co-workers found that salt could be cut by 0.3 per cent to achieve salt levels of 0.75 per cent without affecting the sensory profile of the product [14]. Furthermore, when salt substitutes, particularly KCl were used into the lowest salt lasagne ready meal at a concentration of 0.5 per cent, salt levels could be reduced by a further 0.2 per cent.

Commenting on the lack of bitterness detected on using the potassium chloride, the researchers noted that the presence “flavour-potent herbs and spices in the lasagne ready meal that may have acted to mask the bitter taste normally associated with the inclusion of KCl” [12]. “This could therefore be a potential salt substitute used by certain sectors of the foodservice industry, particularly those serving spiced foods.”

Controlled salt intake: Six grams per day of salt has been set as the national salt intake target, as part of the broader changes in diet and lifestyle to reduce the risk of cardiovascular disease. The 6g/day target will bring health benefits. It has been estimated that a reduction in current salt intake to 6g per day would predict a 13% reduction in stroke and a 10% reduction in ischemic heart disease.

In 1991, COMA (Committee on Medical Aspects of Food and Nutrition Policy) set a Reference Nutrient Intake for sodium of 1.6g (70 mmol) for young people over 11 years and adults which equates to 4g per day of salt. Proportionally lower RNIs were set for infants and children (Table 1). However, the average intake of salt for adults is currently more than double the RNI and considerably higher for young children. (Table-8) shows the current distribution of salt and sodium intake among men and women. Following consultations with experts, policy

Table 8: The recommended targets for salt & sodium are given below.

Age	Salt Intake g/d	Sodium Intake g/d
Up to 6 months	Less than 1g a day salt	Less than 0.4g sodium
7–12 months	1g a day salt	0.4g sodium
1–3 years	2g a day salt	0.8g sodium
4–6 years	3g a day salt	1.2g sodium
7–10 years	5g a day salt	2.0g sodium
11–18 years	6g a day salt	2.5g sodium
Adults	6g a day salt	2.5g sodium

Source: SACN 2003

makers, industry and consumer groups, a salt reduction target to 6g per day for young people over 11 years and adults, was set for 2010. Targets for younger children are proportionally lower.

first step in a long-term program for salt reduction designed to reduce the risk of stroke and cardiovascular disease. This is part of a general lifestyle approach to improving health, which includes measures aimed at decreasing intakes of saturated and total fat, reducing smoking and alcohol consumption, and increasing physical activity.

Concern over the impact of too much salt weigh heavy on governments, pushing them towards costly public health campaigns. Around the world, salt awareness-raising from the top down is being met by bottom-up action from food manufacturers, who are deeply engrossed in reformulation to reduce the salt in their products.

Bit-by-bit, excess salt is being squeezed out by a combination of education and choice-editing. Whether we realise it, or whether it's 'hidden' in packaged and processed foods, we are taking stock of our salt intake.

Swedish salt study calls for clearer rules for food industry: Young Swedish men are consuming twice as much salt as recommended, says a new study which increases pressure on the food industry to curb the salt content of its products. Swedish male 18 to 20-year olds were found to consume an average of double the WHO recommended of 80 to 110 micromoles of sodium per day, equivalent to 5 to 6 grams of salt per day.

With high blood pressure being the biggest contributing factor for stroke, it will come as no surprise that studies have examined a link between salt intake and stroke.

A meta-analysis by [Dr Feng et al. \[15\]](#) reported in 2002 that cutting daily salt intake by six grams may cut stroke by 24 per cent and coronary heart disease (CHD) by 18 per cent. Such a reduction would translate into a global reduction of about 2.5 million deaths.

Impact of salt burden on various vital organs:

Kidneys: Increased salt intakes have also been linked to kidney health, with studies focusing on albumin levels. Microalbuminuria occurs when small amounts of albumin – the most abundant protein in human serum - leaks from the kidney into the urine. It is a marker of early kidney disease development. Montpellier, France-based scientists reported that increased blood pressure, associated with salt intake, increased kidney damage, as measured by increased amounts of urinary protein or albumin.

