TECHNICAL PAPER

Review of Salt and Health: Situation in South-East Asia Region

by

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**Introduction**

High blood pressure (HBP) or hypertension is an important modifiable risk factor for cardiovascular disease (CVD). It currently accounts for about 7.6 million, or 13.5% of annual global deaths.\(^1\) Hypertension is directly responsible for 54% of all strokes and 47% of all coronary heart disease worldwide.\(^1\) Most people with hypertension currently live in low- and middle-income countries that bear a disproportionate burden of hypertension related risk of death, which is double that of high-income countries. Over half of this burden occurs in individuals aged 45–69 years, the most productive segment of the population.\(^1\text{-}^3\) Estimates indicate that 90% of the population aged 55-65 years having normal blood pressure will ultimately develop HBP during their lifetime if they live their average lifespan.\(^4\) Chronic noncommunicable diseases (NCDs), particularly CVD and its principal risk factor HBP, are increasing in the South East Asia Region (SEAR). In 2008, of the 7.9 million NCD-related deaths in SEAR, 3.6 million were attributable to CVD alone (Table1). This is projected to increase to 12.5 million by 2030.\(^5\text{-}^6\) Notably, unlike in developed countries, most of the deaths occur at younger ages with consequent adverse health, economic and social implications.
Table 1: Total mortality (000) by major noncommunicable diseases and major cardiovascular diseases in SEAR, 2008

<table>
<thead>
<tr>
<th>Noncommunicable diseases</th>
<th>Cardiovascular diseases</th>
<th>Hypertensive heart disease</th>
<th>Ischaemic heart disease</th>
<th>Cerebrovascular diseases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Women</td>
<td>Men</td>
<td>Both sexes</td>
<td>Women</td>
<td>Men</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>285</td>
<td>313</td>
<td>599</td>
<td>149</td>
</tr>
<tr>
<td>Bhutan</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>DPR Korea</td>
<td>71</td>
<td>61</td>
<td>133</td>
<td>37</td>
</tr>
<tr>
<td>India</td>
<td>2 274</td>
<td>2 968</td>
<td>5 241</td>
<td>1 003</td>
</tr>
<tr>
<td>Indonesia</td>
<td>482</td>
<td>582</td>
<td>1 064</td>
<td>236</td>
</tr>
<tr>
<td>Maldives</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Myanmar</td>
<td>117</td>
<td>126</td>
<td>242</td>
<td>61</td>
</tr>
<tr>
<td>Nepal</td>
<td>43</td>
<td>49</td>
<td>92</td>
<td>21</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>51</td>
<td>67</td>
<td>118</td>
<td>23</td>
</tr>
<tr>
<td>Thailand</td>
<td>191</td>
<td>227</td>
<td>418</td>
<td>76</td>
</tr>
<tr>
<td>Timor-Leste</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>SEAR</td>
<td>3 517</td>
<td>4 397</td>
<td>7 914</td>
<td>1 606</td>
</tr>
<tr>
<td>Global</td>
<td>17 214</td>
<td>18 908</td>
<td>36 122</td>
<td>8 647</td>
</tr>
</tbody>
</table>

Source: Based on WHO (2009) in Global Health Risk Summary Tables (http://www.who.int/evidence/bod)
Excess Dietary Salt Intake and Health: The Evidence

Over the past few decades, numerous investigations spanning animal, epidemiological, migration and population intervention studies conducted worldwide have found excess dietary salt or sodium intake to be associated with increased risk of HBP. Numerous authoritative scientific reviews that have critically examined this association have confirmed the harmful health impact of excess salt consumption, particularly on cardiovascular health, and unequivocally recommended salt reduction (Table 2).

<table>
<thead>
<tr>
<th>Review / reports</th>
<th>Year</th>
<th>Main recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scientific Advisory Committee on Nutrition, UK</td>
<td>2003</td>
<td>Reduce the mean population salt intake to 6 g/day</td>
</tr>
<tr>
<td>Diet, Nutrition and the Prevention of Chronic Diseases: report of a Joint WHO/FAO Expert Consultation</td>
<td>2003</td>
<td>Salt consumption of &lt;5 g/day while ensuring that the salt is iodized</td>
</tr>
<tr>
<td>Institute of Medicine (IOM). Dietary Reference Intakes: Water, Potassium, Sodium Chloride, and Sulfate</td>
<td>2004</td>
<td>Set 3.75 g/day as an adequate intake, and 5.8 g/day as the upper tolerable intake level for most adults</td>
</tr>
<tr>
<td>World Health Organization (WHO) Forum on Reducing Salt Intake in Populations</td>
<td>2006</td>
<td>Salt consumption of &lt;5 g/day</td>
</tr>
<tr>
<td>Institute of Medicine (IOM). A Population-Based Policy and Systems Change Approach to Prevent and Control Hypertension</td>
<td>2010</td>
<td>Salt consumption of 5.75 g/day or less</td>
</tr>
<tr>
<td>American Heart Association (AHA) Presidential Advisory</td>
<td>2011, 2012</td>
<td>Salt consumption of 3.75 g/day or less</td>
</tr>
</tbody>
</table>

