21 Dietary salt and NCDs

Burden, epidemiology and priority interventions

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Increased sodium intake is associated in a graded manner with several detrimental health outcomes, particularly high blood pressure (BP), heart disease and stroke. A number of public health interventions can effectively reduce dietary salt intake in populations and significantly reduce the NCD burden.

Disease burden

Globally, IHME estimated that 3.3% of all deaths (approximately 1.9 million) were attributable to high sodium in 2019, up from 2.8% in 1990 (Table 21.1). These proportions increased in low- and middle-income countries but decreased in high-income countries (HICs). The age-standardized mortality rates were highest in upper-middle-income countries (MICs) and lowest in high-income countries (HICs), and were decreasing in all income groups between 1990 and 2019. These differences reflect variant patterns in terms of dietary salt intake, as well as prevention and control of salt-related diseases across countries and over time.

Of all deaths in 2019 attributable to high dietary sodium intake (IHME), 41% could be attributed to stroke, 37% to ischemic heart disease, 9% to hypertensive heart disease, 5% to kidney disease and diabetes and 4% to neoplasms. Of note, estimates of the salt-related burden may vary substantially depending on the assumptions made when modelling the relationships between sodium intake, BP, and disease morbidity and mortality.

Definition of elevated salt intake

WHO defines high sodium consumption as >2 grams of sodium/day, equivalent to >5 g of salt (NaCl) per day for a 2000 kcal diet. In many populations, salt intake averages 9–12 g per day, in several high and middle-high-income countries up to 15 g,[1] with <10–20% of individuals meeting the WHO guidance that establishes an upper limit of <5 g per day.

Assessment of dietary salt intake

Determining individuals' salt intake is challenging. The reference method is based on 24-hour urine collections performed once. Recent recommendations

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Table 21.1 Mortality attributable to a diet high in sodium (salt)

	Global		*HICs*		*Upper MICs*		*Lower MICs*		*LICs*	
	1990	*2019*	*1990*	*2019*	*1990*	*2019*	*1990*	*2019*	*1990*	*2019*
Percent of all deaths (%)	2.8	3.3	3.0	2.1	5.2	5.7	1.4	2.2	0.9	1.4
Age-standardized rates (per 100,000)	36	24	19	9	55	35	28	22	36	27

suggest that 24-hour collections should preferably be repeated at least three times to obtain a valid assessment of sodium intake in a given individual. However, urine collections are cumbersome, resource-intensive and not practical outside the research setting. Dietary recalls and food frequency questionnaires are notably inaccurate and prone to bias. Morning urine spots are easy to perform but they rely on calculations that take into account several other variables. Urine spots are useful to assess mean sodium intake at the population level but lack accuracy at the individual level, particularly at low salt intake values. Salt intake is generally greater in overweight persons and parallels their larger calorie intake for energy balance (when they are not engaged in a hypocaloric diet to lose weight).

Relationship between salt intake, blood pressure and cardiovascular disease

Several recent reviews describe the current knowledge.[2,3] Abundant observational and experimental data unambiguously show a direct linear relation between sodium intake and BP, with a steeper association in the upper range of sodium intake.[4,5] Likewise, observational and experimental evidence shows that a reduction in salt intake is associated with reduced BP and lower CVD incidence and overall mortality.[6] However, some studies have found no reduction or even an increase of CVD and/or total mortality at very low salt intake, showing J- or U-shaped relationships and an increase of renin and aldosterone at low salt intake levels.[7] Some of these studies were funded by the industry and/or had methodological limitations that could alter the associations between sodium intake and disease.[8,9] This may be partly related to biased estimation of salt intake in the low sodium intake range in studies based on spot urines and to reverse causation (i.e. sick people tend to have lower food/salt intake), but activation of the renin-angiotensin system and increased plasma lipids concentrations at very low salt intake levels have also been suggested. The effect of sodium intake on BP levels and CVD incidence accrues over time (cumulative effect) and estimates of the salt-related burden can therefore be underestimated when based on studies with short follow-ups.[10] This underlies that salt reduction strategies should start at an early age, including among children. High salt intake is also associated with BP-independent complications such as proteinuria, renal stones and gastric cancer. In addition, a high sodium intake decreases the efficacy of antihypertensive drugs such as diuretics and blockers of the renin-angiotensin system.

