



“DIETARY INTERVENTION LOWERS BLOOD PRESSURE IN SOUTH AFRICANS WITH HYPERTENSION.”

KAREN E. CHARLTON, (CHRONIC DISEASES OF LIFESTYLE UNIT, MRC; CURRENTLY AT SMART FOODS CENTRE, UNIVERSITY OF WOLLONGONG, AUSTRALIA),
KRISLA STEYN (CHRONIC DISEASES OF LIFESTYLE UNIT, MRC AND DEPARTMENT OF MEDICINE, UCT).
DINKY LEVITT, (DEPARTMENT OF MEDICINE, UNIVERSITY OF CAPE TOWN, UCT)

- High blood pressure (hypertension) poses a health and economic burden on South Africans by virtue of its costly complications, and early death. Uncontrolled high blood pressure (BP) results in high rates of strokes, heart attacks and other forms of heart disease(1).
- National surveys in the country estimate that there are about 6.3 million South Africans with high BP (2).
- Diagnosis and management of hypertension is poor in South Africa. National surveys have shown that only 39% of all hypertensive patients report that they have the condition; only 29% diagnosed are treated; and only 14% are controlled BP below 140/90mmHg.
- To improve the control of high BP in South Africans both the promotion of a healthy lifestyle and the early diagnoses and treatment of high BP are necessary.
- The internationally accepted Joint National Council (JNC7) guidelines of the US National Heart Lung and Blood Institute, recommend lifestyle modification for all patients with hypertension even if drug therapy is also initiated (6). Central to this is changes in the foods consumed.
- The Dietary Approaches to Stop Hypertension (DASH) and DASH Sodium studies provide evidence that a dietary pattern that is rich in fruit, vegetables and dairy products and low in salt can reduce BP significantly (7,8). In terms of nutrients, this translates to a diet that is low in sodium and high in potassium, magnesium, calcium and fibre.
- The reported dietary patterns of the majority of South Africans indicate a low carbohydrate, low dietary fibre, and marginal micronutrient intake (9,10). Consumption of fruits and vegetables (and therefore potassium) is inadequate and falls far below the internationally recommended guideline of at least 5 portions of fruits and vegetables per day (11).
- The bread and cereals food group was found to be the major contributor to total sodium intake from processed food in South Africans (15). Bread was the single food item that provided the greatest contribution to total dietary sodium intake.
- Other important food sources of salt included meat products (boerewors, meat pies, polony, vienna, salami, ham, other sausages), as well as soup powders and brick margarine.
- The practice of adding flavour enhancers (eg. Aromat and Fondor) to staple foods during preparation particularly in disadvantaged communities is common in South Africa and also adds to the high Na intake.
- A low calcium (due to low dairy product consumption) and low magnesium intake (due to relatively low lean meat, bean, nuts and seeds intake) was reported which may also contribute to poor high BP control.
- Identification of an affordable, sustainable and culturally acceptable dietary pattern that involves minimal behaviour change is paramount to compliance in all populations.
- It has been proposed that the only effective way to lower salt intake on a population level is through the reduction of the sodium content of processed foods (16,17) that are frequently consumed by most of the population.
- The low awareness of salt as being pathogenic in the development of hypertension that was reported in the MRC study (15) further supports this strategy.



SOURCES OF SALT INTAKE IN THE SOUTH AFRICAN DIET

- An MRC research team at the Chronic Diseases of Lifestyle Unit has recently reported data from a study in Cape Town using the gold standard approach of measuring habitual salt intake, namely analysis of multiple 24-hr urinary sodium (Na) excretion samples.
- All groups of South Africans consume more salt (sodium) than the recommended maximum of 6 g salt/day (6). Mean urinary Na values equate to a daily salt (NaCl) intake of 7.8g, 8.5g and 9.5g in black, coloured and white subjects, respectively (12). Similarly, in all ethnic groups, potassium excretion values fell far below the recommended dietary intake of 90 mmol per day (13) and less than 10% of subjects met this recommendation. Another study in Gauteng reports similar findings (14).
- Up to 46% of the salt consumed is added during preparation of food or at the table, thus much of the salt consumed is found in processed foods produced by the food industry in South Africa.(15)

COLLABORATION BETWEEN THE MEDICAL RESEARCH COUNCIL AND THE FOOD INDUSTRY IMPROVES THE QUALITY OF COMMONLY CONSUMED FOODS.

