**-USE SALT AND FOOD HIGH IN SALT SPARINGLY**

**ABSTRACT**

Increased salt intake leads to an increase in blood pressure and by decreasing sodium intake, relative to the usual or increased intake, results in lowered blood pressure in adults, with or without hypertension. Blood pressure is a strong proxy indicator for risk of cardiovascular disease (CVD), coronary heart disease and stroke.

Hypertension was estimated to have caused 9% of all deaths in South Africa in 2000. In 2008, 42% of men and 34% of women aged between 35-44 years and 60% of men and 50% of women aged between 45-54 years were hypertensive. More than 70% of both men and women above the age of 65 years were hypertensive in 2008.

Multi-level and multi-sectorial strategies are required to lower salt intake at the population level, including legislation of the food supply, clearer labelling and signposting of food packaging, and improved consumer education on behavioural change regarding salt usage practices. A comprehensive national strategy that focuses on salt reduction is needed to reduce national blood pressure levels in the future. Legislating the levels of salt in processed foods is only one part of this national strategy. All health professionals and educators should also provide appropriate nutritional recommendations that will educate, motivate and enable consumers to change their nutritional behaviours to reduce salt intake to less than 5 grams per day as recommended. The aim of this review is thus to revise the current food based dietary guideline (FBDG) for salt, the implementation of which would contribute to lowering population salt intake and a reduction in blood pressure and CVD in SA.

**Introduction**

It is now well established that an increase in salt intake leads to an increase in blood pressure and that decreased salt intake, relative to the usual or increased intake, leads to lowered blood pressure in adults, with or without hypertension.1 Blood pressure is a strong proxy indicator for risk of cardiovascular disease, coronary heart disease, stroke1 and kidney disease.2 Although sodium is an essential element, it is required only in small amounts. Comprehensive strategies that focus on salt reduction are needed to reduce national blood pressure levels in the future.

The previous Food Based Dietary Guidelines (FBDG) published in 2001 stated “Use salt sparingly”. The National Working Group (NWG) responsible for the revision of the FBDG agreed to change the wording to “Use salt and food high in salt sparingly”. The aim of this paper is thus to provide an update on the evidence of the role of dietary salt intake on blood pressure.

The vast majority of sodium in the diet is provided by sodium chloride (NaCl), thus for the purpose of this review, it is assumed that this is the form that impacts on blood pressure and other outcomes. However, many of the studies cited in this review measure salt intake in terms of total dietary sodium (Na) intake or urinary Na excretion. Therefore, it is not clear whether Na is harmful to health only if it is in the form of NaCl, as compared to other sources such as sodium bicarbonate, sodium aspartame or inherent sodium which is naturally present in milk and other foods.

**Hypertension and disease**

According to the World Health Organization (WHO), high blood pressure is the leading preventable risk factor for death in the world.1,3 Worldwide, hypertension is the leading risk factor for mortality, accounting for almost 13% of deaths.4 High blood pressure contributes to the considerable burden of CVD in South Africa. It is estimated that approximately 6 million adults in South Africa are hypertensive (defined as blood pressure of ≥140/90 mmHg5). Hypertension was estimated to have caused 9% of all deaths in South Africa in 2000. Fifty percent (50%) of stroke cases, 42% of ischaemic heart disease (IHD) cases, 72% of hypertensive disease and 22% of other CVD-cased burden in adult males and females are attributable to high blood pressure.5 In South Africa IHD and stroke are the leading causes of death after HIV.6 With the significant increase in hypertension over the past ten years, as well as the inadequate diagnosis and control of raised blood pressure, an increase in heart disease and stroke is inevitable in the years to come. Between 1998 and 2008, the prevalence of hypertension doubled in men ( 22% to 42% in those aged 35-44y; 30% to 60% in those aged 45-54y), and increased to a lesser extent in women (24% to 34% in those aged 35-44y; 38% to 50% in those aged 45-54y). It is estimated that more than 70% of both men and women above the age of 65 years are hypertensive. Reasons for the increasing prevalence in hypertension are related to trends in urbanisation, a shift in dietary patterns from reliance on traditional staples such as maize meal to more processed foods that are high in salt, decreased physical activity levels, as well as increasing obesity, particularly in African women.7

**The role of high sodium intake in disease**

The causal relationship between sodium intake and high blood pressure was not widely accepted in the past, but with the growing body of evidence over the past decade, it has become firmly established.1 Evidence from a wide variety of studies shows a consistent direct relationship between sodium intake and hypertension; blood pressure rises with increased sodium intake in the general population and is reduced with decreased intake.8,9 A meta-analysis of 19 cohort studies showed that high salt intake significantly increases the risk of stroke and total CVD.10 Studies that include stroke as an outcome are far fewer than those investigating cardiovascular disease, however one study in Taiwanese men demonstrated a 50 % reduction in stroke over 31 months of intervention whereby salt was replaced with a potassium-enriched salt substitute.11 In addition to the effect on blood pressure, high sodium intake has also been associated with other adverse effects, including: vascular and cardiac damage, increased risk of kidney stones, renal disease, osteoporosis, stomach cancer and the severity of asthma.9,12

A meta-analysis of controlled trials has shown that sodium intake in children also contributes to the development of hypertension later in life. It is speculated that high sodium intake suppresses the salt taste receptors, which most likely results in children preferring saltier foods in later life,13 thus early intervention and the promotion of healthy eating habits from an early age is important. Chen and Wang, based on a systematic review and meta-regression analysis of the literature from diverse populations, concluded that an elevated blood pressure in childhood is likely to predict adult hypertension and that early intervention is important.14

Furthermore, consumption of salt preserved foods (i.e. salted fish) and a high salt intake is associated with an increased risk of gastric15 and/or nasopharyngeal cancer16 however many of these cohort studies are limited to Asian populations who consume high amounts of Chinese-style salted fish, meat and vegetables.

