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Review paper

Reduction of salt content in meat products

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ABSTRACT

Excessive salt/sodium intake is recognized as a main cause of essential hypertension and it is linked to several health disorders. The World Health Organization (WHO) made a recommendation to Member States to reduce population salt intake by 30%, as part of the nine global targets to reduce premature mortality from non-communicable diseases by 25% by 2025. WHO recommends that adults consume less than 5 g of salt per day (less than 2000 mg sodium).

WHO adopted key broad strategies for salt reduction: (1) government policies — including appropriate fiscal policies and regulation to ensure food manufacturers and retailers produce healthier foods or make healthy products available and affordable; (2) working with the private sector to improve the availability and accessibility of low-salt products; (3) consumer awareness and empowerment of populations through social marketing and mobilization to raise awareness of the need to reduce salt intake consumption; (4) creating an enabling environment for salt reduction through local policy interventions and the promotion of "healthy food" settings such as schools, workplaces, communities, and cities; (5) monitoring of population salt intake, sources of salt in the diet and consumer knowledge, attitudes and behaviours relating to salt to inform policy decisions; (6) salt reduction programmes and programmes that promote fortification with micronutrients of salt, condiments or seasonings high in salt (bouillon cubes, soy and fish sauce) can complement each other.

1. Introduction

Sodium chloride (salt) has been used from ancient times in daily food preparation as well as in fermenting processes. Its use was important primarily for taste and shelf life of food. At the end of 19th century, use of salt was rapidly increased. Recently, salt production was valued at 28.5 billion US$ in 2020, and it is projected to reach a value of over 32 billion US$ by 2026 (*Shahbandeh*, 2022).

Nowadays, dietary sodium intake above 2 g/day is in a positive correlation with average blood pressure and prevalence of hypertension (*Cappuccio et al*., 2022).

There are some controversies about the relation between dietary sodium intake and blood pressure (*Sullivan*, 1991), and some authors described the term "sodium sensitivity" linked with variations in blood pressure due to amounts of sodium in food (*Kawasaki et al*., 1978).

Excessive sodium intake can be associated with some other health problems. *Du Cailar et al.* (2002) mentioned the increasing left ventricular mass and microalbinuria in normotensive patients. Salt intake, in patients with essential hypertension, is an independent determinant of left ventricular hypertrophy, besides blood pressure and obesity (Schmieder and

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Messerli, 2000). *Avolio et al.* (1986) cited that lower sodium intake reduces arterial stiffness, and that has a beneficial effect on distensibility of the central aorta and large peripheral arteries.

After a large load of sodium from food, renin and aldosterone levels are raised that decrease water excretion, which consequently leads to the appearance of idiopathic oedema (*Streeten et al.*, 1973). *Yatabe et al.* (2010) cited salt sensitivity as being linked with insulin resistance in essential hypertensive persons.

Excessive salt intake enhances airway inflammation in asthmatics following exercise (*Mickleborough et al.*, 2005), it is associated with the risk of gastric cancer (*Tsugane et al.,* 2004), with urinary calcium excretion and bone density reduction in adolescence (*Matkovic et al.*, 1995), bone mineral loss in post-menopausal women (*Devine et al.*, 1995), and with excessive urinary sodium excretion that consequently leads to kidney stones (*Cirillo et a*l., 1994).

2. Strategy for salt reduction

In 2013, the WHO made a recommendation to all Member States to reduce population salt intake by 30%, as part of the nine global targets to reduce premature mortality from non-communicable diseases (NCDs) by 25% by 2025 (World Health Organization.(2013):

1. A 25% relative reduction in the overall mortality from cardiovascular diseases, cancer, diabetes, or chronic respiratory diseases
2. At least 10% relative reduction in the harmful use of alcohol, as appropriate, within the national context
3. A 10% relative reduction in prevalence of insufficient physical activity
4. A 30% relative reduction in mean population intake of salt/sodium
5. A 30% relative reduction in prevalence of current tobacco use in persons aged 15+ years
6. A 25% relative reduction in the prevalence of raised blood pressure or contain the prevalence of raised blood pressure, according to national circumstances
7. Halt the rise in diabetes and obesity
8. At least 50% of eligible people receive drug therapy and counselling (including glycaemic control) to prevent heart attacks and strokes
9. An 80% availability of the affordable basic technologies and essential medicines, including generics, required to treat major noncommunicable diseases in both public and private facilities

The World Health Assembly (WHA) adopted in 2004 “Global Strategy on Diet, Physical Activity and Health”, including World Health Organization, international partners, the private sector and civil society to take action to support healthy diets and physical activity.