A landmark collaboration between the MRC and three food industry partners. (SASKO Milling and Baking Company, Unilever Foods, South Africa Ltd and the Low Sodium Sea Salt Company (UK)) resulted in the modification of the cation content (lowered Na and increased K, Mg and Ca content) of 5 commonly consumed food items, namely brown bread, brick margarine, soup mix, stock cubes and a flavour enhancer (Aromat).

- The experimental brown bread compared favourably with standard brown bread with regards to baking quality, appearance, texture and taste. Plant production feasibility was demonstrated within an existing industrial plant setting and a tasting panel could not distinguish between standard and experimental bread (18). The experimental bread contained 32% less Na and 55%, 69% and 35% more K, Mg and Ca, respectively.
- Sodium was reduced by 69% in the soup mix, 24% in the stock cube, 51% in Aromat, and 62% in margarine. All products were similar to the standard versions in terms of appearance, structure and taste.

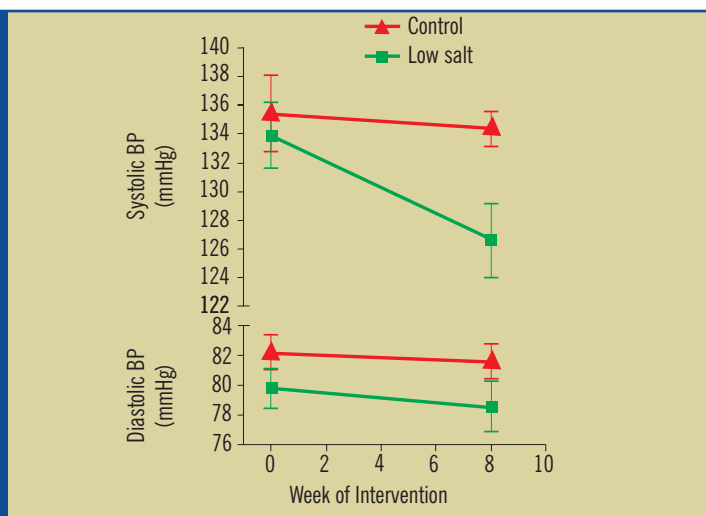
IMPACT OF THE MODIFIED FOODS ON BLOOD PRESSURE: A RANDOMISED CONTROLLED TRIAL

The impact of the modified foods on blood pressure was tested in an eight-week randomised, double blind, controlled trial conducted in a peri-urban area of Cape Town (Langa township), in which 80 black South African men and women took part. All were aged between 50 and 75 years, with drug-treated hypertension. The intervention comprised provision of the 5 modified food items, plus an additional 500ml maas (fermented milk product)/day and a salt replacement. The control diet provided the same quantities of the targeted foods to households, but of standard commercial composition and 500 ml/day of artificially sweetened cold drink. In order to prevent weight changes during the study, participants in both groups were advised to consume their usual quantities of the test foods (except for maas or cold drink). Foods provided in the intervention arm were expected to provide, on average, 41 % less Na and 775 %, 465 %, 368 % more K, Ca and Mg, respectively, compared to foods provided in the control arm. The 500ml maas per day accounted for 75 % of the additional Ca (775 mg), 23 % K (605 mg) and 18 % Mg (60 mg) but also contributed 10 % of the Na content (230 mg) of the intervention foods.

Compared to the control group the office systolic BP measurement of the intervention group was significantly lowered by 6.2 mmHg after 8 weeks (19). Similarly, the mean 24-hour ambulatory BP was also significantly lower. The largest reduction was demonstrated for wake systolic BP - 5.1mmHg, and wake diastolic BP -2.66 mmHg;.

Study reported participants that they could not detect a taste difference between the experimental and regular bread, Aromat, stock cubes or soup mixes. However the modified margarine and salt replacement were rated lower than the usual products.

Figure: Mean systolic and diastolic BP at Pre (baseline) and Post Intervention according to diet group allocation (N= 40 in each diet group).



This dietary approach has demonstrated that improvement of the cation content (lowered Na and increased K, Mg, Ca) of foods commonly consumed by the black, majority population, together with an increased consumption of fermented milk, lowered BP by a clinically important magnitude after 8 weeks. Although this study was conducted only over 8 weeks, it can be speculated that if a similar level of BP reduction could be achieved and maintained on a population level, it would result in a 20% reduction in the number of deaths attributed to high BP, preventing more than 9 000 deaths per year.