Blood pressure is a function of cardiac output and peripheral vascular resistance. The kidneys, which excrete almost all ingested electrolytes and much of the water consumed daily, are responsible for managing the electrolyte and water content in the body. Volume content is tightly controlled by the regulation of sodium (and thereby chloride) excretion. Almost all people living in societies that have access to processed foods ingest a diet that provides quantities of salt that are far in excess of sodium requirements. However not all individuals respond similarly to a high-salt intake. A relationship between renal salt and water excretion and blood pressure can be created for any level of blood pressure and is termed the renal pressure-natriuresis or diuresis relationship, first described by Guyton.17 According to his hypothesis, the pressure–natriuresis curve is always affected in hypertension, whatever the cause that initiates the hypertensive process. All forms of hypertension in animal models tested to date feature a shift in the pressure-natriuresis relationship to the right, so that a higher level of pressure is required to excrete any given amount of salt and water. In normotensive individuals, the relationship between salt and water intake (and excretion) is very steep, so that little change in blood pressure occurs when salt and water intake (and excretion) are modified over a large range. Conversely, a fairly flat pressure-natriuresis curve indicates a sensitivity to salt.

The concept of salt sensitivity in humans was first described by Kawasaki et al.18 and later by Weinberger et al.19, in an attempt to explain the heterogeneity of the blood pressure response to salt. Salt sensitivity was initially defined as an increase in mean arterial pressure greater than 10% when a high-salt diet was administered, compared with a low-salt period.20 The methodology exposed subjects to extreme changes in sodium intake (from 10 mmol/day to 250 mmol/day) for a period of one week. Since there is no quick and easy way to predict whether an individual is salt sensitive, the classification has remained in the research domain rather than being of practical or clinical importance. However, despite seemingly arbitrary and varied definitions of salt-sensitivity, several findings are consistently observed: hypertensive patients are more frequently salt sensitive than normotensive subjects and the prevalence of salt sensitivity is increased in older individuals, black populations, and patients with a low-renin hypertension such as diabetics.20

**Lifestyle factors other than salt, which affect blood pressure**

Although excessive dietary sodium intake is a key risk factor for the development of hypertension, other lifestyle variables, including obesity, excessive alcohol intake, poor diet, and physical inactivity are also important contributors.The DASH (Dietary Approaches to Stop Hypertension) diet, has been determined to result in substantial reductions in blood pressure even when sodium intake is not decreased.21 Nevertheless, evidence for the independent impact of sodium reduction on blood pressure comes from the findings of the follow-up DASH II study which compared the effects of three levels of sodium and two dietary patterns on blood pressure. Sodium was found to have a significant effect on blood pressure in those following either a typical American diet or a DASH diet, and the combination of the DASH diet and reduced sodium intake achieved the greatest effect on blood pressure.22

**Effect of salt reduction**

*The benefits of reducing salt intake on health*

The evidence consistently highlights the fact that dietary salt reduction can achieve health benefits, especially via a reduction in blood pressure.22,23Population based intervention studies and randomised controlled clinical trials have indicated that it is possible to achieve significant reductions in blood pressure with reduced salt intake in adults, both with and without hypertension.1,8 A 4.6 g reduction in daily dietary intake of salt decreases blood pressure by about 5.0/2.7 mmHg in hypertensive individuals and by 2.0/1.0 mmHg in normotensive people.24 Randomised controlled trials have consistently displayed dose-response effects.25 The blood pressure lowering effect of reducing salt intake is effective in men and women, in all ethnic groups, in all age groups, and all starting blood pressures.23,26

The effect of dietary sodium reduction on blood pressure in subjects with resistant hypertension, defined as blood pressure that remains above the goal in spite of use of 3 antihypertensive medications, was studied in a randomized trial.27 The results indicated that patients with resistant hypertension are particularly salt sensitive. They concluded that a low dietary salt intake is an important part of the clinical management and overall treatment of resistance hypertension.

Consuming a diet low in sodium has also been shown to reduce blood pressure in children. A meta-analysis of 10 trials in children and adolescents determined that sodium restriction over a period of 4 weeks resulted in significant reductions in blood pressure.13 A recent meta-analyses confirms that a reduction in sodium intake reduces blood pressure in children.28

*Dietary salt reduction and prevention of cardiovascular disease*

Evidence of a direct effect of sodium reduction on CVD outcomes is the ideal, however few studies to this effect are available. A recent meta-analysis of six randomised trials indicated that dietary restriction of 2-2.3 g of salt (half a teaspoon) per day was associated with a 20% reduction in cardiovascular events.29Other evidence is provided by the long term follow up (10 – 15 year) analysis of the two Trials of Hypertension Prevention (TOHP I and II) randomised control trials, which demonstrated a 25% reduction in CVD events with sodium reduction.30,31 The WHO,1 in their newly published guideline on sodium intake for adults and children concluded that “The evidence regarding the relationship between sodium intake and blood pressure was of high quality, whereas the evidence regarding sodium intake and all-cause mortality, cardiovascular disease, stroke and coronary heart disease was of lower quality”. A more recent meta-analyses of He et al*.*32 reported that a modest reduction in salt intake for 4 or more weeks causes significant and important decreases in blood pressure in hypertensive as well as normotensive individuals. Furthermore, modest salt reduction over a longer term had no adverse effect on hormone or lipid levels. Aburto et al*.*28 reported in their systematic review and meta-analyses that reduced salt intake has no adverse effect on blood lipids, catecholamine levels or renal function. No associations were determined between sodium intake and all-cause mortality in the various observational studies undertaken, however significant effects on mortality from stroke and coronary heart disease were reported.