Stomach damage: The link between salt intake and stomach cancer has been reported in several studies, and centres on the role of *Helicobacter pylori* - the only bacteria that can survive in the acidic environment of the stomach and known to cause peptic ulcers and gastritis. Infection with *H. pylori* also causes gastritis, and infected persons are said to have a two to six-fold increased risk of developing mucosa-associated lymphoid tissue (MALT) lymphoma, and gastric cancer compared with uninfected counterparts.

According to the World Action on Salt and Health (WASH), studies from 2004 [16] and 2008 [17] reported that salt may increase the growth and action of *H. pylori*, thereby raising the risk of stomach cancer. Furthermore, a Japanese study from 2006 reported that salt may play a role in the irritation and inflammation of the stomach lining.

Bones: A recent study from Australia reported that salt reduction may also have benefits for bone health in women at risk of osteoporosis – a condition described by the World Health Organisation as its biggest global healthcare problem. Writing in the *British Journal of Nutrition* [18], researchers from Deakin University reported that middle-aged women with pre- or stage 1 hypertension assigned to consumed a low-sodium diet experienced reductions in calcium excretion compared to people consuming a high-carbohydrate low-fat diet. A study from scientists at the Purdue University looked at the

effects of salt in adolescent girls. Their results, published in the American Journal of Clinical Nutrition [19], suggested that Caucasian girls lose more calcium in their urine than African-American girls. But both races lose calcium at an accelerated rate when they consume a high-salt diet.

Smart salt distribution can cut salt without extra additives. Dutch scientists have developed a new technology to enable up to 25 per cent reduction of salt in food products without loss of taste or adding other additives. Scientists at Top Institute Food and Nutrition (TIFN) in the Netherlands have developed a technique to reduce salt without adding sodium substitutes, or taste or aroma additives.

‘It is not an easy task for the food industry to reduce salt, because there is no real alternative equalent to salt. This new technology will enable the food industry to lower the salt content of many products,’ he added.



Fig. 4: Experimentally salt-deprived (on right) versus normally fed (on left) 3 week-old broiler chicks

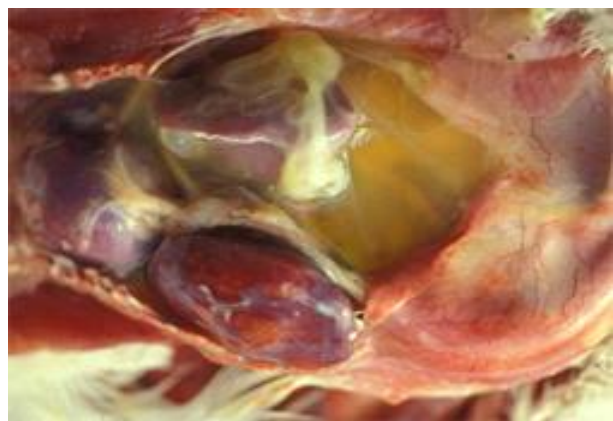


Fig. 5: The abdominal and thoracic cavity of a broiler with ascites syndrome, which can often follow salt deficiency. Yellowish fluid can be seen in the abdomen, and the liver is firm and swollen

New salt balances sodium and potassium: A new sea salt with 66 percent less sodium than common table salt and high potassium content is being offered to food manufacturers, after six years of development work involving salts from the Mediterranean region. Bez Arkush, founder of US-based company Bon Vivant, the company has spent six years working on a proprietary process to balance sodium and potassium content in salt.

He explained that the result, called NutraSalt 66, is made from a combination of two different sea salts, from the Dead Sea and the Red Sea. While all natural sodium chloride salts have more or less the same sodium level, other minerals are present in different quantities, and the company’s process enables these to be finely balanced.

But it’s not just about sodium reduction. Arkush [20] believes there will be more attention paid to the positive role of potassium. The Institute of Medicine recommends people consume at least 4.7g of potassium per day, to reduce the risk of kidney stones and bone loss and blunt the effects of excess salt. Bon Vivant (21) is eyeing three channels for the salt. It says it can be used by food manufacturers, and tests have yielded good results in soups, bakery, meat – and even in certain beverages where the electrolyte balance is important.