These findings suggest that appropriate policy interventions that will support the food industry to produce healthier foods, particularly bread, could have a major impact on the control of high BP in South Africa. Such a public health level approach is promoted internationally (11). The intake of the recommended amount of dairy products should also be promoted.

INTERNATIONAL RECOMMENDATIONS AND INITIATIVES TO REDUCE SALT IN FOOD

One of the five dietary recommendations for populations and individuals outlined in the World Health Organisation's global strategy on diet, physical activity and health is to limit salt (sodium) consumption from all sources and ensure that salt is iodized (20). Reduction of Na intake to 5g salt per day is one of the five lifestyle-related approaches to preventing and managing hypertension outlined in the internationally accepted Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure Guidelines (6). Decreased Na consumption can be accomplished by changing a population's exposure to Na in the food supply. Studies have shown that the implementation of a policy to reduce salt content in manufactured foods can result in a reduction in cardiovascular disease (21). The success of such an intervention can only be achieved with close collaboration between the Department of Health, members of the food industry and food regulating bodies.

Largely as a result of the lobbying of consumer pressure groups in other countries, particularly in the United Kingdom (UK), impressive strides have been made by the food industry in reducing the amount of salt in their products. In the UK, the Food Standards Agency lobbied the food industry to voluntarily lower salt in a wide range of processed foods. At the same time the agency has run an ongoing consumer salt awareness campaign while monitoring the behaviour and attitudes of the community to salt intake (22) This initiative is provided at – www.actiononsalt.org.uk.

This U.K. initiative is now being expanded world wide with the creation of World Action on Salt and Health (WASH) which was launched in October 2006 (23). WASH currently has 180 members from 43 countries and includes experts in high BP, nutrition and public health. It works closely with the WHO to promote a more coherent strategy towards salt reduction worldwide. Further, WASH intends to support individuals or groups in each member country to approach agencies that are able to influence the food industry in that country to reduce the salt content of foods. Their support could be valuable in South Africa. It is noted that some international food companies have already launched products with a reduced salt content.

The labelling of food products to indicate their salt content has also found to contribute to consumer awareness, particularly if a nutritional content claim such as 'reduced salt' is being used. Some countries have adopted nutrition-related logos to help consumers make healthier food choices. For example, in New Zealand, the Pick the Tick programme of the National Heart Foundation serves as a 'nutrition signpost' for consumers and appeals to the food industry as a tool for marketing food products (The South African Heart and Stroke Foundation has a similar Heartmark initiative). In a 1-year period, Pick the Tick influenced food companies to exclude about 33 tonnes of salt from the food supply in New Zealand through the new formulation of 23 breads, breakfast cereals and margarines (16). Similarly, in Australia Kellogg reformulated 12 of their breakfast cereals to provide an average sodium reduction of 40 %, without compromising consumer taste appeal (17). As a result, 235 tonnes of salt were removed annually from the food supply.

FOOD INDUSTRY TRENDS AND CHALLENGES IN SOUTH AFRICA

Bread is a staple food, together with maize meal porridge, for the majority of the South African population. The sodium content of bread in South Africa has remained higher than in many other countries, at the level of 2% salt, which equates to approximately 520 mg per 100g bread. Figures obtained from nutritional labelling on various types of breads indicate that 3 – 4 slices of bread spread with 30g of margarine totals over 2g salt – about 40% of the maximum recommended intake of 5g salt per day. The UK Food Standards Agency has recommended an upper level of salt in bread as 350 mg per 100g as the target for manufacturers to aim towards in that country.

Representatives from two large food companies were recently cited to report that South African consumers are more concerned about issues around sugar, fat and kilojoule content

than Na, and that demand for low-salt versions of foods is presently low (24). These quotes from local food manufacturers identify a need for public education awareness campaigns regarding the negative effects of salt on blood pressure and health.

The additional cost associated with the production of bread with a lower sodium and higher potassium content, calcium and magnesium was considered to make the bread unaffordable to the mass market. It is feasible that the baking industry could produce 25 % reduced sodium bread for the mass market, while at the same time producing a more specialized product, similar to the one used in our trial, for niche markets.

A large sector of the South African population uses flavour enhancers (Aromat or Fondor), stock cubes or soup powder to improve the bland taste of staple foods, thereby increasing the sodium content of their meals. The diets of people who consume these products would be healthier if the food industry developed more healthy variations of these sodium-rich additives for maize meal porridge.

