

A JOINT POSITION STATEMENT TO SUPPORT SINGAPORE'S SODIUM REDUCTION STRATEGY THROUGH NUTRITIONAL EDUCATION AND ENVIRONMENTAL CHANGES FOR CONSUMERS

We, Singapore Nutrition and Dietetics Association (SNDA), Singapore Heart Foundation (SHF), and The National Kidney Foundation (NKF), recognise the importance of reducing sodium intake as a preventive measure against chronic diseases like hypertension, cardiovascular and kidney diseases. We support the Health Promotion Board's sodium reduction strategy, focusing on nutritional education and advocating for environmental changes to reduce the sodium content in food products. We trust that these collective efforts can empower individuals to make healthier, lower-sodium dietary choices.

Prevalence of hypertension in Singapore

According to data from the Ministry of Health and Health Promotion Board, there has been a noticeable rise in the prevalence of hypertension among Singapore residents. In 2010, 2 in 10 Singapore residents had hypertension. In 2021-2022, the proportion had increased to more than 1 in 3 (Figure 1) ^[1].

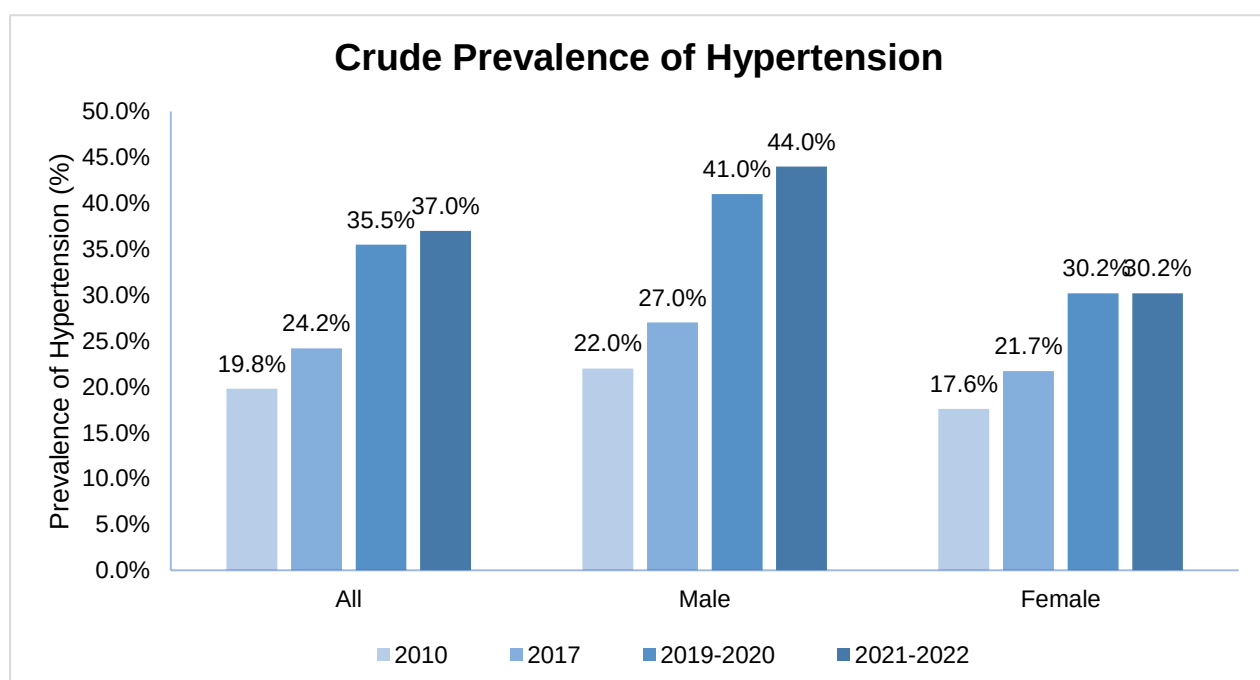


Figure 1: Hypertension crude prevalence (%) trends, extracted from the National Population Health Survey 2022

Source: Ministry of Health and Health Promotion Board ^[1]

Sodium consumption patterns in Singapore

The World Health Organisation (WHO) recommends reducing sodium intake to < 2000 mg per day, i.e., less than 5 g or 1 teaspoon of regular salt. In 2010, Singapore residents consumed 3300 mg of sodium per day on average ^[2]. In 2019, average sodium intake was 3480 mg per day, and in 2022, this further increased to 3620 mg per day ^[3]. Currently, 9 in 10 Singapore residents exceed WHO's recommended limit. Majority of sodium intake was from salt, sauces and seasonings added to cooking and food preparation, with key sources being soupy dishes, gravy and sauce-based dishes, flavoured rice and noodles.