*Cost-effectiveness of salt reduction*

Bibbins-Domingo et al.33 projected that a regulatory intervention designed to achieve a reduction in salt intake of 3 gram per day in the USA would save 194,000 to 392,000 quality-adjusted life-years (QALY) and $10 billion to $24 billion in health care costs annually. They calculated that even a modest reduction of 1 gram salt per day between 2010 and 2019 will be more cost-effective than using medications to lower blood pressure in all persons with hypertension. Modelling has also been performed for 23 developing countries, and this has determined that a 15% reduction in salt intake would avert 8.5 million deaths, at a low cost of $0.40 – 1.00 per person per year.34 A recent review concluded that there is significant evidence to suggest that modifying salt intake and promoting weight reduction may reduce cardiovascular risk related to hypertension in urban, developing communities of African descent.35 Bertram and co-workers reported regarding the effect on cardiovascular disease in South Africa if the sodium content of bread, margarine, gravy and soup is reduced.36 They calculated that the proposed reductions would result in 7400 fewer cardiovascular deaths and 4300 less non-fatal strokes per year compared with 2008, with cost savings of up to R300 million.

**Salt intake patterns**

*Salt intake methodology*

The ‘gold standard’ of sodium intake is measurement of the 24-h urine sodium excretion; however this method does not identify dietary sources of salt. However, dietary methods used to assess sodium intake are not sufficiently sensitive and give an underestimation of sodium intake. Specific problems with these dietary methods are quantifying added salt during food preparation and the addition of salt and other condiments during eating. Measurement of dietary sodium, either at a population or individual level, is fraught with methodological difficulties due to high intra- and inter-subject variability in both added salt use and in dietary intake of high salt processed foods.37,38 To estimate salt intake accurately, by means of dietary intake studies, is challenging. It has been estimated that 81 days of dietary recording would be required to estimate an individual’s intake within 10% of the observed mean intake for sodium.39 Furthermore, dietary surveys do not differentiate between naturally available sodium in foods and that added as salt (NaCl) in processed foods. However, since the vast majority of sodium in the diet is provided by NaCl, it is assumed that this is the form that impacts the most on blood pressure and other outcomes.

The WHO recommends that, assuming a standard deviation of 24-h urinary sodium excretion of about 75 mmol/day, a minimum sample size of 120 participants (for either groups of men or women) is required to ensure sufficient power for a 24-h urinary sodium excretion calculation to be generalisable to the study population.40 However, due to the large day-to-day variability in urinary sodium excretion41 precision would be improved by obtaining more than one 24-h urine collection from each individual. Only one South African study has included multiple 24-h collections.42

*Salt intakes around the world*

Most people worldwide consume far more sodium than the recommended levels. Humans are genetically programmed take in less than 100 mg sodium or 0.25g salt per day.43 Brown et al44 studied estimates of sodium intake based on data from both a 24-h urinary sodium excretion analysis and dietary intake methodology. They reported that the average salt intake in most countries around the world is approximately 9 – 12 grams per day. The Asian countries have a higher intake of more than 12 grams per day. They also determined that salt intake is commonly more than 6 grams per day in children older than 5 years and that it increases with age.

Data from countries such as the UK, estimate that about three-quarters of sodium intake comes from eating processed foods, about 15% is discretionary (half of which is contributed by table salt and half by added salt in cooking), 10-11% is naturally occurring (inherent) in foods, while less than one percent is provided by water.45 In Canada it is estimated that more than 75% of sodium intake is from processed foods, including foods and meals that are served in restaurants.46

*Sodium and salt intake in South Africa*

In South Africa, current salt intake levels are similarly high at about 6 – 11 g per day using either 24-h urinary excretion or spot urine methodology.47 These studies are summarised in Table I.

Limited data is available from dietary surveys on the sodium intake of South Africans and the studies that are available are limited in comparability due to the use of different dietary methods, such as 24 hour dietary recalls and quantified food frequency questionnaire (QFFQ). Older studies performed during the 1980s and 1990s showed a higher intake of 2733 mg sodium for males and 1698 mg sodium for females than later studies.47 The average sodium intake ranged from 855 to 2733 mg per day. Charlton et al42 determined that discretionary salt intake is between 33 and 46% for the three ethnic groups studied. This means that, on average, an additional 40% should be added to take into account the amount of salt added during food preparation and at table. Based on the dietary methodology, it is estimated that the intake of salt is between 4 and 11 grams per day.47

**Table I:** Daily salt intakes as determined from urinary sodium excretion in three surveys

|  |  |  |  |
| --- | --- | --- | --- |
| **Study** | **African Programme on Genes in Hypertension\*****Gauteng** | **Charlton study\*\*****Cape Town** | **Assuring health for all in the FS (AHA-FS)#****Mangaung (Bloemfontein)** |
| Population | African ancestry | Black | White | Mixed ancestry | Black |
| Method | 24-hour urinary excretion | Average of three 24-hour urinary excretions | Spot urine |
| N | 640 | 110 | 103 | 112 | 318 | 71Males | 247Females |
| Average Na intake (mg) ±SD | 2415±1679 | 3112±1152 | 3790±2093 | 3393±1691 | 4094±1219 | 3643±1219 | 4223±1189 |
| Average salt intake (g) ± SD | 6.04±4.2 | 7.8±2.88 | 9.5±5.23 | 8.5±4.23 | 10.2±3.05 | 9.1±3.05 | 10.6±2.97 |