There are the key facts about salt consumption:

- High sodium consumption (>2 grams/day, equivalent to 5 g salt/day) and insufficient potassium intake (< 3.5 grams/day) contribute to high blood pressure and increase the risk of heart disease and stroke.
- The main source of sodium in our diet is salt, although it can come from sodium glutamate, used as a condiment in many parts of the world.
- Most people consume too much salt — on average 9 to 12 grams per day, or around twice the recommended maximum level of intake.
- Salt intake of less than 5 grams per day for adults helps to reduce blood pressure and risk of cardiovascular disease, stroke and coronary heart attack. The principal benefit of lowering salt intake is a corresponding reduction in high blood pressure.
- WHO Member States have agreed to reduce the global population’s intake of salt by a relative 30% by 2025.
- Reducing salt intake has been identified as one of the most cost-effective measures countries can take to improve population health outcomes. Key salt reduction measures will generate an extra year of healthy life for a cost that falls below the average annual income or gross domestic product per person.
- An estimated 2.5 million deaths could be prevented each year if global salt consumption were reduced to the recommended level.

Recommendations for salt reduction are:

- For adults: WHO recommends that adults consume less than 5 g (just under a teaspoon) of salt per day.
- For children: WHO recommends that the recommended maximum intake of salt for adults be adjusted downward for children aged two to 15 years based on their energy requirements relative to those of adults. This recommenda-

tion for children does not address the period of exclusive breastfeeding (0–6 months) or the period of complementary feeding with continued breastfeeding (6–24 months).

- All salt that is consumed should be iodized or "fortified" with iodine, which is essential for healthy brain development in the foetus and young child and optimizing people's mental function in general.

WHO adopted key broad strategies for salt reduction:

- government policies — including appropriate fiscal policies and regulation to ensure food manufacturers and retailers produce healthier foods or make healthy products available and affordable,
- working with the private sector to improve the availability and accessibility of low-salt products,
- consumer awareness and empowerment of populations through social marketing and mobilization to raise awareness of the need to reduce salt intake consumption,
- creating an enabling environment for salt reduction through local policy interventions and the promotion of "healthy food" settings such as schools, workplaces, communities, and cities,
- monitoring of population salt intake, sources of salt in the diet and consumer knowledge, attitudes and behaviours relating to salt to inform policy decisions.
- salt reduction programmes and programmes that promote fortification with micronutrients of salt, condiments or seasonings high in salt (bouillon cubes, soy and fish sauce) can complement each other.

3. Salt reduction in meat products

Salt reduction in meat products can be achieved by reducing added sodium chloride (*Sofos et al.*, 1983), by replacement of sodium chloride with other salts (*Sofos et al.*, 1983; *Terrell*, 1983; *Guàrdia et al*, 2006), by use of flavour enhancers and masking agents (*Desmond*, 2006), by combinations of the aforementioned *(Sofos et al.*, 1983; *Terrell*, 1983), by optimization of physical form of salt (*Angus et al.,* 2005), and by alternative processing techniques (*Claus and Sørheim*, 2006).

Potassium chloride is the most common replacers for sodium chloride, but total replacement is not possible due to its bitter and metallic taste (*Gou et al*., 1996). The use of potassium salts is disputed because some parts of the population are sensitive to them, i.e. people with diabetes mellitus type I, as well as people with kidney and adrenal insufficiency (*Food Safety*, 2003)

With the aim of the improvement, flavour enhancers can be used that activate receptors in the mouth that help to compensate reduced salt content (Brandsma, 2006) and masking agents like yeast extract, lactates, monosodium glutamate and nucleotides. Adenosine 5'-monophorphate, which blocks the activation of gustducin in receptor cells, can be used for taste and to prevent stimulation of nerves that innervates taste receptors (*McGregor*, 2004).

Some salts are used due to their technological characteristics, such as phosphates (*Ruusunen*, 2002). Also physical forms of salt, like salt flakes, can be used for better water holding capacity and protein solubility (*Campbel*l, 1980). Besides the aforementioned, due to technological properties, phosphates can be used in pre-rigor meat or high pressure technology (*Claus and Sørheim*, 2006).

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