The Barbados National Salt Study:

Findings from a Health of the Nation sub-study

This report is a joint publication of the Ministry of Health of the Barbados Government and the Chronic Disease Research Centre, UWI; November 2015.

Authors:
Ms Rachel Harris, Ms Angela Rose, Prof Nigel Unwin

Suggested citation: Harris R, Rose A, Unwin N. The Barbados National Salt Study: Findings from a Health of the Nation sub-study. Chronic Disease Research Centre, the University of the West Indies and the Barbados Ministry of Health: St Michael, Barbados, November 2015; 37 pp.

Acknowledgements

Funding for this project was provided by the Ministry of Health, Barbados.

We are grateful to all respondents who took part in the survey, as well as to the survey data collectors: Mrs Amy Browne, Mrs Clare Clouden and Mrs Lisa Brathwaite-Graham; the data entry staff: Ms Kareen Alleyne and Ms Cassandra Suttle; and the field supervisor: Mrs Martinette Forde.

We also wish to acknowledge Professor Sir Trevor Hassell, Healthy Caribbean Coalition, and Professor Anselm Hennis, PAHO, for their initial assistance and for securing funding for the project; Ms Christina Howitt, CDRC, for technical expertise in the early stages; Professor Ian Hambleton, CDRC, for assistance with analysis; and Dr Kenneth George, Barbados Ministry of Health, Dr Suzanne Soares-Wynter, UWI–Mona and Dr Nita Forouhi, MRC Cambridge, for support throughout the study. In addition, we are grateful to the Pan American Health Organisation and Mr Egbert Gibson, Barbados Reference Laboratory, for technical support.

Contents

Executive summary

Elevated blood pressure is associated with high levels of dietary sodium and the development of cardiovascular disease (CVD), including heart disease and stroke. The main source of sodium in the diet is salt (sodium chloride). Dietary potassium, sources of which include fresh fruit and vegetables, can help to protect against the harmful effects of sodium.

The National Salt Study, a sub-study of the Barbados Health of the Nation (HotN) Survey, was a population based, cross-sectional survey set in Barbados. The primary aim was to estimate average sodium intake. The secondary aim was to identify the main dietary sources of sodium for the population. The study also assessed levels of dietary potassium intake, and knowledge, attitudes and self-reported practices concerning salt. Sociodemographic patterns were explored using age, sex and highest level of education.

A nationally representative sample of 373 adults (25–64 years) each completed a single, timed 24 hr urine collection and two non-consecutive, in-depth 24 hr dietary recalls. Levels of sodium and potassium were determined from the urine samples. The top food sources for both sodium and potassium were identified from the dietary recall data. A culturally adapted questionnaire was used to capture participants' knowledge, attitudes and practices towards salt.

The mean sodium excretion for the population was 2.7 g/d (95% CI: 2.5, 2.8) (equivalent to 6.75 g salt), being higher in men (2.9 g/d; 95% CI: 2.7, 3.1) than in women (2.5 g/d; 95% CI: 2.2, 2.7). This was 1.8 times greater than the recommended daily intake of 1.5 g/d of sodium for black populations and high risk groups. Seventy-nine percent of women and 89% of men consume more than 1.5g/d of sodium. Using the more conservative upper limit of 2.0 g/d (equivalent to 5g of salt) 68% consume more than this. The mean potassium excretion was 1.5 g/d; being slightly higher in men (1.6 g/d) than in women (1.4 g/d). These levels, for all groups, are only one-third of the adult recommendation of 4.7 g/d for potassium. The mean sodium to potassium ratio was found to be 2.0 for the total population. Based on current recommendations ideally this ratio should be 0.5 or less.

The top five individual food items contributing to sodium intake in the population were rice and peas (6.0%), baked chicken (5.6%), macaroni pie (4.3%), white rice (4.2%), and coconut bread (3.8%), which together contributed almost one-quarter of the total sodium intake. Most individuals (94.7%) reported that they were aware that a high salt diet was unhealthy, with 75% linking a high intake of salt to hypertension. However, two out of three individuals thought that they were consuming the right amount of salt or even too little, when in fact they were consuming too much.

The study findings highlight the target foods, areas in which knowledge is lacking and provide baseline measurements against which to evaluate interventions designed to reduce sodium intake, increase potassium intake, and reduce the incidence of high blood pressure and CVD.

