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Dietary Sodium and Health

Summary

Sodium and chloride ions are dietary essentials; there is rarely a problem of shortage, but, in the case of sodium, the risk lies in excessive intakes.

Several authorities, including the World Health Organisation (WHO), the UK Scientific Advisory Committee on Nutrition (SACN), the UK Food Standards Agency (FSA), the American Public Health Association, the US National Academies of Science Institute of Medicine (IoM) and Health Canada, recommend an overall reduction in salt intake to 5-6g/day to reduce the effect on blood pressure (BP), although others take the view that evidence does not justify universal restriction but that intake restriction should be encouraged for older hypertensives and young children. Salt producers, via the Salt Institute, strongly dispute the need for intake restriction guidelines.

Although there are other minor sodium sources in food, the predominant contributor is sodium chloride. Most dietary sodium intake arises from salt incorporated in manufactured and other prepared foods, and these provide the main scope for reduction of intake. While food manufacturers wish to maintain the palatability of those food products in which salt plays a part and the functionality in products where salt performs an indispensable technological function, some have marketed low-salt versions, or have progressively reduced salt content over a period, where technical and microbiological considerations make this possible.

Despite extensive research, there are still areas where knowledge is lacking or where interpretations of existing knowledge differ. Opinions may differ on whether it is appropriate to seek to encourage reduced sodium intake for the whole population. Nevertheless, if reduction is achieved without compromising microbiological safety or essential functionality, no part of the population would be disadvantaged by it, as those who might find certain reduced-salt manufactured foods less palatable have the freedom to add table salt “to taste” before consumption. Recognising that in science, and especially in nutrition/health controversies, nothing can ever be conclusively "proven", one has to make, on what will always be partial knowledge, the best judgement possible at the time. This would, at present, require:

- encouragement to food manufacturers and foodservice outlets to reduce further, where safely and technically possible, the salt content of manufactured or prepared foods (especially those consumed by children) and/or offer an alternative choice of low sodium/salt products;

- foods adequately labelled in respect of sodium/salt to provide sufficient and sufficiently understandable information for the exercise of informed choice;
- appropriate medical advice to older hypertensives and to parents regarding their children's diet; and advice to the public to adopt a healthy balanced diet, low in fat and salt and rich in fruit, vegetables, and complex carbohydrates, and to avoid the excessive use of salt in cooking or at the table.

Dietary requirements and deficiencies

Sodium, potassium and chloride are dietary essentials but, unlike most nutrients, there are very rarely problems involving a dietary shortage. Particularly in the case of sodium, the risk lies in excessive intakes.

Sodium is the principal cation in extracellular fluids in the body, and potassium in the intracellular fluids. Chloride is the major anion in all body fluids. Together with other solutes these ions maintain the volume of the extracellular fluid, osmotic pressure, acid-base balance and electrophysiological activity in muscles and nerves. In addition sodium and potassium are necessary for active transport (i.e. energy-dependent) across cell membranes (sodium-potassium pump).

Sodium intake figures are mostly derived from urinary excretion (100 mmol/day sodium excretion is equivalent to an intake of 6 g salt). Total body sodium can be measured by *in vivo* activation analysis and total exchangeable sodium by isotope dilution (Beretta-Piccoli et al, 1982). That report, using both methods, showed that body sodium tended to be low in young patients and those with mild hypertension but was found to be enhanced in those with more severe hypertension. Exchangeable sodium was significantly subnormal in those with essential hypertension compared with matched controls, which does not fit in with the sodium/blood pressure (BP) conclusions.

Healthy adults can maintain a sodium balance with intakes of 10-20 mmol (230-460 mg)/day, equivalent to 0.57-1.15 g salt/day while the average daily intake in the UK was, at the time reported, between 85 and 145 mmol (3.0-5.1 g) equivalent to 7.5-12.7 g salt/day, -- derived mainly from sodium chloride – around ten times the amount required to maintain balance (UK Department of Health, 1991).