Salt reduction action varies:

Indian practice: In India almost every family cooks their own meals and they add salt in curries and bread according to individual taste unlike many other countries. When cooked meals, ready to eat or half cooked meals are purchased they do not have their control over quantity of addition of salt. In India we do not need salt reduction regulation, however, still in many section of populations on religion basis people eat once a week *Aloona* (without Salt) meals, which will compensate even if one has taken more salt during the other days.

Western practice: Some countries, such as France, Ireland and the UK, started raising public awareness as early as 2004 (Ireland, Lithuania, UK) and 2005 (Belgium). But in Austria, Estonia, Spain, France, Latvia, Norway, and Switzerland, the campaigns only swung into action in 2009.

Germany, EL and MT stand out as the slowest

member states in the process. Germany only started studying sodium excretion in the population so as to measure total salt intake last year.

As for reformulation to reduce levels in foods, France, Ireland and the UK were early adopters again; Czech Republic, Germany, Estonia, Greece, Malta, Sweden, Slovenia did not have plans in place.

As consumers become increasingly more health conscious, the reduction of sodium is becoming more and more important in the food and beverage industry. Until now, sodium reduction was often opposed through the argument that products would suffer in terms of taste. With Sea Salt rim® (Low in sodium, great in taste), a flavourful revolution for the reduction of sodium in food and beverages is possible. It makes it easier than ever to meet the consumer demand for sodium reduced products and still have an authentic salty taste.

Clean label declaration: Sea Salt rim® is based on the combination of sea salt and a natural functional flavour. It uses a low sodium sea salt that is naturally rich in potassium chloride. The natural functional flavour in Sea Salt rim® neutralizes any undesirable off-notes. This unique technology enables for a sodium reduction of up to 45 percent in food and beverages. At the same time, the taste and mouth feel of the products are not impaired. Since Sea Salt rim® is a combination of purely natural ingredients, it can be declared as sea salt and natural flavouring. Sea Salt rim® offers even more advantages as a heat-resistant and non-allergen.

Sea Salt rim® is suitable for the use in a variety of applications. In particular, deep-frozen dishes, canned food, also in soups, sauces and salad dressings benefit from the reduced sodium content of the natural ingredient combination. In addition, Sea Salt rim® can be used in meat, salty snacks, baked goods as well as vegetable beverages.

Why worry about salt: Our body works to maintain a delicate balance of sodium and water. When we eat salt (sodium) the body pulls in or holds onto to extra fluid to keep this balance. The extra fluid increases blood volume. “If there’s more fluid in our blood vessels, there’s more circulating blood volume, and that raises blood pressure,” explains Dr. Helen Delichatsios, assistant professor of medicine at Harvard Medical School. Having high blood pressure

increases our risk for a heart attack or a stroke.

Women urged to eat potassium-rich foods to improve their heart health: Women who eat bananas, avocados and salmon could reduce the negative effects of salt in the diet. The study found that potassium-rich diets were associated with lower blood pressure, particularly in women with high salt intake.”Health advice has focused on limiting salt intake but this is difficult to achieve when our diets include processed foods. Potassium helps the body excrete more sodium in the urine. In our study, dietary potassium was linked with the greatest health gains in women.”

The study included 24,963 participants (11,267 men and 13,696 women) of the EPIC-Norfolk study, which recruited 40 to 79 year olds from general practices in Norfolk, UK, between 1993 and 1997. The average age was 59 years for men and 58 years for women. Participants completed a questionnaire on lifestyle habits, blood pressure was measured, and a urine sample was collected. Urinary sodium and potassium were used to estimate dietary intake. Participants were divided into tertiles according to sodium intake (low/medium/high) and potassium intake (low/medium/high).

The results suggest that potassium helps preserve heart health, but that women benefit more than men. The relationship between potassium and cardiovascular events was the same regardless of salt intake, suggesting that potassium has other ways of protecting the heart on top of increasing sodium excretion [22,23]. The World Health Organization recommends that adults consume at least 3.5 grams of potassium and less than 2 grams of sodium (5 grams of salt) per day.² High potassium foods include vegetables, fruit, nuts, beans, dairy products and fish. For example, a 115 gram banana has 375 mg of potassium, 154 grams of cooked salmon has 780 mg, a 136 gram potato has 500 mg, and 1 cup of milk has 375 mg.