List of abbreviations

AI	Adequate intake
BMI	Body mass index
CDRC	Chronic Disease Research Centre
CVD	Cardiovascular disease
DR	Dietary recall
HotN	Health of the Nation
IOM	Institute of Medicine
K	Potassium
KAP	Knowledge, attitudes and practices
MoH	Ministry of Health
Na	Sodium
NCD	Non-communicable disease
PAHO	Pan American Health Organization
SSB	Sugar sweetened beverages
USDA	United States Department of Agriculture
USA	United States of America
WC	Waist circumference
WHO	World Health Organization

Background and aims

In the Caribbean, non-communicable diseases (NCDs) are the main cause of disability and premature mortality, with approximately one-third of all NCD deaths being attributed to cardiovascular disease (CVD).[1,2] Hypertension is the primary risk factor for CVD. The World Health Organization (WHO) states that increasing blood pressure worldwide is the leading risk factor for death[3] and the second leading risk for disability through heart disease, stroke and kidney failure.[4] In Barbados, hypertension is a public health priority, as recent evidence indicates that 42% of the adult population in Barbados is hypertensive.[5]

A diet habitually high in sodium is one of the major modifiable causes of hypertension,[6] with others including obesity, physical inactivity, and excess alcohol consumption. Sodium is ubiquitous in the food supply, with only a small proportion of ingested sodium being discretionary and readily under the control of the consumer. Salt (sodium chloride) is the biggest contributor to sodium intake. The Institute of Medicine (IOM) set an adequate intake (AI) level for sodium of 1500 mg/day among persons who are 51 years or older and those of any age who are African-American, or have hypertension, diabetes or chronic kidney disease.[7] Modest reductions in dietary sodium could substantially reduce cardiovascular events and the associated economic burden. The Port-of-Spain Declaration, in 2007, secured the commitment of regional governments to combat the NCD burden.[8] The Barbados Strategic Plan for the Prevention and Control of Non-Communicable Diseases 2015–2019, has outlined the reduction of salt as one of its priorities.[9] The Pan American Health Organization (PAHO) has recommended the target of < 5 g salt/day (equivalent to 2000 mg sodium/day) by 2020.[10, 11] Surveillance of actual sodium intake and the determination of the main dietary sources of salt are critical underpinnings to the design of a future national effort to revert the current CVD epidemic.

The National Salt Study, a sub-study of the Barbados Health of the Nation (HotN) Survey, was a population based, cross-sectional survey set in Barbados. The primary aim was to estimate mean sodium intake. The secondary aim was to identify the main dietary sources of sodium for the population. Levels of urinary potassium were also measured as a 'proxy' indicator of dietary potassium intake. Sociodemographic patterns were explored using age, sex and highest level of education. The National Salt Study provides, for the first time, a representative and robust estimate of baseline sodium (and potassium) intake for Barbados, using the objective

timed 24 hr urine collection method. Dietary sources of sodium and the knowledge, attitudes and practices towards salt were also investigated. The HotN survey built the fundament for this sub-study, providing demographic, anthropometric and biochemical measurements.

This report outlines the main study findings and the potential targets for a future salt intervention aimed to improve prevention and control of CVD and stroke in the Barbadian population.

Methods

Using a cross-sectional design, a representative sample of randomly selected Barbadian adults aged 25–64 years (n=373) completed a single timed 24 hr urine collection, two non-consecutive dietary recalls and a questionnaire on the knowledge, attitudes and practices towards salt use.

Recruitment

The National Salt Study participants were recruited from those aged 25–64 years who participated in the HotN survey.[5]

Inclusion and exclusion criteria and general study population

All participants of the HotN survey aged 25–64 years, who had given prior written consent to take part in further research, were eligible for inclusion in this sub-study.

In addition to age, an individual was excluded if:

1. They reported history of renal disease, heart failure, liver disease, or stroke
2. They had started on thiazide diuretics within 2 weeks prior to the interview
3. They were a woman, who was pregnant or lactating (because of their unique nutritional requirements).

All participants were seen within 6 months of their HotN interview.

Ethical approval

Ethical approval was granted by the Institutional Review Board of the Ministry of Health, Barbados and the University of the West Indies. All participants provided written informed consent.

Data collection

Data were collected as home visits, during two face-to-face interviews, between June 2012 and November 2013.