Sources of dietary salt

The main dietary source of sodium is salt, in the form of sodium chloride, but in many parts of the world also in high-sodium sauces and condiments. In many HICs, and increasingly in low- and middle-income countries, a significant proportion of sodium in the diet comes from processed foods, such as cheese, processed meats, bread, soups, salty snacks, salami, stock cubes,[11] which underlies the crucial role of promoting healthy diets based on natural and sustainably produced foods as well as reformulating processed foods rich in salt toward lower salt content. Salt added during cooking or at the table can account for a large proportion of a person's total salt intake, particularly in low-income settings where processed or pre-packaged foods are less available.[12]

Interventions to reduce dietary salt intake in the population

A number of priority actions are available to reduce salt intake in the population.[13,14] The WHO Global NCD Action Plan identifies four best buys aimed at reducing salt intake at the population level. They are:

- Reformulating food products to contain less salt and setting target levels for the amount of salt in foods and meals.
- Reducing salt intake through the implementation of front-of-pack nutrition labelling.
- Reducing salt intake through behaviour change communication and mass media campaigns.
- Establishing a supportive environment in public institutions such as hospitals, schools, workplaces and nursing homes, to enable lower sodium options to be provided.

Reformulating food products to contain less salt and setting target levels for the maximum amount of salt in foods and meals

While the best way to reduce salt consumption is to lower consumption of processed food, which is often high in fats, sugars and salt, reformulation by industry of selected common processed foods that have a particularly high salt content enables people to have a lower salt intake without requiring them to make particular efforts to change their eating habits. Reformulation is more effective when implemented through regulations that set a maximum salt content in selected foods. However, salt reduction in ultraprocessed foods may have less than expected impact if consumption of ultraprocessed foods increases, which emphasizes the need for ambitious salt reduction targets.

Mandatory approaches provide the legal tools and financial and human resources necessary to guarantee appropriate implementation and monitoring mechanisms.[15] Mandatory reformulation can achieve larger salt reductions than voluntary agreements and larger health benefits. The implementation of a regulatory framework implies a level playing field for the food industry (large

vs small and medium-sized enterprises) and legislative measures allow for the introduction of financial penalties for non-compliance. Legislation is more difficult to abandon if a new government comes into power.[16]

While the food industry should be encouraged to reduce salt in foods as much as possible, it should ensure that, where appropriate, salt in packets and salt added to foods is supplemented with iodine (an important public health measure to prevent iodine deficiency disorders). Salt is added to processed foods and meals for a variety of reasons but primarily because it is a cheap way of adding flavour to otherwise bland foods. When high-salt foods are consistently consumed, the salt taste receptors are suppressed, creating the habit of eating highly salted foods and leading to greater consumer demand. Inversely, if the salt content in commonly consumed high-salt foods is reduced gradually over months or years (e.g. in bread), consumers tend to not notice the change, e.g. if the reduction is <20% in one step. With time, individuals become increasingly able to rediscover and enjoy a variety of flavours from the same foods.

In 2021, WHO released a set of global benchmarks for sodium levels in >60 different foods,[17] and the Pan American Health Organization released regional targets in 2015, which were updated and 2021. These benchmarks can guide countries in progressively reducing the sodium content in different categories of processed foods (e.g. packaged bread, savoury snacks, meat products, cheese). These benchmarks may substantially accelerate progress toward the WHO goal of a 30% reduction in global salt/sodium intake by 2025 (compared to 2010).

In the UK, where voluntary targets for industry to reformulate their products were developed, adults' salt intake decreased by approximately 15% between 2003 and 2011, suggesting that target-setting across multiple food categories can achieve some meaningful reductions in sodium consumption in the population. However, no further change was observed in the UK between 2011 and 2018, with salt intake in adults remaining >40% higher than the upper limit of <5 g/day. Also, data from some large food manufacturers indicate that the salt content of their products has not decreased, and in some cases, even increased. This indicates the huge challenge of implementing and maintaining favourable changes and achieving the set goals, as well as the need for appropriate legislation.