\*Adapted from: Norton & Woodiwiss35

\*\* Adapted from: Charlton et al.42

# Adapted from: Lategan70

SD – Standard deviation

*Contribution of foods to sodium intake*

Secondary analysis of dietary data collected as part of various studies performed in South Africa since the 1980s on different cultural groups indicates that the main contribution to total sodium intake, excluding discretionary salt, is provided by bread, both white and brown. Bread contributes between 5 to nearly 35% of sodium intake, depending on the ethnic group studied. Hard/block margarine contributes up to 13% in some of the groups. Soup powder contributes nearly 5% of total sodium intake in some populations while atchaar contributes more than 5% to the intake of the Indian population.47

**Public health strategies**

*Salt intake recommendation*

As a result of the high salt intakes globally, the WHO has set a worldwide target of 5 g or less of salt (<2000 mg sodium) per day per person in 2003.This level of intake was confirmed in 2012 by the WHO.1 Although Canada has a relatively low hypertension rate with only about 20% of adult Canadians with hypertension, Canada has embarked on a sodium reduction strategy with the aim to reduce sodium intake to 2300 mg/day by 2016.46 Targets set at the South African Non-Communicable Disease Summit in September 2011 are to reduce the mean population intake of salt to less than 5 g per day by 2020. The current South African Hypertension Guidelines recommend a maximum salt intake of 6 g (2400 mg sodium) per day.48 Table II provides an overview of current guidelines on salt or sodium intake around the world.

**Table II:** Salt and sodium intake recommendations for adults

|  |  |  |
| --- | --- | --- |
| **Country / Organisation** | **Salt recommendation****gram per day** | **Sodium recommendation****milligram per day** |
| American Heart Association71 | --- | <1500 |
| Australia and New Zealand72 | --- | 1600 - 2300 |
| Canada46 | --- | <2300 by 2016 |
| Dietary Guidelines for Americans2 | --- | <1500 |
| Scientific Advisory Committee on Nutrition (UK)73 | 6 | 2400 |
| South African Hypertension Society48 | <6 | <2400 |
| WHO1 | Adults: <5  | < 2000 |
| WHO1 | Children: the recommended maximum level should be adjusted downward based on the energy requirements of children  | Children: the recommended maximum level should be adjusted downward based on the energy requirements of children |

*Policies*

Regardless of the limited available data on specific disease endpoints, policy makers consider blood pressure as one of the few surrogate outcomes that is sufficiently robust to guide health promotion policy. He and MacGregor8 advocate the reduction of salt intake at population level because ‘a modest reduction in salt intake at the population level worldwide will result in a major improvement in public health’. In September 2011, a United Nations High-Level meeting on Non-Communicable Diseases (NCD) was held where influential political leadership reached consensus on the priority actions needed globally to prevent and treat NCDs. *The Lancet* NCD Action Group and the NCD Alliance proposed the reduction of salt intake as one of the five overarching priority actions.49

Population-based interventions to reduce sodium intake are being successfully implemented in various countries worldwide and have the potential to reduce the prevalence of hypertension and CVD. Not only is sodium reduction one of the easiest ways of potentially reducing the global burden of CVD, it can also help to reduce the burden on healthcare services and is highly cost-effective.34,44

There is clearly a need to give priority to the implementation of national strategies, policies and programmes aimed at the reduction of dietary salt consumption. A comprehensive national strategy is needed to strengthen the drive for the South African public to consume less salt. South Africa has already started the process of legislating for lower salt in processed foods. A provisional set of targets was published in July 2012 inviting interested persons to submit substantiated comments.50 It is anticipated that the final set of targets will be published in 2013. However, legislating salt levels in processed foods is only one part of a national strategy and therefore it is important for all health professionals and educators to also provide appropriate nutritional recommendations that will educate, motivate and enable consumers to change nutritional behaviour.

**Food-based dietary guidelines (FBDGs)**

The existing South African FBDG “Use salt sparingly” highlights limiting discretionary salt added during food preparation and at the table, but is not explicit with regards to limiting “*hidden*” salt from processed foods.51 Table III gives a summary of the sodium/salt guideline in other food-based dietary guidelines around the world. Many countries include guidelines on choosing lower salt foods or on limiting high salt foods. As a large amount of salt intake in the South African population is provided by processed foods, the FBDG should be changed to include this.

**Table III**: Sodium/salt guideline as part of a FBDG

| **Country** | **Sodium / Salt guideline** |
| --- | --- |
| South Africa  | Use salt sparingly |
| Namibia  | Use only iodized salt, but use less salt  |
| Nigeria  | Limit intake of salt, bouillon cubes  |
| Australia  | Limit intake of foods containing saturated fat, added salt, added sugars and alcohol |
| New Zealand  | Choose pre-prepared foods and snacks that are low in fat, salt and sugar  |
| Bangladesh  | Avoid eating too much salt and salty foods; limit salt intake to 5 – 10 grams per day  |
| China  | Choose a light diet that is also low in salt  |
| India  | Salt should be used in moderation; processed and ready-to-eat foods should be used judiciously  |
| Indonesia  | Use only iodized salt  |
| Japan  | Avoid eating too much salt; aim for a salt intake of less than 10 grams per day  |
| Philippines  | Use iodized salt, but avoid excessive intake of salty foods  |
| Singapore  | Reduce salt intake to less than 5 g a day  |
| Bulgaria  | Reduce intake of salt and salty foods  |
| Netherlands  | Be careful with salt  |
| Ireland  | Try not to always rely on salt to flavour foods  |
| UK  | Nothing specific  |
| USA  | Consume less than 2300 mg sodium per day; choose and prepare foods with little salt. At the same time consume potassium-rich foods, such as fruits and vegetables  |