Concerns about the relevance and application of current salt reduction guidelines to those living in places with hot and humid climates, such as most of south-east Asia seems unfounded as evidence indicates that loss of sodium through body sweat or faeces is minimal. Further, heat acclimation happens quite quickly after a few days of exposure to hot climate and individuals lose relatively small quantity of sodium through sweating. Performance testing experiments among US soldiers on 4 g salt per day showed that a well-balanced diet along with adequate intake of water maintained their performance and normal electrolyte measurements during strenuous physical activity of 8 h/day for 10 consecutive days in a hot environment of 41 °C. This indicates that eating a balanced diet with currently recommended levels of salt and drinking appropriate amounts of water will compensate for the sodium loss through sweating and/or physical activity without the need for electrolyte supplements or dietary changes/supplements.17–20

Given the credible body of scientific evidence of increases in salt intake worldwide coupled with the escalating burden of hypertension and CVD, the World Health Organization (WHO) recommends a daily salt intake of less than 5 g.13 Consequently, most national and
international guidelines/position statements for CVD prevention and control universally recommend dietary salt reduction as an important strategy to prevent CVD.\textsuperscript{15,16,21,22} The terms salt and sodium are often used synonymously, although on a weight basis salt comprises 40% sodium and 60% chloride. Box 1 indicates an overview of different units.\textsuperscript{8}

<table>
<thead>
<tr>
<th>Sodium (mg)</th>
<th>Sodium (mmol)</th>
<th>Salt* (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>400</td>
<td>17</td>
<td>1</td>
</tr>
<tr>
<td>2000</td>
<td>87</td>
<td>5</td>
</tr>
<tr>
<td>4000</td>
<td>174</td>
<td>10</td>
</tr>
</tbody>
</table>

\textsuperscript{* a teaspoon of salt contains approximately 6 g salt}

Worldwide, excess dietary salt intake is responsible for 17\%–30\% of hypertension and substantially increases the risk of blood pressure-related CVD events in normotensives.\textsuperscript{23,24} High dietary salt intake has also been associated with direct vascular and cardiac damage, obesity, stomach cancer, osteoporosis, kidney stones and increased severity of asthma symptoms.\textsuperscript{7,8,25} Foods high in salt increase thirst and lead to increased consumption of calorie-dense soft drinks; and few reports have identified it to be a likely contributor to childhood obesity.\textsuperscript{26}

Some recent observational studies reported contradictory findings that indicated a J-shaped association (increased risk at the lowest and the highest sodium intake levels) or reverse association between salt intake and CVD stirring controversy in the scientific arena as well as in the general population through wide press coverage.\textsuperscript{27–32} However, these studies were not originally designed to study the relationship between salt, blood pressure and CVD, and were conducted in patient populations at high risk of CVD or with established disease. Thus, the results are unlikely to be reflective of and applicable to the normal free-living population. In addition, these studies had substantive methodological limitations, and the most recent review by the American Heart Association (AHA) that examined these data indicates that the evidence pertaining to the adverse impact of excess salt intake remains strong regardless, with no requirement to change current recommendations on salt reduction.\textsuperscript{16}

\textbf{Objective of the Paper}

This paper summarizes the information available in SEAR on salt intake and highlights key actions that countries can implement for salt reduction as a population-based strategy for prevention and control of HBP.

\textbf{High Blood Pressure in SEAR}

Nearly a third of the adult population in SEAR has HBP, and not surprisingly HBP is the leading preventable risk for mortality, accounting for 1.5 million deaths annually or 9\% of all deaths (Fig. 1).\textsuperscript{5}
Fig. 1: High blood pressure in adult population of SEAR (%), 2008*

*HBP ≥140/90 mm Hg or on anti-hypertensive treatment

Awareness, Treatment and Control Rates of Hypertension

Country-specific data on awareness, treatment and control of hypertension disaggregated by age, gender and other indicators are not available for most countries in the Region. Such data even when available are usually obtainable from small subnational or sample studies.5 Available data indicate that detection, treatment and control rates of hypertension are very low and suboptimal with the “rule of halves” (less than half with hypertension are detected, less than half of those detected receive treatment and less than half of those receiving treatment have blood pressure adequately controlled) still being largely valid or worse in most Member countries where control rates are typically less than 10%.3,33,34 This is causing avoidable complications, premature mortality and high health care costs.

Rationale and Potential Impact of Population-based Salt Reduction Strategies to Reduce Hypertension and Associated CVD

There is robust scientific evidence that reducing the amount of dietary salt consumed will reduce mean population blood pressure and associated risk of cardiovascular events in both hypertensive and normotensive individuals.7–9,35 For example, a population-wide decrease of 2 mmHg diastolic blood pressure, such as that achievable by modest salt reduction, is estimated to reduce the prevalence of hypertension by 17%, coronary artery disease by 6% and the risk of stroke by 15%, with many of the benefits occurring among persons with normal blood pressure underlining the huge potential of salt reduction to improve population health.35 Given that nearly half of the blood pressure-related CVD events occur among those without hypertension, population-wide salt reduction is potentially one of the most cost-
effective strategies to prevent CVD. In addition, it is also cost-saving as it has the potential to improve hypertension control rates, reduce the need for anti-hypertensive medications and consequently curb associated health care costs.\textsuperscript{13,14}

Leading international health organizations/governments (such as the WHO,\textsuperscript{13} US Institute of Medicine,\textsuperscript{14} World Economic Forum,\textsuperscript{36} American Medical Association,\textsuperscript{15,16} World Medical Association,\textsuperscript{37} National Institute for Health and Clinical Excellence (NICE) UK Guidelines on Prevention of Cardiovascular Disease at the Population Level,\textsuperscript{38} UK Scientific Advisory Committee on Nutrition,\textsuperscript{10} Government of Canada’s Canadian Heart Health Strategy and Action Plan and, Sodium Reduction Strategy for Canada — Recommendations of the Sodium Working Group\textsuperscript{39}) that have extensively examined the whole gamut of issues pertaining to salt and cardiovascular health have advocated for as well as endorsed salt reduction policies and called upon health care professionals, governments and the food industry to work in collaboration to reduce population salt consumption (see Boxes 2 and 3).