It is commonly believed that there is a need for extra salt under condition of increased sweating (severe exercise and/or high ambient temperatures) but the body adapts to such conditions by producing more dilute sweat and extra salt may be required for only a short time. Sodium balance can be maintained with an intake of less than 1 mmol (23 mg)/day but potassium intake must be maintained since losses cannot be reduced below 5-15 mmol (600-1800 mg). Potassium depletion elevates blood pressure and potassium-depleted subjects become sodium-sensitive; hence the dietary ratio of sodium:potassium is important, as well as the amounts.

The minimum daily requirements of sodium and potassium recommended by various authorities are as follows:

	Sodium		Potassium	
	mmol	mg	mmol	mg
UK 1991 LNRI*	25	575	50	2000
UK 1991 RNI**	70	1600	90	3500
EU 1993 acceptable level	25-150	575-3500	80	3100
United States 1995	21.7	500	51	2000

* Lower Reference Nutrient Intake (applies to individuals)
** Reference Nutrient Intake (equivalent to RDA, applies to population groups)

(Note. 1 mmol = 23 mg sodium, equivalent to 58.4 mg salt).

Dietary excess

Heart failure, cirrhosis, nephrotic syndrome, asthma, stroke, stomach cancer and idiopathic and cyclical oedema have been associated, in some studies, with sodium intake. In particular it has been shown epidemiologically that in some individuals (about 10% of the population) high intakes are associated with hypertension, which, in turn, is a risk factor in coronary thrombosis (e.g. Alderman et al, 1991 and 1995; Cutler et al 1991; Frost et al 1991). The extent to which the high sensitivity of those individuals may be genetic depends on further research in this area (Sanders,2007)

Moreover, some patients with high BP benefit from severe restriction of sodium intake -- similar results have been observed in animals. There is generally an increase in BP with age, except in populations with habitually low salt consumption; but the results are partly obscured by other contributory factors such as obesity, alcohol and smoking. There is evidence in some individuals that high salt intake in infancy may eventually result in hypertension (Mitchell, 1989).

Hypertension is defined as consistent systolic BP greater than 140 mm, and diastolic readings greater than 90 mm in adults over 18 years of age, irrespective of their age (Ramsay et al, 1999). Normal levels are 130 mm and 85 mm respectively. By this definition, the prevalence in England was 41% for men and 33% for women, increasing with age from 16% in men aged 16-24 years to 73% in those aged 75 and over; for women, from 4% to 78% (1998 Health Survey for England, Erens & Primatesta, 1999) . In Scotland the Scottish Health Survey 1998 (Scottish Executive Health Department, 2000) reported an overall prevalence of 33% for men and 28% for women. The prevalence increased from 10% in men aged 16-24 to 74% in those aged 65-74 years, and for women, from 4% to 76%.

Human appetite for saltiness

Saltiness is one of the five recognized basic tastes (the others are sweetness, sourness, bitterness and "umami"). Saltiness is innately appealing to humans, although responses to salty foods are influenced by environmental factors. Limited data reveal no clear association between early exposure to salt and various hedonic responses to salt later in life, but recent exposure markedly alters a person's preferred salt content of foods. Restricting exposure for 8-12 weeks can enhance the appeal of reduced-sodium foods in both normotensive and hypertensive individuals (Mattes, 1997). Experience has shown that consumers acclimatise to the gradual reduction of salt content of manufactured foods.

Recent research on rats has suggested that inadequate dietary ω-3 polyunsaturated fatty acids during development results in an exaggerated sodium appetite later in life (Weisinger et al, 2010).

Dietary studies

Numerous studies have been carried out on the relation of sodium intake and BP.

Intersalt Co-operative Research Study (ICRS)

ICRS involved 10,000 people in 52 population groups and the first report was published in 1988. After some criticism and further consideration of the evidence, a second report with firmer conclusions was published in 1996. The report concluded that increasing salt intake (using sodium excretion as a measure of intake) is associated with a significant rise in BP, the size of the rise increasing with age. It was deduced that a salt intake of 4.2 g/day (sodium excretion of 7 mmol/day) maintained from the age of 25 to 55 years would result in systolic pressure 10-11 mm lower than individuals with intake of 10.2 g/day.