**Recommended new FBDG for salt**

At a ‘Consultative meeting on reducing salt in food’ held on 21 July 2011 (organised by the Department of Health: Strategic health programmes) the following guideline was suggested:

**“**Use salt, and foods high in salt, sparingly**”**

**Barriers to reducing salt intake**

*Taste*

Taste is an important consideration in food preparation and food choices. One of the potential barriers to lowering salt intake is the concern that food may taste bland. When encouraging individuals to not add salt (or add less salt) to their foods, they should be made aware of the fact that taste adapts to lower levels of sodium. As salt intake falls, the salt taste receptors in the mouth adapt and become more sensitive to lower concentrations of salt within one or two months.52 Once salt intake is reduced, people prefer the taste of food with less salt and reject more salty foods.53 The use of other flavourings such as herbs and salt-free spices should also be encouraged and emphasised in education materials. Salt reduction in bread has been shown to be acceptable to consumers in terms of flavour.54,55 Sudden, large reductions in salt content are less acceptable to consumers56 than small to moderate changes57 which may lead to a preference for a lower salt diet.58,59 An Australian study demonstrated that a gradual one-quarter reduction in the sodium content of bread was not detected by consumers.60 Lowering the sodium content of bread by about one-third, accompanied by a two-fold to three-fold increase in the nutritionally favourable potassium and magnesium, can produce an acceptable dark European-type bread.60,61 A South African study62 has reported on substitution in the diet of a similarly sodium-reduced brown bread, with high consumer acceptance in terms of taste, flavour and texture. Importantly, inclusion of this reduced sodium bread along with other reduced sodium variants of commonly consumed food items for eight weeks resulted in a clinically significant blood pressure reduction in older hypertensive South Africans.

*Does salt appetite exist?*

New information based on animal studies suggests that sodium could possess addictive qualities. Morris and co-workers also suggests that ‘hedonic and/or affective consequences of major fluctuations in sodium balance along with neural plasticity that follows disturbed sodium homeostasis may play a role in promoting excessive sodium intake.63 The Salted Food Addiction Hypothesis (SFAH) proposes that salted food acts in the brain like an opiate agonist and results in a hedonic reward (perceived as flavourful, tasty or delicious). With withdrawal of the stimulus of an opiate receptor the body perceives it as “urges”, “cravings” and “hunger”.64

Bread is currently the major contributor to salt intake in South Africa and legislation will be introduced to gradually decrease the sodium content of bread. Bolhuis and co-workers65 conducted a study in the Netherlands to examine the effects of gradually reducing the salt content in bread on bread consumption and sodium intake. They reduced the salt content of brown bread over four weeks by 31, 52 and 67%. The results showed that reducing salt in bread up to 52% did not lead to lower consumption of bread in comparison to controls. In addition, they found that the participants in the study did not induce compensation of sodium intake. A study by Lucas and co-workers66 indicated that there is no association between sodium concentration and liking or consumption of hash browns. A recent study also indicated that a salt reduction of up to 48% is possible in commercial vegetable soup samples without affecting consumers’ liking for the meal.67

**Food labelling and consumer education**

The ingredient list, nutrition information table and health logos on food products are labelling tools which can help consumers make informed purchasing decisions. However, reading labels is often perceived as being complicated and adequate education is necessary to assist consumers in understanding nutrition labelling. Labels reflect sodium (as per the current labelling regulations) and not the salt content of foods, which often results in difficulties in consumer understanding. Consumer education is needed to address misunderstanding by consumers. Sodium chloride is approximately 40% sodium and 60% chloride. To calculate the salt content of food (in g), the sodium value (in g) should be multiplied by 2.5. By listing the sodium value, rather than the salt value, the information provided includes sodium from all sources, not only salt.

Other useful conversions:

* 2300 mg of sodium is equivalent to 100 mmol of sodium and is the amount of sodium in 5.84 g of salt which is about 1 teaspoon of salt
* 1500 mg of sodium is equivalent to 65 mmol of sodium and is the amount of sodium in 3.8 grams of salt which is about 2/3 teaspoon of salt.

Consumers should be made aware that if the words “salt” or “sodium” appears in the first few words of the ingredient list, that product is most likely high in salt and should be used sparingly, if at all. Foods with a sodium content of more than 600 mg per 100 g (1.5 g salt) in the nutrition information table may be considered high in sodium. Examples of high salt foods include:stock cubes, soup powders, salty seasonings, processed meats or sausages, fast or take away foods and salty snacks.

Although the Department of Health is legislating the maximum sodium content that will be allowed in certain foods, the food industry has a number of years to reach these targets. In the interim, consumers should be encouraged to choose lower salt alternatives of the processed foods they consume including bread, cereals, margarine or fat spreads. Consumer education is needed to empower the public to be able to make informed food choices at the point of purchase by comparing the sodium content per 100 g of similar products. For many consumers, signposting of products with health logos such as the Heart and Stroke Foundation’s SA Heart Mark may be an easier and more useful tool for identifying lower sodium alternatives.