RECOMMENDATION FOR POLICY AND ACTION IN SOUTH AFRICA

- It would be valuable if the South African nutrition-related organisations such as the Association for Dietetics in South Africa (ADSA), the Nutrition Society, the Heart and Stroke Foundation, and the Departments of Nutrition at Universities joined the World Action on Salt and Health (WASH). This would help create unified lobby groups to advocate for healthier foods with less salt for the South African market.
- The use of taxation and subsidies, in combination with food-related legislation, are mechanisms by which health authorities can positively improve the health of the population as a whole. (20). Since the primary business of the food industry is to sell food to consumers to generate profit and not necessarily to improve the health of the nation, the introduction of legislation or incentives may be necessary to encourage the food industry to be more proactive in their product development, as well as their marketing and pricing strategies.
- The food labelling regulations are currently in the process of being revised. The latest draft, with regard to nutrient content claims allowed on food packaging for Na specifies that the term 'low sodium' may only be used for food containing < 120mg sodium (300mg of salt) per 100g. Thus even if the Na content of bread is reduced from the current level to 350mg salt/100g, a nutrient content claim could not be made. The current and proposed new food labeling regulations do not provide motivation for baking companies to lower the salt content of bread since legislation (if passed in its current format) would not allow the following health claim "Diets low in sodium may reduce the risk of high blood pressure, a disease associated with many risk factors" unless the low sodium nutrient content claim could be met. It is suggested that food labeling regulators consider introducing an item of 'reduced salt bread' (that would allow an associated health claim) for bread that contains the minimum level of salt that allows the baking process to proceed effectively. Since bread is an important staple food in South Africa such a step could be motivated in order to substantially reduce the high sodium intake in the country.
- The South African Heart Foundation currently allows subscribing food companies to display the Heart Mark logo provided the following Na levels are adhered to in products (and in conjunction with meeting other nutrient content standards): Bread: maximum of 450 mg of salt per 100g of bread; margarine: 400mg of salt per 100g; Reconstituted soup powders: 200 mg of salt per 100g. Since these Na levels are higher than the newer international recommendations, the Heart and Stroke Foundation should be encouraged to lower the Na levels associated with the Heart Mark. Different messages on Na intake portrayed to consumers using various labeling and logos standards provide the potential for confusion and misunderstanding.
- It has been demonstrated that the most frequently encountered source for information on nutrition in urban black South African women is the media, with the radio and TV being the most frequently accessed sources (26). Information from these sources

are perceived as being highly reliable and trustworthy. Regulations that ban the marketing of unhealthy food items, including foods that are high in salt, may influence individuals to make better food choices. To date, no such regulations exist in South Africa. Internationally, it has been suggested that the feasibility of codes of practice in food advertising should be explored through the Codex Alimentaris international foods standard-setting body (20).

- The DOH have initiated the introduction of food-based dietary guidelines, one of which aims to encourage people to use less salt, namely "Use salt sparingly". Furthermore there is another positive message which encourages an increased consumption of potassium and magnesium "Eat plenty of vegetables and fruit every day". Health workers are encouraged to use these simple messages to improve blood pressure levels in the population. Appropriate training of all levels of health care providers is required in order to enable them to provide effective nutrition education.