**Box 2: NICE UK Guidelines on Prevention of Cardiovascular Disease at the Population Level**

**Goal:** To reduce population salt intake and reduce CVD

**Key suggested actions:**
- Progressively reduce adult salt intake to 6 g/day by 2015 and 3 g/day by 2025
- Introduce national legislation if required
- Ensure continued action by food producers and caterers to reduce salt in commonly eaten foods (such as bread, meat products, cheese, soups and breakfast cereals)
- Establish that children under 11 years should consume substantially less salt than adults
- Establish an independent system for monitoring national salt levels in commonly consumed foods
- Ensure that low-salt products are sold cheaper than their higher salt equivalents
- Label foods with the Food Standards Agency approved traffic light system labelling

**Box 3: Sodium Reduction Strategy for Canada — Recommendations of the Sodium Working Group**

**Goal:** To reduce population salt intake to <6 g/day

**Key suggested actions:**
Use of structured voluntary approach involving:
- Publishing salt reduction targets for foods with timelines
- A mechanism for public commitment by the food industry to reduction targets
- Monitoring plan to assess progress by a non-food industry independent body
- Independent evaluation of the reduction programme with the option of implementing stronger measures as required
Select countries (Finland, Japan, UK) have successfully reduced their population salt intake with associated benefits in terms of population blood pressure lowering and subsequent reduction in CVD events.\textsuperscript{7,11} Many others are implementing or are in the process of initiating implementation of salt reduction programmes.\textsuperscript{14,40,41}

Table 3 illustrates the potential blood pressure lowering impact of salt reduction in select countries of SEAR. These modeled estimates are based on a 15\% reduction in salt intake by voluntary reduction in processed foods and condiments by the food industry and through consumer education to encourage dietary change using mass media. The estimated cost (as of 2005) of implementing salt reduction in these countries was between US\$ 0.04–0.06 per person per year. These costs were calculated on the basis of prices of resources required for programme implementation, such as salaries, equipment costs and mass media costs based on the WHO-CHOosing Interventions that are Cost Effective (CHOICE) database which utilizes gross per capita national product to predict country-specific unit costs.\textsuperscript{42}

**Table 3: Potential impact of salt reduction on blood pressure in select SEAR countries**

<table>
<thead>
<tr>
<th>Age (Years)</th>
<th>Bangladesh</th>
<th>India</th>
<th>Indonesia</th>
<th>Myanmar</th>
<th>Thailand</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Men</td>
<td>Women</td>
<td>Men</td>
<td>Women</td>
<td>Men</td>
</tr>
<tr>
<td>30-44</td>
<td>1.3</td>
<td>1.1</td>
<td>1.6</td>
<td>1.4</td>
<td>1.5</td>
</tr>
<tr>
<td>45-59</td>
<td>1.7</td>
<td>1.6</td>
<td>2.0</td>
<td>1.7</td>
<td>2.0</td>
</tr>
<tr>
<td>60-69</td>
<td>2.3</td>
<td>2.2</td>
<td>2.5</td>
<td>2.3</td>
<td>2.6</td>
</tr>
<tr>
<td>70-79</td>
<td>2.8</td>
<td>2.8</td>
<td>3.1</td>
<td>2.8</td>
<td>3.1</td>
</tr>
<tr>
<td>≥80</td>
<td>3.5</td>
<td>3.5</td>
<td>3.8</td>
<td>3.5</td>
<td>3.9</td>
</tr>
</tbody>
</table>

**Population Salt Intake, Dietary Salt Sources and Assessment Methods in SEAR**

Tremendous changes in lifestyles and dietary patterns across SEAR have led to consumption of unhealthy diets that are high in salts, fats and sugars, and low in fruits and vegetables. Estimates indicate that almost 80\% of people do not consume adequate quantities of fruits and vegetables, which are good sources of potassium and can blunt the impact of sodium on blood pressure. Reports indicate that salt intake is high in many countries of the Region and exceeds the *WHO recommended daily level of 5 g or less* dietary salt intake.\textsuperscript{5}