However, at the same time, Midgeley et al (1996) published the results of an examination of 56 published random trials and found that in younger people salt restriction had no effect on normotensive subjects but that effects were shown in older hypertensive subjects. These authors did not support universal salt restriction. In the older hypertensive subjects a reduction of salt intake to 6 g/day (100 mmol excretion) resulted in a fall of 3.7 mm systolic and 0.9 mm diastolic pressures. The strongest criticism came from Hanneman (1996), writing on behalf of the Salt Institute (a US-based trade association of salt producers) casting doubt on the validity of the Intersalt trial and interpretation. The extent and tenor of the disagreement was well illustrated in issues of the British Medical Journal (BMJ,1996, 1997) which also contained arguments on both sides of the controversy.

Hypertension Optimal Treatment (HOT) Study

Nineteen thousand hypertensive patients were treated with a mixture of drugs to lower their BP to one of three levels - a diastolic pressure of 85 to 90 mmHg, 80 to 85 mm Hg, or below 80. The main conclusion of the study was that the optimal BP is 138/83 mm Hg. Lowering BP to this level was associated with a reduction of risk of stroke and heart attack, but further reduction had no effect. There was no evidence that lowering BP below this level was unsafe. The results were different for patients with diabetes, in whom reductions of BP below 138/83 were associated with a further reduction of risk (Chalmers, 1998).

National Health and Nutrition Examination Survey

Alderman et al (1998) reported on the first National Health and Nutrition Examination Survey (NEHANES 1), developed and funded by the National Center for Health Statistics of the (US) Centers for Disease Control and Prevention, the National Institute on Ageing, the National Cancer Institute, and other institutes of the National Institutes of Health. The Survey established a baseline in 1975 for 20,729 US adults (aged 25-75). A cohort of 11,348 participants underwent medical examination and nutritional examination based on 24 hour recall. Vital status at June 30, 1992, was obtained for the 11,346 participants through interview, tracing, and searches of the national death index. Mortality was examined in sex-specific quartiles of sodium intake, calorie intake, and sodium/calorie ratio. Multiple regression analyses were done to assess the relations with mortality.

There were 3,923 deaths, of which 1,970 were due to cardiovascular disease (CVD). All-cause mortality (per 1000 person-years; adjusted for age and sex) was inversely associated with sex-specific quartiles of sodium intake and total calorie intake, and showed a weak positive association with sodium/calorie ratio. The pattern for CVD mortality was similar. In Cox multiple regression analysis, sodium intake was inversely associated with all-cause ($p=0{\cdot}0069$) and CVD mortality ($p=0{\cdot}086$) and sodium/calorie ratio was directly associated with all-cause ($p=0{\cdot}0004$) and CVD mortality ($p=0{\cdot}0056$). By contrast, calorie intake in the presence of the two measures of sodium intake was not independently associated with mortality (all-cause $p=0{\cdot}86$; CVD $p=0{\cdot}74$). Analysis restricted to participants with no history of CVD at baseline gave similar results. The authors' interpretation was that this observational study does not justify any particular dietary recommendation, and specifically, that these results do not support current recommendations for routine reduction of sodium consumption, nor do they justify advice to increase salt intake or to decrease its concentration in the diet. The methodology and interpretation have been attacked by opponents and defended by the authors (Correspondence, 1998). The authors acknowledged the limitations of the analysis, including the reliability of the measures based on a single 24-hour dietary recall, for both sodium and energy intakes. As well as no objective measurements of sodium excretion from 24-hour urine collections, the estimated sodium intakes in NHANES did not include salt used in cooking or at the table. Hypertensive persons, who may have been advised to reduce their salt intake, were included in the analysis and there was no control for smoking as a confounder. An alternative analysis of the NHANES I data (He et al, 1999) which did control for smoking status, found that in those participants who were overweight, sodium intake was associated with increased frequency of stroke, mortality from coronary heart disease, cardiovascular disease and all causes.