These findings indicate that a heart healthy diet goes beyond limiting salt to boosting potassium content better in women than in men. Food companies can help by swapping standard sodium-based salt for a potassium salt alternative in processed foods. On top of that, we should all prioritise fresh, unprocessed foods since they are both rich in potassium and low in salt.”

Salt and Pets: In nature, all animals by instinct understand the salt requirement and eat naturally available materials to quench their thirst for required quantity of salt. The scenario changes during domestication.

Ruminant animals like cows, sodium has an added importance in saliva, which is produced in vast amounts daily to help to buffer the acid produced from fermentation in the rumen. Secretion of saliva is stimulated by chewing of feed, particularly during the process of rumination. A dairy cow may produce up to 150 litres of saliva per day, depending on the diet it receives compared to a monogastric animal of a similar size. Roughage/long fibre has the effect of increasing rumination activity, which in turn increases the amount of saliva secreted. Saliva contains sodium bicarbonate, which has a buffering effect and counteracts the acidic by-products of carbohydrate (fibre, starch and sugar) digestion. It also helps to keep the rumen pH at a level that is optimal for the microorganisms living there to function. This is the reason for the higher requirement of sodium, and a lack of it can depress rumen functionality. Sodium is also linked to total feed intake, as ruminants tend to prefer salty foods over more bland foods. Water intake can also be affected by sodium, and adding sodium to the diet can help to stimulate that.

Sodium in forage: Sodium is found in forage because it is taken up by plants as they grow. However, sodium can leach from soils and the amount of sodium in the soil can vary depending on farm location. A coastal farm will have more sodium in the soil due to higher levels in rain, whereas an inland farm is more likely to be sodium deficient. Areas with high rainfall may be more prone to sodium leaching from soils. Some particular forage species like maize, lucerne and kikuyu are well known not having the capability to take up sodium from the soil even if present in adequate amounts.

Dairy NZ has put the recommended sodium level for lactating dairy cows at 0.2 percent of total dry matter. It also suggests that the sodium level of pasture ranges from 0.03 percent to 0.6 percent [24]. This means that at times pasture is deficient in sodium compared to animal requirements.

Sodium deficiency : Sodium deficiency in ruminants can cause reduced appetite, reduced water intake,

weight loss, reduced milk production and pica (an appetite for substances that are largely non-nutritive). Milk is 87 percent water, so a cow that is not drinking enough water will have a significant drop in milk production. With severe deficiency, animals may become dehydrated, uncoordinated when moving, shiver, and even die from arrhythmia of the heart.

Sodium supplementation: Sodium is not stored in the body in significant amounts, which means that it's best to supplement it little and often. The most common form of supplementation for sodium is sodium chloride, more commonly known as salt. Sodium chloride contains 40 percent sodium. Salt can be applied to forage as a fertiliser, dusted on pasture or included in water, although these methods can often have high wastage (particularly dusting), be time consuming and unreliable. Offering salt to animals in blocks or free-access rock salt in troughs can work really well and it allows the animals to regulate how much sodium they need. One downfall of salt blocks is that animals may not be able to consume enough to meet requirements due to time constraints.

Salt can also be included in compound feed and blends, which is a good way of ensuring each animal receives adequate sodium every day. The salt can help to increase the intake of feeds by increasing palatability. Ruminant diets that contain forages low in sodium (such as maize silage) will need to be balanced with higher levels of supplemented sodium each day and several routes of supplementation may be best. While salt can help to increase the palatability of feeds to the animals, though too much salt can cause water/feed to become unpalatable, so balance is required.