SEAR has a very rich and diverse dietary culture with extensive use of salt and spices. A review of the literature, however, indicates paucity of current information because contemporary data on population salt consumption and sources that comprise the intake are very limited (Table 4). In most studies, data were obtained from select or non-representative samples. In addition, reliance on dietary data instead of the gold standard 24-hour urinary sodium assessment points to the likely underestimation of actual salt intake. Furthermore, data on knowledge of the public about the adverse health impact of excess salt consumption and attitudes in regard to salt and salt reduction is limited. The review of available information on salt consumption levels in different countries of the Region is summarized below. No information on salt intake or dietary salt sources in diet are available from Democratic People’s Republic of Korea, Maldives, Myanmar and Timor-Leste.
<table>
<thead>
<tr>
<th>Country</th>
<th>Study Area and Year</th>
<th>Sample</th>
<th>Salt/Sodium Intake</th>
<th>Method Used</th>
</tr>
</thead>
</table>
| Bangladesh   | Araihazar, 2000–2002 | 11 116 aged ≥18 years | 146 mg sodium per day in normotensives  
179 mg sodium per day in treated hypertensives | Food frequency questionnaire        |
| Bangladesh   | Dhaka, 2010          | 200 aged 20–60 years | 17 g salt per day                                                                  | Estimated from spot urine sample    |
| India        | 13 states, 1986–88   | 107 864 aged ≥18 years | 13.8 g salt per day per person Ranged between 7–26 g per day per person in different states | Household salt weighing            |
| India        | Ladakh and Delhi, 1988 | 399 aged 20–59 years | 12 g salt per day in Ladakh  
9 g salt per day in Delhi                  | 24 hour urinary sodium excretion   |
| India        | Chennai, 2007        | 1902 aged ≥20 years | 8.5 g salt per day                                                                  | Food frequency questionnaire        |
| India        | Rural Andhra Pradesh, 2010 | 1429 aged ≥18 years | 42.3 g salt per day                                                                  | Household salt weighing            |
| Indonesia    | Jakarta, 2007        | 556 aged ≥55 years | 198 mg sodium per day among men  
161 mg sodium per day among women          | 24-hour dietary recall             |
| Indonesia    | 2011                | National household survey of 68000 persons | 5 g salt per day                                                                  | Per capita household consumption   |
| Nepal        | Kotyang, Bhadrakali, 1993 | 927 adults | 10–13 g salt per day                                                              | 24-hour urinary sodium excretion   |
| Nepal        | Bhadrabas and Alapot in Kathmandu, 2006 | 1218 aged ≥21 years | Consumption of >5 g salt per day per person in 90% of the sample                  | Household salt weighing            |
| Sri Lanka    | Urban Ceylon, 1970   | 48 adults and 17 children aged ≤12 years | 7 g salt per day                                                                  | Consumption estimated by collecting a measured amount of the clear salt solution added to dishes |
| Sri Lanka    | 2012                | 328 adults, aged 30–59 years | 8 g salt per day: 9 g salt per day in men and 7.7 g salt per day in women  
11.4 g salt per day per person               | 24-hour urinary sodium excretion  
Household salt weighing                     |
| Thailand     | 2008-09             | National household survey of 10080 persons | 10.8 g salt per day                                                                  | 7-day dietary recall               |
**Bangladesh**

An analysis of 11,116 adults aged 18 years and above in Araihaazar that assessed dietary salt intake using food frequency questionnaire found the intake to range from 146 mg sodium per day in normotensives to 179 mg sodium per day among those being treated for hypertension. In 2009–2010, the National Heart Foundation Hospital and Research Institute, Bangladesh conducted a study among 200 adults aged 20-60 years and estimated the average salt intake per person from spot urine samples to be 17 g/day.

**Bhutan**

No studies on salt intake were available from Bhutan. Obtainable information points to high intake of salt as Bhutanese regularly consume salted tea, salted snacks and pickles. In addition, salt is also commonly used as a preservative in dried foods, meat and pickles, which are consumed in high quantities by the majority of the population. Salt is also a likely contributing factor to increase in stomach cancer cases in Bhutan.

**India**

Limited available data indicates that population salt intake is very high across the country with the average intake being 9–12 g/day. The intake is reported to be higher in urban settings compared to rural settings.

The earliest data on population salt intake is from a study conducted by the Indian Council of Medical Research during 1986–1988 in 13 states, which reported an average per capita salt consumption of 13.8 g/day (7–26 g/day in these different states). Till date, INTERSALT is the only study that has objectively assessed salt intake in 1988 by measuring 24-hour urinary sodium excretion in two clinical populations in Delhi and Ladakh. The daily salt intake in Delhi and Ladakh was 9 g and 12 g, respectively. In 2007, Radhika et al. assessed salt intake in urban Chennai adults using food frequency questionnaire and found it to be 8.5 g/day. A recent study from rural Andhra Pradesh reported a high salt intake of 42.3 g/day/person. Although most information apart from the aforementioned study are not contemporary, these data indicate a high level of intake compared to the WHO recommended intake level of 5 g/day and the National Institute of Nutrition’s (NIN) recent Recommended Dietary Allowances (RDA) for Indians of 5–6 g/day.

Available information indicates that most salt in India is added during cooking and/or at the table in contrast to the developed world where processed foods contribute most substantially to overall population salt intake. However, with rapidly increasing urbanization, proliferation of multinational food outlets/fast food centres, increasing availability of prepared foods, and increasing frequency of eating out, processed foods are anticipated to become a major source of salt intake.
Indonesia

A study conducted in Jakarta among 556 elderly persons aged ≥55 years reported a sodium intake of 198 mg/day among men and 161 mg/day among women using a 24-hour food recall method. However, sodium intake was assessed only from food intake while other sources, such as table salt and soy sauce were not assessed leading to these likely underestimates. According to the Indonesian Society of Hypertension, daily salt intake is reported to be 15 g/day, which is nearly three times the amount considered acceptable by the WHO. However, a recent national household survey reported a far lesser figure of 5 g/day, a likely underestimate given that the method used was estimated per capita household salt consumption.