Evidence for the urgency to reduce sodium intake

We are concerned with the rising rates of hypertension and rising cases of kidney diseases given our increasingly elderly population, and hence, we recognise the urgent need to reduce sodium intake as a key strategy for disease prevention. Lowering the prevalence of hypertension is a key objective set by the WHO ^[4]. Numerous population-based studies have demonstrated that hypertension is not only a risk factor but also a leading cause of cardiac, cerebral, and vascular complications, such as stroke, coronary heart disease, heart failure, atrial fibrillation, peripheral artery disease, cognitive impairment, dementia, and kidney failure ^[5-7]. Given Singapore's increasingly and rapidly ageing population and the steadily rising prevalence of obesity and diabetes, a sizeable proportion of the population is already at a high risk of developing cardiovascular and kidney diseases, leading to an even greater disease burden for the city state ^[8]. The diverse body of evidence from clinical and population studies has found that incremental reduction in sodium significantly lowers blood pressure and mitigates the age-related rise in blood pressure ^[9]. Even a moderate reduction of 2 g of salt per day (equivalent to 1/3 teaspoon) is projected to avert about 4,000 Disability-adjusted life years (DALYs) annually ^[8].

Strategies to reduce risk factors for hypertension and chronic diseases

1) Promoting an optimal sodium-to-potassium intake (Na:K) ratio

While the individual effects of sodium and potassium on blood pressure are well-established, there is consensus that an individual's Na:K ratio is a more significant predictor of hypertension, cardiovascular, and kidney diseases ^[10-12]. High salt intake impacts blood pressure through sodium retention, volume expansion, inflammation and oxidative stress ^[13]. Conversely, evidence shows an inverse association between dietary potassium intake and blood pressure due to vasodilation of blood vessels ^[14].

Extensive evidence, including the large ecological INTERSALT study ^[15] and various meta-analyses ^[16, 17], support the effectiveness of reducing the Na:K ratio in achieving significant reductions in cardiovascular diseases (CVDs) and mortality rates. In addition, there is a greater risk of chronic kidney disease (CKD) progression with a higher urinary Na:K ratio ^[12]. As per the WHO, it is recommended to have a sodium intake of <2000mg/day and a potassium intake of >3510mg/day, achieving a Na:K ratio of ≤ 0.6 mg/mg in the blood ^[18]. These findings align with the principles of the Dietary Approaches to Stop Hypertension (DASH) diet, which encourages low sodium and high potassium foods, a comprehensive dietary plan to effectively lower risk factors for CVDs and kidney diseases ^[19]. Incorporating foods such as fruits, vegetables, cereals, low-fat dairy, and unprocessed lean meats as part of a balanced diet will improve the Na:K ratio ^[10]. Conversely, cured, and processed meats, as well as fat spreads, worsens the Na:K ratio. Thus, providing guidance to consumers on healthier food choices is essential for maintaining optimal blood pressure to reduce the risk of chronic diseases.

2) Influencing the food environment through product reformulation and increasing accessibility to lower sodium ingredients and foods

Reducing hypertension and chronic diseases requires a multifaceted approach. A key element of the Health Promotion Board's sodium reduction strategy involves influencing the food environment through product reformulation. Collaborating with the

food industry to promote reformulation and adopt reduced sodium products, especially lower-sodium salt alternatives, is crucial as “added salt” constitutes the largest contributor (50%) to our dietary sodium, according to the Health Promotion Board. Gradually reducing sodium intake with these lower-sodium salt alternatives can maintain taste and flavour while addressing the challenge of adjusting to a lower-sodium diet for those accustomed to salty foods. Incorporating these alternatives into the food supply is a significant step in reducing sodium intake. Long-term maintenance of reduced salt intake in individuals with CKD can lower blood pressure and albuminuria, thus potentially leading to reductions in CKD progression and cardiovascular outcomes [20].

Currently, there are several types of lower-sodium salt alternatives in the market. These edible salt products replace a certain proportion of sodium chloride with other minerals such as potassium and magnesium, or glutamate enhancers.

(i) Potassium (K) salt substitutes

Numerous systematic reviews and meta-analyses have shown that using K salt or increasing potassium intake can significantly reduce systolic and diastolic blood pressure [21,22] and reduce the risk of cardiovascular events [23-26], without significant adverse effects. A Cochrane systematic review of 26 clinical trials, recently published in 2022, found that using K salt substitutes lowers blood pressure and reduces the risk of stroke, acute coronary syndrome and cardiovascular deaths in adults while increasing blood potassium levels only slightly compared to regular salt [25].

A position statement published by the American Heart Association in 2019 notes that K salt substitutes can be a safe and effective salt alternative to reduce the risk of cardiovascular diseases[27].

Although dietary potassium intake has been postulated to be an important contributor to hyperkalaemia in patients with CKD, the singular association between dietary and serum potassium is weak [28]. A recent trial conducted among elderly across 46 residential elderly care facilities in China found that K salt lowered blood pressure and the risk of cardiovascular events by 40% [29]. In this trial, 6% of patients had kidney

diseases and 8% were on medications that may raise serum potassium. Although the use of K salt increased mean serum potassium, it was not associated with any adverse clinical outcomes.