Second National Health and Nutrition Examination Survey (NHANES II).

Cohen et al (2006) assessed the association of sodium intake with cardiovascular disease (CVD) and all-cause mortality and the potential impact of dietary sodium intake =2300 mg, by examining data from the Second National Health and Nutrition Examination Survey (NHANES II). Over a mean 13.7 (range: 0.5-16.8) years follow-up, there were 1343 deaths (541 CVD). Sodium (adjusted for calories) and sodium/calorie ratio as continuous variables had independent inverse associations with CVD mortality (P = .03 and P = .008, respectively). Adjusted HR of CVD mortality for sodium =2300 mg was 1.37 (95% confidence interval [CI]: 1.03-1.81, P = .033), and 1.28 (95% CI: 1.10-1.50, P = .003) for all-cause mortality. Alternate sodium thresholds from 1900-2700 mg gave similar results. Results were consistent in the majority of subgroups examined, but no such associations were observed for those >55 years old, non-whites, or the obese. They concluded that the inverse association of sodium to CVD mortality raises questions regarding the likelihood of a survival advantage accompanying a lower sodium diet. These findings highlighted the need for further study of the relation of dietary sodium to mortality outcomes.

Dietary Approaches to Stop Hypertension (DASH) trial

The DASH trial (Appel et al, 1997) assessed the effects of dietary patterns on BP, and the follow-up DASH Sodium Trial (Sacks et al, 2001) which used a rigorously controlled design to examine the combined effect of the DASH diet (a healthy balanced diet, low in fat and rich in fruit, vegetables, and complex carbohydrates) and reduced salt intake. Results showed that reducing sodium lowered BP for both the DASH diet and a typical American diet. The biggest BP-lowering benefits were for those eating the DASH eating plan at the lowest sodium level (1,500 mgs per day).

Trial of Hypertension Prevention (TOHP) Phase 1 and Phase II

744 participants in TOHP I and 2382 in TOHP II were randomised to a sodium reduction intervention or control. Net sodium reductions in the intervention groups were 44 mmol/24 h and 33 mmol/24 h, respectively. Vital status was obtained for all participants and long-term follow-up information on morbidity was obtained 10-15 years after the trials from 2415 (77%), with 200 reporting a cardiovascular event. Risk of a cardiovascular event was 25% lower among those in the intervention group (relative risk 0.75, 95% confidence interval 0.57 to 0.99, P=0.04), adjusted for trial, clinic, age, race, and sex, and 30% lower after further adjustment for baseline sodium excretion and weight (0.70, 0.53 to 0.94), with similar results in each trial. In secondary analyses, 67 participants died (0.80, 0.51 to 1.26, P=0.34) (Cook et al, 2007).

Trial of Nonpharmacologic Interventions in the Elderly (TONE)

The TONE Trial (Whelton et al, 1998) studied the effects of salt reduction and weight loss, alone and combined, in older hypertensives (aged 60-80) whose BPs were controlled with one antihypertensive drug. Weight loss and salt reduction in the diet were achievable and, where both interventions were successful, more individuals were able to stop and remain off medication. The greater success of the salt reduction and weight loss intervention in this age group may reflect a greater motivation to reduce dependence on antihypertensive medication. Effects were harder to sustain at 36 months, and it was not possible to demonstrate an enhanced combined effect of both salt reduction and weight loss. The greater magnitude of the short-term compared to long-term effects is probably a reflection of the difficulties individuals face in making substantial changes to their diet and complying with dietary restrictions, particularly in relation to reduced salt intake. It supports the contention that population based changes to the composition of some manufactured foods is required. This point is further supported by a more recent systematic review which examined the long term effects of advice to reduce dietary salt in adults (Hooper et al, 2002).

Both TONE and TOPH II used nutritional counselling to support achievement of intervention goals.