Nepal

In Nepal, among a sample of 1218 adults residing near Kathmandu, almost 90% had a per capita salt consumption of >5 g/day. Over a 25-year period this increased from 56% in the same area coupled with a threefold increase in the prevalence of hypertension. Another investigation among 927 adults living in hilly areas reported an average urinary sodium excretion of 10–13 g/day.

Sri Lanka

The earliest estimate of per capita salt consumption in Sri Lanka was 7 g/day. Recent unpublished data indicate that it has increased to 9–11 g/day.

Thailand

A one-time household survey conducted in 2008–2009 reported a salt intake of 10.8 g/day. Salt intake was assessed using a 7-day dietary recall method that viewed food consumed both in and out of home with a focus on condiments that are widely used in Thailand. The main sources of salt were food flavour enhancers, such as fish sauce, soy bean sauce, table salt, shrimp paste, oyster sauce and food flavour powder. The other sources were ready-to-eat cooked food and food products, such as processed noodles, canned fish, steamed mackerel, fermented fish (Pla Som) and varieties of spicy cooked pastes (Nam Prik, consumed with vegetables and meat).

Methods for Assessing Salt Intake

As mentioned above, most of the data on salt consumption are derived from dietary recall or household salt weighing methods. Employing the most appropriate method is critical not only in assessing baseline intake but also to evaluate the impact of potential salt reduction initiatives. The principal methods of assessing salt intake are by:

- Dietary recall
- Estimating salt content of food using food composition tables/databases
- Estimating household per capita or per adult equivalent salt intake by salt weighing
- Measuring 24-hour urinary sodium excretion
- Measuring urinary sodium from spot urine samples

Most of these methods, however, are not ideal, and there are challenges that impair accuracy (Table 4). While the 24-hour urinary sodium excretion is considered the gold standard method of assessment, this comparatively reliable method is difficult to implement when assessing populations. Simpler methods, such as dietary recall and estimating salt content of food using food consumption tables/databases, are less reliable when assessing populations. Notably, there is considerable intra-individual variability in intake and a single day’s measure may not adequately indicate usual intake on an individual basis. Furthermore, methods that rely on recall do not accurately quantify salt added while cooking or at the table, leading to likely underestimates. This is particularly of concern in populations such that of SEAR where much of the salt is added during cooking or at the table.

Table 4: Comparative characteristics of different methods for assessing salt intake

<table>
<thead>
<tr>
<th>Methods</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dietary recall</td>
<td>Inexpensive</td>
<td>Requires time and expertise</td>
</tr>
<tr>
<td></td>
<td>Easy to conduct</td>
<td>May not be representative of usual individual intakes if restricted to a single day and requires a repeat recall on a different day to estimate usual intake</td>
</tr>
<tr>
<td></td>
<td>Can be incorporated into existing surveys</td>
<td>Requires considerable analysis to categorize foods and obtain sodium levels</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Requires deep probing to ensure complete recalls</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Prone to reporting errors as salt added during cooking or at the table may not be taken into account leading to underestimation</td>
</tr>
<tr>
<td>Estimating salt content of food using food composition tables/databases</td>
<td>Provides detailed profiles of the nutritional composition of foods</td>
<td>Needs constant and ongoing updating as food products are dynamic in that their nutrient composition changes e.g. due to the elimination of trans fats, reductions in sodium, discretionary addition of nutrients, use of new manufacturing processes</td>
</tr>
<tr>
<td></td>
<td>Provides average values of sodium in different food categories</td>
<td>Need to account for local and ethnic foods, restaurants foods and foods from street vendors for completeness</td>
</tr>
<tr>
<td></td>
<td>Can be constructed or modified using secondary sources of data</td>
<td>Food tables may not capture variation in the proportion of salt added while cooking that is retained by the food, and plate losses (i.e. salt left behind on the plate)</td>
</tr>
<tr>
<td></td>
<td>Can provide within brand differences in sodium levels among products available/sold in different countries</td>
<td>Requires considerable analysis to categorize foods</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Prone to underestimation due to</td>
</tr>
</tbody>
</table>
### International Experiences in Salt Reduction: Success Factors

Finland provides one of the best examples of a country achieving salt reduction through implementation of sound public health policies. From the 1970s Finland implemented a population based salt-reduction policy through regulation and public education, resulting in a 40% decrease in salt intake (from about 14 g/day to 9 g/day during 1972–2002). This reduction is estimated to have contributed to a 10 mmHg reduction in blood pressure and 70% reduction in mortality from stroke and coronary artery disease. Important factors that