Reducing salt intake through the implementation of front-of-pack nutrition labelling

Nutritional labelling, including salt content, enables consumers to better select the products they buy. Front-of-pack labels should be government-endorsed and allow consumers to correctly, quickly and easily identify products that contain excessive amounts of critical nutrients, preferably through mandatory front-of-package interpretative warning labels (e.g. as requested by law in Chile and being implemented in an increasing number of countries), since they have proven to effectively reduce a population's calorie intake and purchase of unhealthy foods.[18] Other common front-of-pack labelling systems include traffic light systems or NutriScore.[19,20] Using a smartphone to scan a food's barcode (when barcodes provide such information) is a user-friendly way for

informing consumers about detailed food and beverage nutritional value (as well, for some systems, its environment impact, including carbon footprint).

Reducing salt intake through behaviour change communication and mass media campaigns

Health education campaigns must inform the public about how to choose healthy food and raise their awareness about limiting their salt intake. This includes providing information on salt levels in processed foods and how to interpret it, information about the effect of salt on health and encouraging individuals to reduce salt when cooking and at the table. Comprehensive and interpretative information that can be obtained from barcodes on foods has a large potential for educating consumers about choosing healthy foods. Choosing low-salt foods is especially important among individuals with hypertension and/or at increased risk of CVD. Partial substitution of NaCl with KCl may be useful, but KCl tends to have an unpleasant taste if its concentration is high (use of spices and herbs may be useful). A simple and short practical health message for all individuals can be to 'eat plenty of fruit, vegetables, grains and unsalted nuts, drink water (instead of sugary beverages), and less processed foods and pre-packaged meals'. Such public health messaging has multiple benefits as fruit and vegetables contain low amounts of salt, while containing plenty of potassium (which attenuates the detrimental impact of salt on BP) and other nutrients that are also beneficial for NCD prevention and control. In addition a high fruit and vegetables diet will reduce the intake of saturated fats, salt and calories.

Establishing a supportive environment in public institutions such as hospitals, schools, workplaces and nursing homes, to enable lower sodium options to be provided

There is good potential for reducing salt in the food supply in settings such as schools, workplaces and hospitals, as the management often has control over the foods served. Community settings are a platform for local implementation of both national salt reduction policies and specific salt reduction interventions. The establishment of healthy foods and drinks guidelines (national or for some specific institutions), including salt criteria, is useful. Several countries have developed standards for food providers and defined the maximum levels of salt in foods sold in schools and hospitals.[21]

The WHO SHAKE technical package

The WHO SHAKE technical package for salt reduction provides guidance on the development, implementation and monitoring of salt reduction strategies, and for working with industry to reduce levels of salt in food products. SHAKE[22] consists of five elements:

- **S**urveillance: measure and monitor salt use.
- **H**arness industry: promote the reformulation of foods and meals to contain less salt. The food industry should be encouraged to reduce salt in foods as

much as possible while at the same time ensuring that, where appropriate, salt added to foods is iodized.
- **A**dopt and implement standards for accurate labelling and marketing of food.
- **K**nowledge: educate and communicate to empower individuals to eat less salt.
- **E**nvironment: support settings to promote healthy eating.

The SHAKE package also includes a number of useful country case studies.

Relevant global targets and indicators for salt reduction

A 25% relative reduction in the prevalence of raised BP or contain the prevalence of raised BP, according to national circumstances.	Age-standardized prevalence of raised BP among persons aged 18+ years (systolic/diastolic BP ≥140/90 mmHg) and mean systolic/diastolic BP.

Monitoring

This includes surveillance of salt intake in the population, for example through 24-hour urine collections or morning urine spots in random sub-samples of population-based surveys (e.g. STEPS). It is also important to regularly assess the salt content in selected common processed foods to inform and monitor salt-reduction interventions. It is important to monitor the salt content of foods in each country or region as foods from the same brand often have different levels of salt in different countries.[23] The FLIP Food Information Program has been used successfully in Canada, Latin America and the Caribbean to monitor sodium content through food labels.

WHO has developed a *Sodium Country Score Card* to track the progress of countries in implementing legislative and other measures to reduce dietary sodium intake, including: national policy towards sodium reduction; voluntary approaches to reduce sodium in the food supply; mandatory declaration of sodium on pre-packaged foods; and implementation of one or several of the sodium-related WHO best buys for tackling NCDs.[24]

Notes

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