In addition, food labelling legislation can help guide lower sodium choices. The following categories could apply to sodium content claims that can be made on food packaging, as currently outlined in Regulation 146 – Regulations relating to the labelling and advertising of foodstuffs68:

* Low in sodium – not more than 120 mg per 100 g
* Very low in sodium – not more than 40 mg per 100 g
* Free of sodium – not more than 5 mg per 100 g

**Iodisation**

A potential concern of reducing salt intake within the population is that it would interfere with the national iodisation fortification programme. However, if salt is sufficiently iodated, a salt intake as low as 5 g per day would provide an adequate amount of iodine. In SA, salt is sufficiently iodated to a concentration of 40 to 60 ppm, so the salt-lowering message will not interfere with the nutritional requirements for iodine intake in the population.69

**Conclusion**

There is conclusive evidence of the adverse effects of excessive dietary salt consumption on health, particularly on blood pressure, leading to cardiovascular disease. In view of the significant increase in hypertension among the South African population over the past decade, predisposing factors such as high salt intake needs to be curtailed in order to reduce blood pressure in the future. Current recommendations indicate that to prevent chronic diseases, the population average consumption of salt should be less than 5 g per day i.e. 2 g per day of sodium.1 As population-based reductions in dietary sodium consumption are highly cost-effective, there is clearly a need for government to invest in this high priority. In South Africa, national strategies are underway to achieve this via regulation of the sodium content of certain categories of processed foods and the reformulation of these foods by the food industry. However, these policies will take a number of years to be implemented and need to be supported by concurrent changes in the environment which would empower consumers to make healthier food choices (e.g. via clear labelling of processed foods) as well as via active health promotion and consumer education. In South Africa, the main sources of salt have been identified and include certain categories of processed foods. Discretionary salt added at the table and during cooking remain important contributors to dietary salt intake, however, it is important that these categories of processed foods also need to be reduced. Importantly, salt is sufficiently iodated in South Africa, therefore a salt-restricted diet of 5 g per day will not compromise iodine status. The South African FBDG’s have been developed to help guide healthier food choices by the population which includes a reduction in sodium intake. Practically, these guidelines translate to a daily diet that includes plenty of vegetables and fruit, regular intake of legumes and a moderate intake of minimally processed whole grain starchy foods, as well as inclusion of low-fat dairy products and fish, lean meat or chicken. Adoption of the revised FBDG which states “Use salt, and foods high in salt, sparingly” strengthens the drive to lower national levels of salt intake which would ultimately contribute to reducing the burden of hypertension and CVD in SA.

**References**

1. WHO. Guideline: Sodium intake for adults and children. Geneva: World Health Organization (WHO), 2012. Available from: <http://www.who.int/nutrition/publications/guidelines/sodium_intake/en/>
2. USDA. Report of the Dietary Guidelines Advisory Committee on the Dietary Guidelines for Americans, 2010. USDA, May 2010.
3. Ezzati M, Lopez AD, Rodgers A, Hoorn SV, Murray CJL, Comparative Risk Assessment Collaborating Group. Selected major risk factors and global and regional burden of disease. Lancet. 2002;360:1347-1360.
4. WHO. Global health risks: mortality and burden of disease attributable to selected major risks. Geneva: World Health Organization (WHO), 2009. (<http://www.who.int/healthinfo/global_burden_disease/GlobalHealthRisks_report_full.pdf>)
5. Norman RGT, Laubscher R, Steyn K, Bradshaw D. Estimating the burden of disease attributable to high blood pressure in South Africa in 2000. SAMJ. 2007;97:692-698.
6. Norman R, Bradshaw D, Schneider M, Pieterse D. Revised Burden of Disease Estimates for the Comparative Risk Factor Assessment, South Africa 2000. Cape Town: Medical Research Council, 2006.
7. Bradshaw D, Steyn K, Levitt N, Nojilana B. Non-communicable diseases: a race against time. Cape Town: Medical Research Council South Africa (undated).
8. He FJ, MacGregor GA. Salt, blood pressure and cardiovascular disease. Curr Opin Cardiol. 2007;22:298-305.
9. He FJ, MacGregor GA. A comprehensive review on salt and health and current experience of worldwide salt reduction programmes. J Human Hypertension 2009;23:363-384.
10. Strazzullo P, D’Elia L, Kandala N-B, Cappuccio FP. Salt intake, stroke, and cardiovascular disease: meta-analysis of prospective studies. Br Med J. 2009;339:b4567.
11. Chang HY, Hu YW, Yue CSJ, et al. Effect of potassium-enriched salt on cardiovascular mortality and medical expenses of elderly men. Am J Clin Nutr. 2006;83:1289-1296.
12. De Wardener HE, MacGregor GA. Harmful effects of dietary salt in addition to hypertension. J Human Hypertension. 2002;16:213-223.
13. He FJ, MacGregor GA. Importance of salt in determining blood pressure in children: meta-analysis of controlled trials. Hypertension. 2006;48:861-869.
14. Chen X, Wang Y. Tracking of blood pressure from childhood to adulthood. A systematic review and meta-regression analysis. Circulation. 2008;117:3171-3180.
15. D’Elia L, Rossi G, Ippolito R, Cappuccio FP, Strazzullo. Habitual salt intake and risk of gastric cancer: a meta-analysis of prospective studies. Clin Nutr. 2012;31:489-498.
16. Wei-Hua J, Hai-De Q. Non-viral environmental risk factors for nasopharyngeal carcinoma: a systematic review. Seminars in Cancer Biology 2012;22:117-126.
17. Guyton AC. Dominant role of the kidneys and accessory role of the whole-body autoregulation in the pathogenesis of hypertension. Am J Hypertens. 1989; 2: 575–585.

Kawasaki T, Delea CS, Bartter FC, Smith H. The effect of high-sodium and low-sodium intakes on blood pressure and other related variables in human subjects with idiopathic hypertension.Am J Med. 1978; 64: 193–198.

Weinberger MH, Miller JZ, Luft FC, Grim CE, Fineberg NS. Definitions and characteristics of sodium sensitivity and blood pressure resistance. Hypertension*.* 1986; 8 [Suppl II]: 127–134.