<table>
<thead>
<tr>
<th>Estimating household per capita or per adult equivalent salt intake by salt weighing</th>
<th>Inexpensive</th>
<th>Accurate weighing may be difficult due to reporting and measurement errors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Easy to conduct</td>
<td>Can significantly exaggerate consumption because of the large amounts of salt discarded in cooking water or when salt is used for non-cooking purposes</td>
</tr>
<tr>
<td></td>
<td>Minimal participant burden</td>
<td>Does not reliably reflect individual intake</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Prone to underestimation and overestimation making assessment of individual intakes highly unreliable</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Measuring 24 hour urinary sodium excretion</th>
<th>Most accurate method as it can capture 85%–90% of individual sodium intake</th>
<th>High participant burden</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unaffected by subjective reporting characteristic of dietary intakes</td>
<td>Requires time and expertise</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Expensive</td>
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<td>A single assessment does not accurately predict usual intake on an individual basis due to Intra-individual variability on a day-to-day basis in urinary sodium excretion</td>
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<td>Needs more than one measurement to accurately predict usual individual intake</td>
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<td>Does not account for electrolyte loss other than through the kidneys, thus likely underestimating actual sodium intake by 10% or 15%</td>
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<td>Problems of completeness: collection needs to be accurately timed to avoid under or over collection</td>
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<tr>
<th>Measuring urinary sodium from spot urine samples</th>
<th>Inexpensive</th>
<th>Does not reliably reflect usual individual intake</th>
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<tr>
<td></td>
<td>Easy to conduct</td>
<td>Prone to underestimation making assessment highly unreliable</td>
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<td></td>
<td>Less participant burden</td>
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<td>Timed collection is not required</td>
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contributed to this decline in salt consumption included the adoption of a systematic approach with strong leadership, consumer education using mass media, regular monitoring of population salt intake through 24-hour urine assessments and dietary surveys, intensive community and stakeholder engagement, cooperation with and oversight of the food industry, use of low sodium potassium-enriched substitute (PANSALT®) and mandatory food labelling with high salt warnings.7,8,13,23

In Japan, a national campaign implemented in the 1960s against the backdrop of one of the highest stroke mortality rates in the world at that time decreased salt intake between 1.5 g/day to 4 g/day over the following decade leading to population blood pressure reduction and an 80% decrease in stroke mortality despite an increase in other cardiovascular risk factors.7,8,13,61 The key factor was a sustained public education programme to educate the population on the adverse health consequences of excess salt consumption. More recently, the UK has initiated a national salt reduction program based on collaboration with the food sector, implementing labeling using traffic light colors and improving public awareness. These efforts have decreased average population salt consumption from 9.5 g/day in 2004 to 8.6 g/day in 2008.62 Factors contributing to this decline include strong leadership by the UK government through its Foods Standards Agency and the Health Department, establishment of reduction targets, engagement with stakeholders, and availability of baseline data on salt intake, salt content in foods and consumer knowledge against which changes could be assessed and monitored. Other developed countries, such as Australia, Canada and US have begun similar programmes while in most developing countries full-fledged efforts in this direction are yet to begin, although some have initiated steps to address salt reduction.14,39,40

Experience in these countries indicate that some of the key strategies for successfully reducing population salt intake are: (i) collaborative partnerships with the food sector along with regulation, particularly in the absence of voluntary action, (ii) reformulating processed foods that are high in salt and account for a high percentage of intake, (iii) implementing effective and context-specific consumer education programmes on the effects of excess salt consumption on health, (iv) implementing mandatory easy-to-understand consumer-friendly food labelling to identify low-salt products, as well as (v) creating an enabling environment to make healthy dietary choices easier by increasing the access to and availability of low salt as well as healthy foods.

Salt Reduction Initiatives in SEAR: Current Status

A recent review identified population salt reduction initiatives in 32 countries worldwide, mostly in the European, Americas and Western Pacific Regions of the WHO, but no initiatives were identified from SEAR.63 However, limited initiatives are in place or being planned as hypertension rates increase and policies for NCD prevention and control prioritize population-based measures to result in greater health gains at lower costs.

In Thailand, a stroke awareness campaign resulted in mobilizing multiple stakeholders that included an expert group (of government officials, civil society organizations and restaurant associations to form “Salt Net”) that later catalysed the household survey mentioned earlier
to assess salt intake and sources of salt in Thai diet. This has provided valuable data for developing appropriate context-specific salt reduction interventions.\cite{64} Currently the Thai Government is implementing a national NCD prevention campaign that has salt reduction as one of its focus areas. In addition, the Royal College of Physicians of Thailand and Thai Health are jointly planning to advance reformulation of food products and food labelling, conduct an evaluation of the NCD campaign vis-à-vis salt reduction and develop a food composition database to monitor salt content in foods.\cite{64}

In India, the NIN has recently released new RDAs for Indians that recommend salt reduction. However, no concerted action has been taken nationally to implement these guidelines. The Public Health Foundation of India (PHFI) recently conducted a national research consultation to identify salt reduction strategies for India. Following this, PHFI initiated studies to gather evidence to facilitate national salt reduction policy development. One of the studies will obtain accurate and contemporary baseline data on salt intake and sources of salt in diet through collection of 24-hour urine samples and dietary assessment while another will analyse stakeholder perspectives on salt reduction and assess food composition to establish a food monitoring database. Additionally, a knowledge translational clustered-randomized trial (DISHA — Diet and Lifestyle InterventionS for Hypertension Risk reduction through Anganwadi workers and Accredited Social Health Activists (ASHA)) that aims to utilize grassroots health workers in the community across select states of India is currently underway to evaluate the feasibility and impact of structured health promotion strategies (including those focused on salt) on population blood pressure reduction.