For dog: Dogs need salt for their cells to function and a healthy amount of it is between 0.25g – 1.5g per 100g of food. At these levels, salt isn't bad for dogs and helps maintain cellular functions like fluid balance, blood pressure stability, acid-base balance and nerve signal transmission. Excess salt and salty foods are not recommended for dogs. Excessive salt can lead to "salt poisoning," which is characterized by dehydration, vomiting, muscle tremors, seizures, incoordination, and diarrhea. Commercial dog foods contain sodium as part of a balanced diet, either naturally from the ingredients or as an additive. Therefore, salt in the proper amount is essential in a dog's diet, though in excess, however, it can lead to serious health consequences or death.

Salt poisoning due to ingested too much salt, the first signs may include vomiting and/or drinking large amounts of water, exhaustion, have a swollen stomach and become very stiff due to loss of moisture from the muscle. If left untreated, salt poisoning can lead to death. Clinical signs may progress to include diarrhea, swelling or fluid accumulation, excessive urination, tremors and seizures, in coordination, head pressing. Providing access to fresh, clean water can help prevent salt poisoning in healthy dogs which accidentally ingest large amounts. However, dogs with certain health conditions may be unable to regulate electrolytes and fluids, which increase their risk of salt poisoning after accidental ingestion.

If you believe that your dog may have accidentally ingested salt, call your veterinarian or the Pet Poison Helpline immediately. Knowing how much salt was ingested and your dog's weight will be helpful. If salt poisoning is suspected, hospitalization at a veterinary facility for continuous care and monitoring may be recommended. Typical diagnostics and treatment during hospitalization can include IV fluids, electrolyte monitoring, and supportive medications deemed appropriate by the veterinarian. Hospitalization times and prognosis vary based on the time since salt ingestion and the responsiveness to supportive care.

For Poultry: Salt is an important nutrient for Poultry. Most chickens need between 0.12% to 0.2% sodium in the diet. If measured as NaCl or "salt," it should be 0.4-0.6%. When you are feeding a formulated diet to animals, the nutritional balance in every bag of feed vary. Because chickens are highly selected for rapid growth (broiler breeds) or for high reproductive levels (egg-producing breeds), nutritional problems show up quickly. Those problems can arise because

of the content of the feed, whether it is adequately mixed, or how it is stored.

Salt Deficiency is a serious problem for domesticated poultry. In general, sodium (a component of table salt) is added to chicken feeds at the rate of about 0.15% sodium in the feed mix. Without salt, growth is slowed, and chicks are dull and listless. Getting salt levels back up to required levels will speed up appetite and growth, but often the birds never completely recover from the early setback (Fig. 4). In broilers especially, the rapid growth that occurs following correction of feed problems may exceed the development of the heart and lungs. These birds may collapse and die suddenly; opening up the body cavity will reveal fluid accumulations around the lungs and heart (Fig.5).

This is known as broiler ascites syndrome, and if it begins to occur in your flock you should consider early slaughter to avoid losing more birds. In older birds, appetite decreases, pecking behaviour may increase and egg production is likely to decrease. Occasionally a feed processing company may make a mistake and fail to add ingredients, but more likely a problem may occur with clumping or settling out of ingredients. As well, some forms of salt (like rock salt) are coarser and less miscible than others. In these cases, feed analysis of individual bags of feed may be too low, or too high, in sodium content, although the overall feed mix was correct. In either case there is a problem, because salt is required, but can be toxic at high concentrations.

SALT AND POLITICS

Salt Satyagraha: The Salt Satyagraha was a campaign of non-violent protest against the British



Fig. 6: Mahatma Gandhi on Dandi March May 5, 1930

salt tax in colonial India which began with the Salt March to Dandi on March 12, 1930. It was the first act of organized opposition to British rule after Purna Swaraj, the declaration of independence by the Indian National Congress. Mahatma Gandhi led the Dandi march from his Sabarmati Ashram to Dandi, Gujarat to make salt, with growing numbers of Indians joining him along the way. When Gandhi broke the salt laws in Dandi at the conclusion of the march on April 6, 1930, it sparked large scale acts of civil disobedience against the British Raj salt laws by millions of Indians. Gandhi was arrested on May 5, 1930, just days before his planned raid on the Dharasana Salt Works (Fig.3). The Dandi March and the ensuing Dharasana Satyagraha drew worldwide attention to the Indian independence movement through extensive news paper and newsreel coverage. The satyagraha against the salt tax continued for almost a year, ending with Gandhi's release from jail and negotiations with Viceroy Lord Irwin at the Second Round Table Conference. Over 80,000 Indians were jailed as a result of the Salt Satyagraha [25]. The campaign had a significant effect on changing world and British attitudes toward Indian independence, and caused large numbers of Indians to actively join the fight for the first time, but failed to win major concessions from the British.