Other researchers have looked beyond the isolated effect on BP of sodium intake restriction and have investigated its effect on other metabolic variables. Graudel et al (1998) reported the results of a meta-analysis and concluded that the results do not support a general recommendation to reduce sodium intake but that it may be used as a supplementary treatment in hypertension. This, like other meta-analyses [e.g. Midgeley et al (1996); Alam A S and Johnson A G, 1999] has been criticised for inclusion of short duration trials ~~of short duration~~, and trials that compared the effects of acute salt loading followed by severe depletion which does not reflect the true situation with actual diets.

A later meta-analysis (He and McGregor 2003) only included those studies with modest salt reductions and with a duration of at least four weeks. The DASH Sodium Trial II [Sacks et al (2001)], which had not been published at the time of previous meta-analyses, was also included. Seventeen trials in hypertensives and 11 trials in normotensives were combined and pooled estimates found significant reductions in blood pressure of 4.96/2.73 mm Hg in hypertensives (p=and 2.03/0.97 mm Hg in normotensives. These results demonstrate that on a population-wide basis, a modest reduction in salt intake for a period of four or more weeks has a significant effect on BP in hypertensive and normotensive individuals.

Calcium Absorption

Dietary sodium affects urinary loss of calcium and so may play a part in the progress of osteoporosis (Massey and Whiting, 1996; Ginty et al, 1998). Both sodium and calcium are filtered in the glomeruli of the kidneys but most of this, more than 99% of the sodium and more than 95% of the calcium, is reabsorbed.

It is suggested that increased sodium intake reduces the amount of calcium reabsorbed and that for every 100 mmol sodium excreted there is a urinary loss of 1 mmol calcium. Earlier work had suggested that this was compensated either by adaptation to absorb more calcium from the intestines or reduced excretion; but this has been shown to be incorrect and higher salt intakes are believed to be associated with reduced hip bone intensity. Because reports on the effects of salt on bone biomarkers have been inconsistent, it is not possible to draw any firm conclusions regarding the effect of salt on bone health.

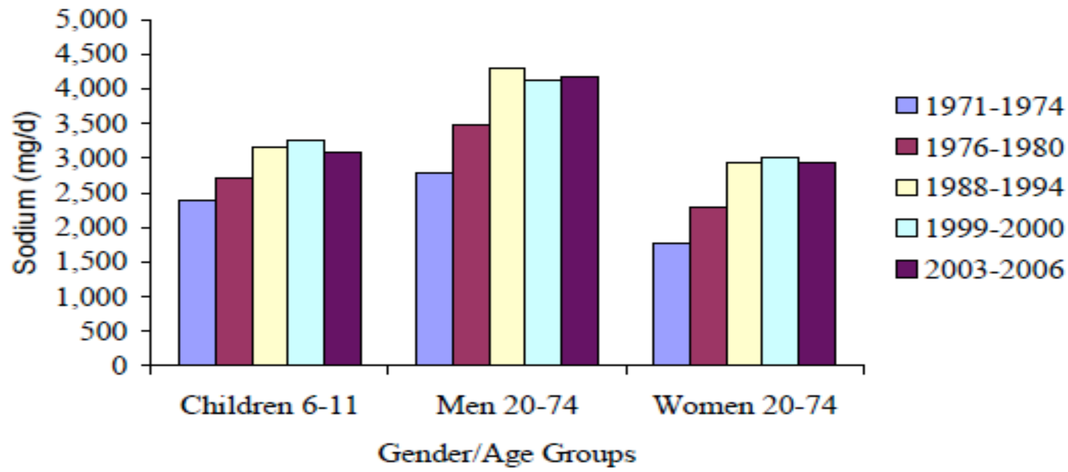
Sodium in the UK diet

While a few food additives are sodium compounds and contribute sodium to some manufactured foods, taking the diet as a whole the contribution of sodium from those sources is negligible and for practical purposes sodium intake may be considered as contributed by salt (of whatever origin).