**Indonesia**

The Government is considering regulating the food industry as part of an NCD control strategy to label salt, sugar and fat content in restaurant foods and on ready-to-consume foods. The regulation is expected to come into effect soon.\cite{65}

**Sri Lanka**

As part of efforts to advance NCD control, the Government is in the process of drafting regulations to ensure that food outlets and restaurants provide salt separately, instead of adding to the meal, as well as implement a colour-coded mandatory food labelling system similar to traffic lights. The red, amber and green colours will indicate high, medium and low salt, respectively. Given the impediments in implementing and monitoring these changes in the small-scale food sector, it will be initially implemented for processed foods.\cite{66} In addition, the Ministry of Health has prepared a major plan to implement a salt reduction programme that includes collaborating with the food industry to reduce population salt intake to 6 g/day by reducing salt in meat products, bread and bakery products, as well as setting reduction targets for other products. Furthermore, a monitoring system to determine salt intake and likely reductions, development of a databank of processed foods, and implementation of public education campaigns are planned over the next few years.\cite{67}
Role of Private Sector/Food Industry

SEAR is witnessing an influx and proliferation of transnational food companies, greater exposure to western lifestyles and marketing influences leading to increased consumption of unhealthy foods, particularly nutrient-poor calorie-rich processed foods. This coupled with the ongoing health transitions (epidemiological, demographic, nutritional) are leading to significant changes in dietary patterns. Against this milieu, the private sector can play a significant role in promoting healthy diets, limiting levels of salt, restricting advertising particularly those targeting children and youth, increasing availability of healthy and nutritious food choices that are low in salt, reformulating foods high in salt, and reviewing current market practices. They could also contribute to the development of policies that create enabling environments for people to lead healthy lives and exercise healthy lifestyle choices to prevent disease and disability. The private sector could also help in creating effective public–private partnerships which would benefit people from all socio-economic strata. Given that NCD control ideally requires multisectoral action and partnerships involving a “whole of society” approach to influence public health policy, the private sector would have a major role to play in salt reduction programmes.

Salt Intake and UN NCD Reduction Goal

The landmark United Nations High Level Meeting on NCDs has mandated HBP prevention and control by population salt reduction to be one of the most urgent, cost effective and immediate high priority interventions to reduce CVD worldwide. Following this countries have now agreed to an ambitious goal of 25% reduction in NCDs by 2025 through a range of multi-stakeholder driven actions and to establish a global monitoring framework to measure progress. This framework includes targets and indicators in regard to HBP and salt reduction as well which proposes a 25% relative reduction in population prevalence of HBP and 30% relative reduction in mean salt intake. This would provide an excellent opportunity and the necessary impetus to drive national salt reduction efforts within SEAR.

Data Gaps to be Addressed to Facilitate Implementation and Evaluation of Salt Reduction Strategies in SEAR

1. Paucity of data on population salt intake, sources and public knowledge

Salt intake, even though an important modifiable determinant of HBP, remains inadequately investigated in countries of SEAR. Most countries of the Region lack current and reliable data on salt intake. This is critical for implementation of any programme as well as for evaluating the effectiveness of any planned salt reductions efforts. Similarly, reliable information is lacking with regard to the exact sources of salt in SEAR diets as well as public knowledge about the adverse health impact of excess salt consumption, and readiness to implement salt reduction programmes. Such information will be important to facilitate the development of suitable intervention strategies.
2. Absence of Regional evidence on likely effectiveness and potential economic impact of salt reduction efforts

Studies from many developed countries indicate the effectiveness and cost-effectiveness of salt reduction programmes. Such data help in engaging policy-makers more effectively and purposefully. Regional evidence on the effectiveness of specific strategies to lower salt intake and improve population cardiovascular health is virtually non-existent. Though some limited information is available on cost-effectiveness of globally proven strategies being applied to SEAR, more extensive modelling exercises should be undertaken to obtain current country-specific information that can contribute to effective implementation of salt reduction programmes.

3. Limited availability of country-specific food tables and food composition databases

Evaluation of food sources contributing most to salt intake is a critical first step to develop and subsequently monitor the impact of context-specific salt reduction strategies. It requires assessments using food tables and composition databases. This is particularly important in SEAR, given that most of the salt in SEAR diets is still largely from food made in homes. However, such systems are lacking in most of SEAR. In addition, as consumption of ready-to-eat meals and processed foods is likely to increase as a result of economic progress, it is necessary to obtain, monitor and track changes in nutritional information about these foods if salt reduction efforts are to be effective.

Recommendations

While scientific evidence for salt reduction is very strong, regrettably contemporary data as well as optimal context-specific salt reduction strategies that are necessary to translate scientific evidence into policy and programmes to reduce population salt intake is mostly non-existent, particularly in developing countries like those in SEAR. Thus, it is imperative to discuss and develop appropriate as well as feasible salt reduction strategies for hypertension prevention and control through a consultative process involving country-level stakeholders and implement these strategies adopting multisectoral and “whole of society” partnerships. Few recommendations that could facilitate this are summarized below.

