Institution: St George's, University of London

Unit of Assessment: A1 Clinical Medicine

Title of case study:

Reducing salt intake to reduce risk of heart attack and stroke

1. Summary of the impact (indicative maximum 100 words)

MacGregor and colleagues working at St George's have provided extensive clinical and epidemiological evidence that has changed UK government policy on recommendations for salt intake. In 2011 NICE recommended continued reduction in dietary salt intake in the UK. A 3 gm reduction in daily salt intake is calculated to result in 14–20,000 fewer deaths from cardiovascular disease annually, a saving of approximately £350 million in healthcare costs, and the gain of 130,000 quality-adjusted life years. The global benefits of this policy have been recognised with the WHO making recommendations for similar levels of salt reduction worldwide.

2. Underpinning research (indicative maximum 500 words)

MacGregor has demonstrated the relationship between salt intake and blood pressure in an extensive series of publications whilst working at St George's. The clinically important question of whether a reduction of dietary salt led to reductions in blood pressure and hence reduced morbidity and mortality was challenged by others in two meta-analyses of salt reduction trials in the late 1990s. However, these meta-analyses included a large number of metabolic studies in which salt intake was reduced for only 4 to 5 days.

- **Salt reduction reduces blood pressure**
  He & MacGregor demonstrated in a meta-analysis of 28 trials that a longer-term modest reduction in salt intake resulted in a significant and clinically meaningful reduction in blood pressure [1,2]. This reduction was predicted to reduce stroke mortality by 14% and coronary mortality by 9% in hypertensive individuals, and by 6% and 4% (respectively) in normotensive individuals.

  He & MacGregor went on to show a dose-response relationship between salt intake and blood pressure. Within the range of 12 to 3 g/d, the lower the salt intake, the lower the blood pressure. A salt reduction of 3 g/day predicts a fall in blood pressure of 3.6/1.9 to 5.6/3.2 mmHg in hypertensives and 1.8/0.8 to 3.5/1.8 mmHg in normotensive individuals. The effect would be doubled with a 6 g/d reduction and tripled with a 9 g/d reduction. Reducing salt intake by 9 g/d (e.g. from 12 to 3 g/d) was predicted to reduce stroke by approximately one third and ischaemic heart disease (IHD) by one quarter, and this would be expected to prevent about 20,500 stroke deaths and 31,400 IHD deaths a year in the UK [3].

- **Salt reduction in the elderly and in ethnic groups**
  The St George's group demonstrated that a modest reduction in salt intake leads to a fall in blood pressure in both normotensive and hypertensive older people of a magnitude similar to that found in trials of diuretic treatment in this population, and would therefore have an impact on the prevention of stroke [4]. He et al also demonstrated that a modest reduction in salt intake causes significant falls in blood pressure in Caucasian, Asian, and Black patients [5]. Salt reduction also reduced urinary albumin excretion and improved large artery compliance [5].

- **Salt reduction in children**
  He et al showed that in British children and adolescents, differences in salt intake were associated with differences in blood pressure of public health relevance [6]. A lower salt diet starting from childhood may lessen the subsequent rise in blood pressure with age and

therefore prevent the development of hypertension and cardiovascular disease later in life. They also demonstrated that during childhood salt is a major determinant of the consumption of fluids, including sugar-sweetened soft drinks. A reduction in salt intake could, therefore, play a role in helping to reduce childhood obesity through its effect on sugar-sweetened soft drink consumption [7].

3. References to the research (indicative maximum of six references)

1. He FJ, MacGregor GA. Effect of modest salt reduction on blood pressure: a meta-analysis of randomized trials. Implications for public health. J Hum Hypertens. 2002;16:761-70.
2. He FJ, MacGregor GA. Effect of longer-term modest salt reduction on blood pressure. Cochrane Database Syst Rev. 2004:CD004937.
3. He FJ, MacGregor GA. How far should salt intake be reduced? Hypertension. 2003;42:1093-9.
4. Cappuccio FP, Markandu ND, Carney C, Sagnella GA, MacGregor GA. Double-blind randomised trial of modest salt restriction in older people. Lancet. 1997;350:850-4.
5. He FJ, Marciniak M, Visagie E, Markandu ND, Anand V, Dalton RN, MacGregor GA. Effect of modest salt reduction on blood pressure, urinary albumin, and pulse wave velocity in white, black, and Asian mild hypertensives. Hypertension. 2009;54:482-8.
6. He FJ, Marrero NM, Macgregor GA. Salt and blood pressure in children and adolescents. J Hum Hypertens. 2008;22:4-11.
7. He FJ, Marrero NM, MacGregor GA. Salt intake is related to soft drink consumption in children and adolescents: a link to obesity? Hypertension. 2008;51:629-34.