The UK National Diet and Nutrition Survey, which was carried out between 2000 and 2001 in a nationally representative sample of 1495 adults aged 19 to 64 years, showed that 24-hour urinary sodium was 187 mmol (11.0 g/d of salt) for men and 139 mmol (8.1 g/d of salt) for women. Having regard to the significant reductions of salt content of manufactured foods (q.v.) since then, there is a need for current data on which to base statements of "current intake". The UK Food Standards Agency (FSA) has stated in 2010 that urinary analysis data have shown that average adult intakes dropped from 9.5g/day in 2001 to 8.6g/day in 2008. More definitive figures would be available in 2011, when the FSA would publish~~ed~~ the results of new urinary analysis studies.

Sodium in the US Diet

Figure 1: Trends in Mean Sodium Intake from Food for Three Gender/Age Groups, 1971-1974 to 2003-2006



Source: Briefel and Johnson (2004) for 1971-2000 data; NHANES for 2003-2006 data.

Sodium in the Canadian Diet

Table 1: Sample sizes and overall sodium daily intake, by age-sex group

	Youth aged 1-8 years	Youth aged 9-18 years	Adult males aged 19+ years	Adult females aged 19+ years	All
Sample size	5,451	8,625	8,470	10,583	33,129
Average sodium daily intake (mg/day)	2,388	3,412	3,587	2,684	3,098

Note: The data contained in this table are based on the Canadian Community Health Survey--Cycle 2.2, Statistics Canada, 2004.
Source: Health Canada

Sodium in the Australian Diet

Using our most recent analytical data, Food Standards Australia and New Zealand (FSANZ) has estimated current sodium intakes from salt for the Australian population. These results show that Australians aged 2 years and older consume an average of 2,150 mg of sodium per day from an average of 5,500 mg of salt (5.5 g). Around 80% of this would be from processed foods and 20% from salt used at the table or in home cooking. This estimate does not include the smaller amounts of sodium coming from naturally occurring sodium or sodium-containing food additives. Some Australians (34%) are estimated to consume sodium at levels above that recommended from salt alone (FSANZ, 2009)..

Published Recommendations

Several authorities have recommended, with varying degrees of emphasis, an overall reduction in salt intake. However, this is the subject of considerable controversy. For example recommended reductions from 9 g to 6 g salt per day are small compared with the severe restrictions found beneficial in hypertensive patients. Furthermore, the wisdom of advising the entire population to reduce their salt intake for the sake of a minority has been questioned. Indeed, in one report, while salt restriction was shown to reduce BP more frequently in patients over the age of 45, in younger patients (25-44) BP was more often increased than decreased (Overlack et al, 1995). This, however, was a study of 46 non-obese subjects with essential hypertension, and measuring blood pressure responses to very low (20 mmol sodium/day = 1.17 g salt/day) and very high (300 mmol sodium/day = 17.5 g salt/day) carried out for one week only.

In May 2003 the UK Food Standards Agency issued daily salt intake targets to which children's salt consumption should be reduced, based on the UK Scientific Advisory Committee on Nutrition Report (SACN, 2003). These were

- for children aged 0-6 months, the aim should be less than 1 gram/day
- 7-12 months, 1 gram/day
- 1-3 years, 2 grams/day
- 4-6 years, 3 grams/day
- 7-10 years, 5 grams/day
- 11-14 years, 6 grams/day