REFERENCES

1. Bradshaw D, Groenewald P, Laubscher R, Nanna N, Nojilana B, Norman R et al. Initial burden of disease estimates for South Africa 2000. *S Afr Med J* 2003;93:682-688.
2. Steyn K, Gaziano TA, Bradshaw D, Laubscher R, Fourie JM. Hypertension in South African adults: results from the Demographic and Health Survey, 1998. *Journal of Hypertension* 2001; 19(9): 1717-1725.
3. Moodley J, Steyn K, Ehrlich R, Jordaan E, Marais AD, Burgess L. Lipid and ischaemic heart disease risk factors in an urbanising work force. *S Afr Med J* 1997; 87: 1615 – 1620.
4. Steyn K, Fourie J, Lombard C, Katzenellenbogen J, Bourne L, Jooste P. Hypertension in the black community of the Cape Peninsula, South Africa. *East Afr Med J* 1996; 73: 758-763.
5. Mollentze WF, Moore AJ, Steyn AF. Coronary heart disease risk factors in a rural and urban Orange Free State black population. *S Afr Med* 1995; 85: 90-96.
6. National High Blood Pressure Education Program. The Seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of high Blood Pressure. US Department of Health and Human Services: NIH Publication No 03-5231, May 2003.
7. Appel L, Moore T, Obarzanek, et al. A clinical trial of the effects of dietary patterns on blood pressure. *N Engl J Med* 1997;336:1117-1124.
8. Sacks FM, Svetky LP, Vollmer WM, Appel LJ, Bray GA, Harsha D, Obarzanek E, Conlin PR, Miller ER III, Simons-Morton DG, Karanja N, Lin P-H for the DASH-Sodium collaborative research group. Effects on blood pressure of reduced dietary sodium and the dietary approaches to stop hypertension (DASH) diet. *New Engl J Med* 2001; 1: 344: 3-10
9. Vorster HH, Oosthuizen W, Jerling JC, Veldman FJ, Burger HM. The Nutritional Status of South Africans. A Review of the Literature from 1975 – 1996. Durban: Health Systems Trust; 1997.
10. Steyn NP, Bradshaw D, Norman R, Joubert J, Schneider M, Steyn K. Dietary changes and the health transition in South Africa: Implications for Health Policy. Cape Town: South African Medical Research Council, 2006.
11. WHO/FAO. Diet, Nutrition and the Prevention of Chronic Diseases. Report of a Joint WHO/FAO Expert Consultation. WHO Technical Report Series 916. Geneva: World Health Organization, 2003: 101.
12. Charlton KE, Steyn K, Levitt NS, Zulu J, Jonathan D, Veldman D, Nel JH. Urinary excretion and reported dietary intake of sodium, potassium, calcium and magnesium in normotensive and hypertensive South Africans from three ethnic groups. *Eur J Cardiovascular Prevention and Rehabilitation* 2005;12: 355- 362.
13. National High Blood Pressure Education Program. The sixth report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. *Arch Intern Med* 1997; 157:2413-2446.
14. Maseko MJ, Majana HO, Milne J, Norton GR, Woodiwiss AJ. Salt intake in an urban, developing South African community. *Cardiovasc J South Afr* 2006;17:186-191.
15. Charlton KE, Steyn K, Levitt NS, Zulu JV, Jonathan D, Veldman FJ, Nel JH. Diet and blood pressure in South Africa: intake of foods containing sodium, potassium, calcium and magnesium in three ethnic groups. *Nutrition* 2005; 21: 39-50.
16. Greenfield H, Smith AM, Maples J, Wills RBH. Contributions of foods to sodium in the Australian food supply. *Hum Nutr Appl Nutr* 1984; 38: 203-210.
17. Williams P, McMahon A, Boustead R. A case study of sodium reduction in breakfast cereals and the impact of the Pick the Tick food information program in Australia. *Health Promotion International* 2003; 18: 51- 56.
18. Charlton KE, MacGregor E, Vorster N, Levitt NS, Steyn K. Partial replacement of NaCl can be achieved with K, Mg and Ca salts in brown bread. *Int J Food Science & Nutrition*. 2007;58(7), Published on line 6th June 2007 <http://dx.doi.org/10.1080/09637480701331148>.
19. Charlton KE. The development of a dietary intervention to modify dietary cation content and the evaluation of its effect on blood pressure in hypertensive black South Africans. PhD thesis, pp1-346. Cape Town: University of Cape Town, 2006.
20. World Health Organization. Fifty-Seventh World Health Assembly. Global Strategy on diet, physical activity and health. WHA 57.17 Geneva:World Health Organisation. 22 May 2004.
21. Murray CJL, Lauer JA, Hutubessy RCW, Niessen L, Tomijima N et al. Effectiveness and cost of interventions to reduce systolic blood pressure and cholesterol: A global and regional analyses on reduction of cardiovascular-disease risk. *Lancet* 2003;361:717-725.
22. Food Standards Agency. New Salt reduction targets published as part of FSA campaign to reduce salt in our diets. Ref:2006/0639. Tuesday 21 March 2006.
23. MacGregor G. Invitation to join the World Action on Salt and Health. World. The World Hypertension League Newsletter, No 110. December 2006
24. The great salt debate. *Food Review*; Nov/Dec 2004
25. Department of Health, Foodstuffs, Cosmetics and Disinfectants Act, 1972 (Act no 54 of 1972). Regulations relating to labelling and advertising of foodstuffs. 8 August 2002. NO. R. 1055. Government Notice, Government Gazette, No 7431, Volume 8, No 23714, Pretoria.
26. Charlton KE, Brewitt P, Bourne LT. Sources of nutrition information in black urban South African women, with special reference to messages related to obesity. *Public Health Nutrition* 2004;7(6):801-811.