Weinberger MH. Sodium sensitivity of blood pressure. Curr Opin Nephrol Hypertens. 1993; 2: 935–939.

1. Appel LJ, Moore TJ, Obarzanek E, et al. A clinical trial of the effects of dietary patterns on blood pressure. N Engl J Med. 1997;336:1117-1124.
2. Sacks F, Svetkey L, Vollmer W, et al. for the DASH–Sodium Collaborative Research Group. Effects on blood pressure of reduced dietary sodium and the dietary approaches to stop hypertension (DASH) diet. N Engl J Med. 2001;344:3-10.
3. He FJ, MacGregor GA. Effect of longer-term modest salt reduction on blood pressure. Cochrane Database Syst Rev. 2004;3:CD004937.
4. He FJ, MacGregor GA. Effect of modest salt reduction on blood pressure: a meta-analysis of randomized trials. Implications for public health. J Human Hypertension. 2002;16:761-770.
5. He FJ, MacGregor GA. How far should salt intake be reduced? Hypertension. 2003;42:1093-1099.
6. Cappuccio FP, Capewell S, Lincoln P, McPherson K. Policy options to reduce population salt intake. Br Med J. 2011;343:d4995.
7. Pimenta E, Gaddam KK, Oparil S, Aban I, Husain S, Dell’Italia LJ, Calhoun DA. Effects of dietary sodium reduction on blood pressure in subjects with resistant hypertension. Results from a randomized trial. Hypertension. 2009;54:475-481.
8. Aburto NJ, Ziolkovska A, Hooper L, Elliott P, Cappuccio FP, Meerpohl JJ. Effect of lower sodium intake on health: systematic review and meta-analyses. BMJ. 2013;346:f1326 doi: 10.1136/bmj.f1326 (published 5 April 2013).
9. He FJ, MacGregor GA. Salt reduction lowers cardiovascular risk: meta-analysis of outcome trials. Lancet. 2011;378:380-382.
10. Cook NR, Cutler JA, Obarzanek E, et al. Long term effects of dietary sodium reduction on cardiovascular disease outcomes: observational follow-up of the trials of hypertension prevention (TOHP). BMJ. 2007;334(7599):885-888.
11. Cook NR, Obarzanek E, Cutler JA, et al. Joint effects of sodium and potassium intake on subsequent cardiovascular disease: the Trials of Hypertension Prevention follow-up study. Arch Internal Med. 2009;169:32-40.
12. He FJ, Li J, MacGregor GA. Effect of longer-term modest salt reduction on blood pressure (Review). Cochrane database of systematic reviews. 2013;4: Art. No.: CD004937. DOI: 10.1002/14651858.CD004937.pub2
13. Bibbins-Domingo K, Chertow GM, Coxson PG, et al. Projected effect of dietary salt reductions on future cardiovascular disease. N Engl J Med. 2010;362:590-599.
14. Asaria P, Chisholm D, Mathers C, Ezzati M, Beaglehole R. Chronic disease prevention health effects and financial costs of strategies to reduce salt intake and control tobacco use. Lancet. 2007;370:2044–2053.
15. Norton GR, Woodiwiss AJ. Hypertension in Africa: redressing the burden of cardiovascular disease using cost-effective non-pharmacological approaches. SA Heart 2011;8:28-36.
16. Bertram MY, Steyn K, Wentzel-Viljoen E, Tollman S, Hofman KJ. Reducing the sodium content of high-salt foods: Effect on cardiovascular disease in South Africa. SAMJ 2012;102:743-745.

[Sowers M](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=pubmed&cmd=Search&itool=pubmed_Abstract&term=%22Sowers+M%22%5BAuthor%5D), [Stumbo P](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=pubmed&cmd=Search&itool=pubmed_Abstract&term=%22Stumbo+P%22%5BAuthor%5D). A method to assess sodium intake in populations. J Am Diet Assoc. 1986;86(9):1196-1202.