4. Details of the impact (indicative maximum 750 words)

The Significance of this Research

The persuasive evidence provided by the body of work emanating from the St George's group led to recommendations from the Scientific Advisory Committee on Nutrition (SACN) to reduce salt intake. This resulted in a reduction in salt intake in the UK from a value of 9.5 gm/day in 2003 to 8.6 gm/day in 2008 [A]. This was calculated to have reduced deaths from cardiovascular disease by 6000 over this period at a cost of £15 million for the advertising campaign. The calculated saving to the UK economy was £15 billion.

NICE Guidelines

The Department of Health subsequently asked NICE to provide public health guidance on the prevention of cardiovascular disease in the UK, and in 2011 NICE produced its report entitled *"Guidance on the prevention of cardiovascular disease at the population level"* [B]. This wide-ranging report considered multiple factors including dietary fats, physical activity, food marketing and labelling, but its primary recommendations related to salt intake and specifically cited He and MacGregor's work. Specifically this report recommended:

1. Accelerate the reduction in salt intake among the population. Aim for a maximum intake of 6 g per day per adult by 2015 and 3 g by 2025.

2. Ensure children's salt intake does not exceed age-appropriate guidelines (these guidelines should be based on up-to-date assessments of the available scientific evidence).

3. Promote the benefits of a reduction in the population's salt intake to the European Union (EU). Introduce national legislation if necessary.

4. Ensure national policy on salt in England is not weakened by less effective action in other parts of the EU.

5. Ensure food producers and caterers continue to reduce the salt content of commonly consumed foods (including bread, meat products, cheese, soups and breakfast cereals). This can be achieved by progressively changing recipes, products and manufacturing and production methods.

6. Establish the principle that children under 11 should consume substantially less salt than adults. (This is based on advice from the Scientific Advisory Committee on Nutrition.)

7. Support the Food Standards Agency so that it can continue to promote – and take the lead on – the development of EU-wide salt targets for processed foods.

8. Establish an independent system for monitoring national salt levels in commonly consumed foods.

9. Ensure low-salt products are sold more cheaply than their higher salt equivalents.

10. Clearly label products which are naturally high in salt and cannot meaningfully be reformulated. Use the Food Standards Agency-approved traffic light system. The labels should also state that these products should only be consumed occasionally.

11. Discourage the use of potassium and other substitutes to replace salt. The aim of avoiding potassium substitution is twofold: to help consumers' readjust their perception of 'saltiness' and to avoid additives which may have other effects on health.

12. Promote best practice in relation to the reduction of salt consumption, as exemplified in these recommendations, to the wider EU.

Furthermore, the NICE clinical guidelines on management of hypertension published in 2011 recommend dietary salt reduction in the management of hypertension.

Underpinning these recommendations was the calculation that a reduction in mean salt intake of 3 g per day for adults (to achieve a target of 6 g daily) would lead to around 14–20,000 fewer deaths from CVD annually. Using conservative assumptions, this equates to a gain of 130,000 quality-adjusted life years (QALYs), and a saving in healthcare costs around £350 million. A reduction of 6 g per day would lead to twice the gain: some 260,000 QALYs and an annual saving of £700 million.

The Reach of this Research

This work has impacted the commercial food retail world as evidenced, for example, by statements on Marks & Spencer, Waitrose and Tesco websites that recommend low salt intake and have labeled their products accordingly [C,D,E].

The global influence of this work has been extensive. In 2010 the WHO convened a meeting on "Strategies to monitor and evaluate population sodium consumption and sources of sodium in the diet" which considered a number of technical issues and strategies to reduce salt consumption worldwide [F]. Their report, entitled "Sodium intake for adults and children" cites several items of Macgregor's work [G]. The World Health Assembly passed a comprehensive programme to reduce non-communicable diseases, and one of the targets was for a worldwide salt reduction of 30% by 2025 with an eventual target of 5g/day for adults. Progress towards these aims has been achieved in many nations, notably in Latin America.

5. Sources to corroborate the impact (indicative maximum of 10 references)

A. Food Standards Agency. Dietary sodium levels surveys, 22 July 2008. http://www.food.gov.uk/science/dietarysurveys/urinary.

B. National Institute for Health and Clinical Excellence (NICE). Guidance on the prevention of cardiovascular disease at the population level. http://guidance.nice.org.uk/PH25.

C. http://plana.marksandspencer.com/you-can-do/health/5/

D. http://www.waitrose.com/home/inspiration/health_and_nutrition/nutrition_advice_and_healthy_eating/know_your_nutrients/salt.html

E. http://realfood.tesco.com/our-food/guideline-daily-amounts.html

F. http://www.who.int/dietphysicalactivity/reducingsalt/en/

G. WHO. *Guideline: Sodium intake for adults and children*. Geneva, World Health Organization (WHO), 2012.