In February 2004, the US National Academy of Sciences issued a Report on "Dietary Reference Intakes for Water, Potassium, Sodium, Chloride, and Sulfate". Regarding salt, it stated that healthy 19- to 50-year-old adults should consume 1.5 grams of sodium and 2.3 grams of chloride each day -- or 3.8 grams of salt -- to replace the amount lost daily on average through sweat and to achieve a diet that provides sufficient amounts of other essential nutrients ... A tolerable upper intake level (UL) is set at 5.8 grams of salt per day; this is not a recommended intake level. Older individuals, African Americans, and people with chronic diseases including hypertension, diabetes, and kidney disease are especially sensitive to the blood pressure-raising effects of salt and should consume less than the UL. More than 95 percent of American men and 90 percent of Canadian men ages 31 to 50, and 75 percent of American women and 50 percent of Canadian women in this age range regularly consume salt in excess of the UL. The typical Western diet is high in salt and low in potassium -- the opposite of what evidence shows is optimal for good health and reducing the risks of chronic disease, the report says. Research is needed to find ways to help people select better food choices to reduce their salt intake and boost their potassium consumption. In addition, because Americans and Canadians get the majority of their salt -- 77 percent, according to one study -- from prepared and processed foods, research should be done to help food processors develop alternative technologies that can reduce the amount of salt added during processing. There was no evidence of chronic excess intakes in apparently healthy individuals to compel establishing a UL for potassium. However, people who have kidney dysfunctions that impair their ability to excrete potassium or who are on certain types of drug therapies -- such as ACE inhibitors -- should be under the supervision of a medical professional, who may recommend consuming less than the recommended 4.7 grams per day.

In June 2006, the American Medical Association AMA called for measures to reduce sodium intake in US diet. It urged FDA to revoke the "generally recognized as safe" (GRAS) status of salt and to develop regulatory measures to limit sodium in processed and restaurant foods; and called for a minimum 50 percent reduction in the amount of sodium in processed foods, fast food products and restaurant meals to be achieved over the next decade.

In 2008, the US Congress asked the IOM to recommend strategies for reducing sodium intake to levels recommended in the Dietary Guidelines for Americans, currently no more than 2,300 mg per day for persons 2 or more years of age. In its 418-pages Report (IoM, 2010), the IOM concludes that reducing sodium content in food requires new government standards for the acceptable level of sodium. Manufacturers and restaurants need to meet these standards so that all sources in the food supply are involved. The goal is slowly, over time, to reduce the sodium content of the food supply in a way that goes unnoticed by most consumers as individuals' taste sensors adjust to the lower levels of sodium.

In 2008 The European Union developed a common framework to advance salt intake reduction at the population level in order to achieve the national or WHO recommendations. Data from Member States bring to light that the current salt intake levels are clearly exceeding the WHO maximum limit of 5 g per day. In some Member States the current national data basis may be insufficient to judge the magnitude of the problem. In other cases, national data might show that the population salt intake is close to the WHO recommended maximum level. To consolidate the mapping of the situation, it is possible for Member States to carry out 24 hour urinary sodium excretion surveys.

In 2007, the Canadian Minister of Health established the Sodium Working Group (multi-stakeholder group) to develop “a population health strategy for reducing sodium intake among Canadians”. The Sodium Working Group’s Report was issued in July 2010. Its Sodium Reduction Strategy for Canada is multi-staged and based on a three-pronged approach that includes: structured voluntary reduction of sodium levels in processed food products and foods sold in food services establishments; education and awareness of consumers, industry, health professionals and other key stakeholders; and research. A fourth component, monitoring and evaluation, cuts across all three other areas. The Strategy is comprehensive and integrated; the recommendations in the four areas cannot be separated from one another in that a successful outcome depends on all being acted upon. The Strategy has an interim sodium intake goal of a population average of 2300 mg of sodium per day to be achieved by 2016. The ultimate goal is to lower sodium intakes to a population mean whereby as many individuals as possible (greater than 95%) have a daily intake below the Tolerable Upper Intake Level (UL) of 2,300 mg per day. For practical purposes, achieving this requires moving the population mean daily intake of sodium much closer to the Institute of Medicine of the U.S. National Academies' (IOM) recommended Adequate Intake which is 1,500 mg per day for persons aged 9 to 50 years, and less for those younger and older than that.

In Australia, the National Health and Medical Research Council (NHMRC) recommends that Australian adults consume less than 2,300 mg of sodium per day (equivalent to about 6,000 mg (6 g) of salt). The NHMRC Dietary Guidelines for Australian Adults recommend choosing foods low in salt.(NHMRC, 2003).

Manufactured Foods

Manufactured foods provide the greatest scope for significant reduction of salt intake.