Hyperkalaemia is frequently associated with additional clinical factors warranting a more holistic management approach. Individuals with advanced stages of kidney disease should adopt a no or low-added salt (regular or K salt) diet where possible. These individuals who may be on dialysis or have decreased kidney function and taking medications (such as angiotensin-converting enzyme inhibitors, angiotensin 2 receptor blockers and mineralocorticoid receptor blockers), which may affect blood potassium levels, should consult their healthcare providers or dietitians for holistic clinical management and regularly monitor potassium levels.

(ii) **Monosodium-glutamate (MSG) salt substitutes**

Monosodium glutamate (MSG) is a flavour enhancer, rendering food an “umami” flavour, while containing less than a third of the sodium in table salt. MSG can be used as a substitute for salt, or used to replace some sodium chloride in table salt.

MSG is derived from glutamate, a naturally occurring amino acid that is found in nearly all foods. The glutamate in MSG is chemically indistinguishable from naturally occurring glutamates in foods (e.g. tomatoes, cheeses), as our bodies metabolise both sources of glutamate in the same way. The consensus among regulatory agencies worldwide, such as the United States Food and Drug Administration (FDA) ^[30], European Food Safety Authority (ESFA) ^[31], Food Standards Australia New Zealand (FSANZ) ^[32] and the Joint FAO/WHO Expert Committee on Food Additives (JECFA) ^[33], is that MSG is safe for consumption when used in accordance with good manufacturing practices. For example, the United States FDA has granted MSG “Generally Recognized As Safe” (GRAS) status.

There have been claims of adverse reactions to MSG, including headaches, flushing, and sweating, collectively known as “Chinese Restaurant Syndrome”. However, these claims have not been substantiated by scientific evidence ^[34]. Some people may be sensitive to MSG, just like any other food ingredient, but these cases are rare, and the

symptoms are mild and short-lived. Regulatory agencies have conducted comprehensive safety evaluations of MSG and have established acceptable daily intake (ADI) levels for MSG consumption. The levels are set far below the amount that typically seen in one's diet without any health risk. This provides additional safety margins and allows individual who are sensitive to MSG to be able to enjoy it without experiencing adverse effects.

(iii) Other sodium reduction solutions

Other possible ingredients that can be used to reduce sodium in foods include yeast extract and magnesium.

Yeast extract is a natural ingredient, obtained through the fermentation of yeast and subsequent disruption of its cell walls ^[35]. It is largely made up of proteins or amino acids, nucleotides and peptides, some of which can impart salty taste, “umami” or “meaty” flavours thus allowing for sodium or salt reduction in foods ^[36, 37]. Yeast extract has been granted GRAS status by the United States FDA ^[38], and has been used globally in a variety of reduced sodium products ^[39, 40].

Magnesium (Mg) sulphate is another ingredient that could be used to replace some sodium chloride in regular table salt to achieve sodium reduction. In addition to sodium reduction, several studies have also investigated the potential health benefits of increasing magnesium intake. A meta-analysis of randomised controlled trials found that Mg supplementation reduced both systolic and diastolic blood pressure in hypertensives, compared to placebo ^[41]. Another meta-analysis of observational studies found an inverse association between dietary magnesium intake and the risk of cardiovascular diseases ^[42].

Hypermagnesemia can occur when magnesium intake exceeds the body's ability to excrete it. Individuals with impaired kidney function and gastrointestinal dysfunction may be at increased risk of hypermagnesemia as the excretion of magnesium is impaired. However, research has shown that higher magnesium levels were associated with lower risks for all-cause mortality, cardiovascular events and mortality, among individuals with chronic kidney disease ^[43].

Conclusion

Excessive sodium intake significantly contributes to high blood pressure, a leading risk factor for CVDs, chronic kidney disease, and other health issues. Lowering hypertension rates is a crucial public health goal. As healthcare professionals, we continue to do our part to raise awareness of the dangers of high sodium intake as well as to encourage individuals to improve their Na:K ratio for better health outcomes. We recognise the importance of influencing the food environment by increasing the availability of lower-sodium alternatives in the food supply through a multi-stakeholder partnership among the government, industry, and professional bodies. In the retail sector, these products are identifiable by the Healthier Choice Symbols on their front-of-pack. When dining out, consumers can opt for F&B outlets using lower-sodium ingredients, indicated by the “Lower-sodium options available here” Healthier Choice identifier. Individuals should also strive to use less salt, whether regular salt or lower-sodium salt substitutes, to further reduce sodium intake and cultivate a palate for less salty food.

Lastly, it is important to note that lifestyle changes such as adopting a healthy balanced diet, increasing physical activity, and maintaining a healthy weight, are equally important to promote overall health and well-being.

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