1. Espeland MA, Kumanyika S, Wilson AC, et al. Statistical issues in analysing 24-hour dietary recall and 24-hour urine collection data for sodium and potassium intakes. Am J Epidemiol. 2001;153(10):996-1006.
2. Mattes RD, Donnelly D. Relative contributions of dietary sodium sources. J Am Col Nutr. 1991;10:383-393.
3. WHO/PAHO Regional Expert Group for Cardiovascular Disease. Prevention through population‐wide dietary salt reduction. Protocol for population level sodium determination in 24‐hour urine samples. 2010. Available from: <http://www2.paho.org/hq/dmdocuments/2010/pahosaltprotocol.pdf>
4. Liu K, Cooper R, McKeever J, et al. Assessment of the association between habitual salt intake and high blood pressure: methodological problems. Am J Epidemiol. 1979;110:219-226.
5. Charlton KE, Steyn K, Levitt NS, et al. Diet and blood pressure in South Africa: intake of foods containing sodium, potassium, calcium, and magnesium in three ethnic groups. Nutrition. 2005;21:39-50.
6. He FJ, MacGregor GA. Reducing population salt intake worldwide: from evidence to implementation. Prog in Cardiovas Dis. 2010;52:363-382.
7. Brown IJ, Tzoulaki I, Candeias V, Elliott P. Salt intakes around the world: implications for public health. Int J Epidemiol. 2009;38:791-813.
8. Sanchez-Castillo CP, Warrender S, Whitehead TP, James WP. An assessment of the sources of dietary salt in a British population. Clin Sci. 1987;72:95-102.
9. Campbell NRC, Strang R, Young E. Hypertension: prevention is the next great challenge and reducing dietary sodium is the starting point. Can J Cardiol. 2011;27:434-436.
10. Wentzel-Viljoen E, Laubscher R, Steyn K. The foods that contribute to South Africans’ high salt intake – evidence for salt reduction regulations. 2013. *Submitted*
11. Seedat YK, Rayner BL. South African hypertension guideline 2011. SAMJ 2012;102:57-84.
12. Beaglehole R, Bonita R, Horton R, et al*.* for The Lancet NCD Action group and the NCD Alliance. Priority actions for the non-communicable disease crisis. Lancet. 2011;377:1438-1447.
13. Department of Health. Regulations relating to the reduction of sodium in certain foodstuffs and related matters. Pretoria: Government Gazette, 11 July 2012 no 35509. Available on <http://www.info.gov.za/view/DownloadFileAction?id=170455>
14. Charlton KE, Jooste PL. Eat salt sparingly – sprinkle, don’t shake. S Afr J Clin Nutr. 2001;14(3),supplement:S55-S64.
15. Blaise CA, Pangborn RM, Borhani NO, Ferrell MF, Prineas RJ, Laing B. Effect of dietary sodium restriction on taste responses to sodium chloride: a longitudinal study. Am J Clin Nutr. 1986;44:232-243.
16. Teow BH, Nicolantonio RD, Morgan TO. Sodium chloride preference and recognition threshold in normotensive subjects on high and low salt diet. Clin Exper Hypertens. 1985;7:1681-1695.
17. Breslin P, Beauchamp G. Salt enhances flavour by suppressing bitterness. Letter. Nature. 1997;387:365.
18. Salovaara H. Sensory limitations to replacement of sodium with potassium and magnesium in bread. Cereal Chem. 1982;59:427-430.
19. Beauchamp G, Bertino M, Moran M. Sodium regulation: sensory aspects. J Am Diet Assoc. 1982;80:40-45.
20. Rodgers A, Neal B. [Less salt does not necessarily mean less taste.](http://www.ncbi.nlm.nih.gov/pubmed/10218541?ordinalpos=4&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_DefaultReportPanel.Pubmed_RVDocSum) Lancet. 1999;353 (9161):1332.
21. Beauchamp GK, Bertino M, Engelman K. Failure to compensate decreased sodium intake with increased table salt usage. J Am Diet Assoc. 1987;258:3275-3278.
22. Bertino M, Beauchamp G, Engelman K. 1982. Long-term reduction in dietary sodium alters the taste of salt. Am J Clin Nutr. 1982;36:1134-1140.
23. Girgis S, Neal B, Prescott J, et al. A one-quarter reduction in the salt content of bread can be made without detection. Eur J Clin Nutr. 2003;57:616-620.
24. Charlton KE, Steyn K, Levitt NS, et al. A food-based dietary strategy lowers blood pressure in a lowsocio-economic setting: a randomised study in South Africa. Public Health Nutr. 2008;11(12):1397-1406.
25. Charlton KE, MacGregor E, Vorster NH, Levitt NS, Steyn K. Partial replacement of NaCl can be achieved with K, Mg and Ca salts in brown bread*.* Int J Food Sci Nutr. 2007;58(7):508-521.
26. Morris MJ, Na ES, Johnson AK. Salt craving: the psychobiology of pathogenic sodium intake, Physiology & Behavior 2008;94:709-721.
27. Cocores JA, Gold MS. The Salted Food Addiction Hypothesis may explain overeating and the obesity epidemic. Medical Hypotheses 2009;73:892-899.
28. Bolhuis DP, Temme EHM, Koeman FT, Noort MWJ, Kremer S, Janssens AM. A salt reduction of 50% in bread does not decrease bread consumption or increase sodium intake by choice of sandwich fillings. J Nutr. 2011;141:2249-2255.
29. Lucas L, Riddell L, Liem G, Whitelock S, Keast R. The influence of sodium on liking and consumption of salty food. J Food Sci. 2011;76:S72-S76.
30. Mitchell M, Brunton NP, Wilkinson MG. The influence of salt taste threshold on acceptability and purchase intent of reformulated reduced sodium vegetable soups. Food Quality and Preference. 2013;28:356-360.
31. Department of Health. Regulations relating to the labelling and advertising of foodstuffs. Pretoria: Government Gazette 2010; 1 March. Available from: <http://www.doh.gov.za/docs/regulations/2010/reg0146.pdf>
32. Charlton KE, Jooste PL, Steyn K, Levitt NS, Ghosh A. A lowered salt intake does not compromise iodine status in South Africa, a country with mandatory salt iodization. Nutrition. 2012; <http://dx.doi.org/10.1016/j.nut.2012.09.010>
33. Lategan R. The association of body weight, 25-hydroxy vitamin D, sodium intake, physical activity levels and genetic factors with the prevalence of hypertension in a low income, black urban community in Mangaung, Free State, South Africa. PhD thesis. Bloemfontein, South Africa: UFS, 2011.
34. Lloyd-Jones DM, Hong Y, Labarthe D, et al. American Heart Association Strategic Planning Task Force and Statistics Committee. Defining and setting national goals for cardiovascular health promotion and disease reduction: the American Heart Association’s strategic impact goal through 2020 and beyond. Circulation. 2010;121:1768-1777.
35. National Health and Medical Research Council, Australian Government Department of Health and Ageing, New Zealand Ministry of Health. Nutrient reference values for Australia and New Zealand including recommended dietary intakes. Canberra: Commonwealth of Australia, 2006.
36. Scientific Advisory Committee on Nutrition. Salt and health. London: The Stationery Office, 2003.