1. Develop monitoring systems to assess salt intake, sources of dietary salt and food environments

Given the lack of reliable and contemporary data, one of the key actions that can contribute to salt reduction efforts in SEAR is the establishment of monitoring systems. These will help assess salt intake, determine main sources of dietary salt, ascertain public knowledge about harmful impact of excess salt intake and obtain information about Regional and country-specific food environments which will provide important as well as credible evidence for initiating public health action to build enabling food environments where making healthy food choices will be easier. National health surveys, demographic surveillance systems (such as INDEPTH) and NCD risk factor surveys (such as STEPS) could potentially incorporate
assessment of salt intake and sources as well as information related to food environments in relation to other adverse nutrients, such as sugars, fats and oils, that contribute to hypertension and NCDs. The scale and scope of such assessments of salt intake, sources and public knowledge could be decided depending on feasibility and resources available at the country level. In addition, these surveys should be periodically repeated to monitor changes and thereby inform policy implementation and evaluation. Given that many SEAR countries also face a high burden of iodine deficiency disorders and are implementing programmes to address it, joining forces and collaborating with iodine intake monitoring systems that are already functioning could facilitate joint tracking and monitoring at substantially lesser costs both in terms of human and financial resources.

It is essential to develop country specific food tables with nutritional values of common foods/groups that are consumed after determining the major sources of dietary salt. This would help identify foods contributing most to salt intake, assess salt intake appropriately as well as design and implement suitable interventions. Country- or Region-specific food composition databases should be developed that can measure sodium levels in foods sold in respective markets. In addition, food tables can also be used to comprehensively measure the food environment vis-à-vis other nutrients, such as fats, sugar, calories and serving sizes in consonance with the recommendations of the WHO Global Strategy on Diet, Physical Activity and Health.

2. Analyse stakeholders to assess facilitating and impeding factors

Before initiating any salt reduction efforts, a comprehensive baseline analysis of key country stakeholders to evaluate their current knowledge, attitudes, practices and receptiveness to a range of salt reduction policy intervention options should be undertaken. These can include government representatives, health care organizations, civil society organizations, industry, consumers and academia. This analysis will enable eliciting information on the main barriers and likely facilitating factors that could contribute in developing and implementing successful salt reduction interventions. A similar exercise should be carried out for the general population as well.

3. Increase consumer education and awareness

Consumer education that uses multiple approaches for dietary change and increases the understanding about nutritional information, will be a key factor in driving salt reduction in SEAR given the predominance of home cooked food and condiments as the major sources of salt intake. Varied approaches, such as mass media, could be used for behaviour change to modify practices related to household preparation of foods as well as their consumption. Advocacy messages should be sustained, consistent and culturally tailored to increase awareness of the deleterious health impact of excess salt consumption, so that individuals can make healthier choices. Public education campaigns for other chronic diseases could be potentially leveraged to disseminate information on salt reduction and in understanding nutritional information. Given the diversity of the population as well as diets in the Region, interventions should be tested on pilot modes so as to tailor interventions to increase acceptability and effectiveness.
3. Engage policy-makers and non-health sectors in salt reduction programmes

Evidence from other countries that have successfully reduced salt intake and improved hypertension prevention and control indicates the need to purposefully engage policy-makers both in the health and non-health sectors. This will help position salt reduction efforts within the broader ambit of NCD prevention framework and catalyse favourable policy changes for: (i) creating enabling environments for people to make healthier choices, (ii) promoting food labelling, (iii) regulating salt content in foods, (iv) restricting marketing of salty foods, and (v) encouraging reformulation and voluntary action by the food sector. Governments can in the absence of voluntary action by the food industry use their regulatory capacity to bring about change.

4. Engage with the food industry in salt reduction programmes

The salt reductions achieved in the developed world were in part the result of successful collaborative partnerships with the food industry. Engagement without compromising public health interest can spur action that can lead to achievement of salt reduction targets, particularly with regard to processed foods. Regulated or voluntary actions should be set to specific timelines and appropriate targets to achieve reduction goals. Mechanisms need to be put in place to maintain transparency in engagement and to ensure that the food sector follows up on promised targets for reductions in salt and is independently monitored.

5. Develop and implement food labelling

Food labelling is an important strategy to raise awareness and educate the public about salt. It has contributed to reduced salt consumption in many countries. Simple but effective consumer-friendly labelling indicating salt content in foods as currently in place in the UK can contribute significantly to salt reduction efforts. Governments in collaboration with the food sector should develop and mandatorily implement evidence-based but contextual labelling that will enable the population in choosing healthier foods.

5. Build multisectoral coalitions and regional partnerships

NCDs and hypertension are complex with their key determinants encompassing not only individual-level factors but also societal factors lying outside of the health sector. Thus to effectively address these determinants and initiate comprehensive actions, multisectoral partnerships involving multiple key health and non-health stakeholders is essential. For instance, nongovernmental organizations partnering in this effort can act as pressure groups and lobby the food sector to take action and the government to make salt reduction policies a priority. They can also partner with governments in public education directed at increasing public awareness which will create enabling conditions for salt reduction. SEAR countries should also develop regional partnerships for advancing research and policy implementation which can help address determinants that act across countries, such as the influence of transnational food and marketing companies.
6. Provide impetus to healthcare providers and their organizations

Healthcare professionals, including physicians, nurses and other health workers as well as their professional organizations should be catalysed to assume leadership and build cross-sectoral partnerships for salt reduction. At an individual level they can counsel patients on the adverse health risks of excess salt intake, ways to reduce consumption, as well as employ an interdisciplinary approach to assess salt intake (using brief questionnaires) during patient encounters as a standard practice in hypertension management. In addition, professional organizations can contribute to the development and endorsement of consensus policy statements highlighting the scientific rationale for salt reduction and the actions that require to be implemented. This can also help inform context-specific advocacy efforts and in building partnerships to engage and lobby with policy-makers for salt reduction and hypertension control.

References


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