The Salt Satyagraha campaign was based upon Gandhi's principles of non-violent protest called satyagraha, which he loosely translated as "truth-force." In early 1930 the Indian National Congress chose satyagraha as their main tactic for winning Indian independence from British rule and appointed Gandhi to organize the campaign. Gandhi chose the 1882 British Salt Act as the first target of satyagraha. The Salt March to Dandi, and the beating of hundreds of non-violent protesters in Dharasana, demonstrated the effective use of civil disobedience as a technique for fighting social and political injustice. The satyagraha teachings of Gandhi and the March to Dandi had a significant influence on American civil rights activist Martin Luther King, Jr., and his fight for civil rights for blacks and other minority groups in the 1960s.

Salt water lake in India (Sambhar lake): Sambhar quite literally means salt. It is India's largest saline lake, about 190 sq km situated in the state of Rajasthan, is a place where horizons stretch to infinity, where water and sky merge in a shimmer of gauzy blue. The lake, which is located about 110 kms from



Sambhar Lake (Rajasthan)

Rajasthan capital Jaipur, has been a good source for acquiring quality salt since the days of the British Raj. It is said to be one of its kind in Asia. The Sambhar lake is an extensive saline wetland, with water depths fluctuating from just a few centimeters as 60 cm during the dry season to about 3 meters (about 10 ft) after the monsoon season. It occupies an area of 190 to 230 square kilometers, based on the season. (ANI).

Legendary Lake: According to one reference in the epic Mahabharata, Raja Yayati, emperor of Bharatvarsh (India) and a descendant of Lord Brahma the Creator, married Devyani, daughter of Shukracharya (the guru of demons) who lived by the lake.

According to another legend, the Goddess Shakambhari bestowed the lake upon the people of the area some 2,500 years ago. A small glimmering white temple in her honor stands under a rocky outcrop jutting into the lake. The locals will insist that you visit her temple before doing anything else.

The various administrators of the area have extracted salt from here for over a thousand years. Over time, these have included the Sindhias, Rajputs, Marathas, Mughals and the rulers of Jaipur and Jodhpur who jointly owned the lake, and who in 1870 leased it to the British. After independence, the lake was taken over by the government and is now managed by Sambhar Salts Limited, a joint venture of Hindustan Salts and the Government of Rajasthan.

Sambhar lake may soon cease to exist due to want of conservation. Scientifically it contains 99 percent sodium chloride. This water source was first explored and tapped in 1800 by some Englishmen. Later, a commercial salt producing plant was set up in 1870. Since then, this heritage lake has been producing and supplying salt to the northern parts of the country.



Himachal Pradesh rock salt mines:: Drang in Mandi is famous for the best mines of rock salt — also known as ‘Gumma salt’ in local language [26]. Kala namak (“black salt” in Hindi) is a rock salt infused with sulfurous herbs and spices. Kala namak has withstood the test of time, sung of in ancient Vedic hymns, and identified by Maharishi Charak, the 300 BCE father of ayurvedic medicine. Ayurvedic healers claim this Indian black salt possesses several therapeutic qualities, and use it to pacify the bowels, aid weight loss, combat hysteria, and produce good dental hygiene [27]. Salt comes in all colors, shapes and sizes; as well as pure white, salt may be pink, grey, black or green. Sendha namak, Himalayan rose, or pink salt is one of the

purest forms of salts that is also mined in Pakistan’s side of Himalayas. It consists of 84 natural minerals and nutrients that are essential for the human body. Its colour ranges from white to deep pink. Drang mines were closed for several years, but now Himachal Government again strating production very soon [27] .

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