Replacement of salt by potassium chloride or magnesium chloride can lead to a bitter taste, though some success has been achieved with a blend of sodium and potassium chloride. The substitution of salt by herbs and spices is rarely satisfactory but slight increases in acidity increase perceived saltiness. A report by Leatherhead Food Research (2010) highlights recent research in this area.

With the advent of refrigeration and other modern methods of food preservation there is less need for salt for preservation; while cured meats cannot be produced without salt, there are many products on the market prepared with reduced salt.

In most products where salt is incorporated for taste palatability, it is relatively easy to reduce the added salt content; and it is always open to the individual consumer requiring more, to add discretionary table salt "to taste". Various food manufacturers have produced low-salt versions of such products, or gradually reduced the salt content over a period, and several major retailers have been doing likewise with own-label products.

In December 2004, an FSA survey showed shows that salt levels in soups varied substantially. Many soups contained as much as a third of the recommended maximum daily intake for an adult per serving, while some contained as much as half. The survey looked at the salt content in the canned, fresh/chilled and dried soup categories and revealed that not only was there wide variation within each category but there was also wide variation within each flavour. The dried soup category ranged from 1.2g to 2.9g of salt per serving, while two brands of canned mushroom soup contained twice the amount of salt of another canned mushroom soup brand. No brand was consistently high or low in salt.

Discussion

It could be argued that the DASH diet alone, without reduced sodium intake from manufactured foods, would achieve the desired BP reduction, but many people would not adopt the DASH diet, and the evidence suggests that few who did would be able to sustain it on an ongoing basis.

However, if the reduction of intake to 6 g salt/day is achieved by gradual reduction of salt content of some manufactured foods and in catering and home-cooking, without compromising microbiological safety, some will gain significant health benefit but nobody's health will thereby be adversely affected. Moreover, no part of the public would be disadvantaged by it, as those who might find certain reduced-salt manufactured foods less palatable than the products to which they were previously accustomed have the freedom to add table salt "to taste" before consumption.

The marketing of low salt versions of foods involves bringing them to the attention of consumers by labelling claims. Guidelines on nutrition labelling claims have existed for some years in the UK.

In January 2007, Corrigendum to EU Regulation (EC) No 1924/2006 (OJ 409/9 30/122/2006) on nutrition and health claims made on foods, set the following limits for sodium/salt claims:

Low Sodium/Salt
A claim that a food is low in sodium/salt, and any claim likely to have the same meaning for the consumer, may only be made where the product contains no more than 0.12g of sodium, or the equivalent value for salt, per 100g or per 100ml. For waters, other than natural mineral waters falling within the scope of Directive 80/777/EEC, this value should not exceed 2mg of sodium per 100 ml.

Very Low Sodium/Salt
A claim that a food is very low in sodium/salt, and any claim likely to have the same meaning for the consumer, may only be made where the product contains no more than 0.04g of sodium, or the equivalent value for salt, per 100g or per 100ml. This claim shall not be used for natural mineral waters and other waters.

Sodium-Free or Salt-Free
A claim that a food is sodium-free or salt-free, and any claim likely to have the same meaning for the consumer, may only be made where the product contains no more than 0.005g of sodium, or the equivalent value for salt, per 100g.

Conclusions

Recognising that in science, and especially in nutrition/health controversies, nothing can ever be conclusively "proven", one has to make, on what will always be partial knowledge, the best judgement possible at the time. The latter would, at present, require

- encouragement to food manufacturers and caterers to continue to reduce further, where safely and technically possible, the salt content of manufactured or prepared foods, especially of food products consumed by children, or offer an alternative choice of low sodium/salt products;
- that foods should be adequately labelled in respect of sodium/salt to provide sufficient and sufficiently understandable information for the exercise of informed choice;
- appropriate medical advice to older hypertensives and to parents regarding their children's diet;
- advice to the public to adopt a healthy balanced diet, low in fat and salt and rich in fruit, vegetables, and complex carbohydrates and to avoid the excessive use of salt in home cooking or at the table.

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