This study used a single timed 24 hr urine collection to assess sodium and potassium intake. The 24 hr urinary sodium excretion method is considered the 'gold standard' for obtaining data on sodium consumption. This objective method overcomes some of the limitations associated

with self-reported dietary assessment methods.[13] A single 24 hr collection of urine on many individuals provides a good estimate of levels of sodium intake in the population as a whole.[12,13]

Two non-consecutive dietary recalls were used to identify the dietary sources of sodium in the Barbadian population. Data on the knowledge, attitudes and practices towards salt were captured using a modified PAHO questionnaire.[11]

Timed 24 hr urine collection

Internationally recommended standard procedures[11] were followed and no behavioural constraints were placed on participants. Written instructions and a simplified chart detailing the 24hr urine collection method were given. The urine collection commenced by discarding the first urine void at the beginning of their day. This point was noted as the start of the 24 hr collection. All urine was then collected from that point onwards until the final void on the following day, at the corresponding 24 hr finish time. A Participant Diary was given in which the timing of the urine collection, any missed urine voids, strenuous activity, illness (i.e. vomiting/diarrhoea) and any medication taken during the collection period were recorded. This was done to increase compliance with the strict protocol.

Urine samples were excluded if:
(1) Urine volume was < 500 ml or > 5000 ml (n=364)
(2) Timing of collection fell outside the range 20–28 hr
(3) The participant reported missing more than one urine void

Urinary creatinine was also used as a marker of completeness. This approach to assessing completeness is based on assumption that a certain amount of creatinine is excreted in the urine each day. Although this method is imperfect it provides a useful additional approach to checking the validity of the findings. Two criteria were used for urine completeness:

1. Restricting to those within WHO (1985)[14] proposed ranges of creatinine per kg body weight (n=235)
2. Restricting to those with greater or equal to 500 mg creatinine in their urine (n=317)

Frozen urine samples, 15 ml for each participant, were retained and stored at the Chronic Disease Research Centre (CDRC) for any future analyses.

24 hr dietary recall

Two non-consecutive, interviewer-administered, 24 hr dietary recalls were recorded, using the United States Department of Agriculture (USDA) multi-pass method.[15] This method follows five research-based steps, which aim to increase accuracy and reduce participant burden. Systematic probing of all foods and beverages consumed in the previous 24 hr, including supplements, were detailed. Information on serving sizes, portions eaten and frequency of consumption were documented.

Three-dimensional Nasco food models (Nasco Company, 901 Jamesville Ave, Fort Atkinson, Wisconsin 53538, USA), standard measuring cups and utensils were used to capture the portion sizes in which foods are served and consumed in one sitting. The timing and place of eating, cooking method, seasoning use and recipes were noted.

Knowledge, attitudes and practices (KAP) questionnaire

The questionnaire on the knowledge, attitudes and behaviours was adapted from the PAHO protocol for population level sodium determination.[11] The questionnaire contained questions related to knowledge of personal consumption, and possible harmful effects of salt, as well as assessing attitudes and behaviours to lowering sodium intake. The participants answered on a range of different scales such as “rarely, sometimes, often”, “yes, no” and “too much, just the right amount, too little”.

This questionnaire was adapted using information collected during focus groups held in 2011 using people from varying backgrounds: nursing, nutrition and public health. These focus groups were conducted by a nutrition expert. Questions were asked in an interactive group setting about perceptions, opinions, beliefs, and attitudes towards salt. Information gathered during these sessions were used to inform and modify the PAHO KAP questionnaire, so that culturally specific sources of salt, methods of food preparation and condiment use were included. This questionnaire was administered during the second home visit.

Statistical methods

The aim was to randomly select 500 individuals from the adult Barbadian population, stratified by sex and age-group (25–44 and 45–64 years), yielding at least 100 individuals in each group. This sample size followed WHO guidance; assuming that the standard deviation of sodium excretion is 80 mmol/d, the sample size of 300 would enable a difference between two groups of 25 mmol/d of sodium (approximately 1.5 g of salt) to be detected, with 80% power and a p value < 0.05.[12]

The nutritional analysis programme, Nutribase Pro (version 9, Cybersoft Inc., 2016 E. Muirwood Drive, Phoenix, Arizona, USA), was used to analyse dietary data. The underlying database is comprised of the USDA and Canadian food composition tables, as well as brand name data. Several traditional Barbadian dishes (e.g. pudding and souse, macaroni pie, sautéed corned beef), which had been analysed using the weighed recipe approach,[16] were added to the Nutribase database. This allowed access to a more culturally appropriate nutrient database, which specifically addressed certain aspects of the Barbadian diet.

Statistical weighting of data used in urinary analyses was performed to reflect the age and sex distribution of the underlying Barbadian population. The response rate for the study was also taken into consideration. Statistical analyses were performed using STATA/SEV.12 (Stata Corp, College Station, Texas, USA).

Findings

Response Rates and Characteristics of the Study Population

Key points

- Two out of three study participants were overweight, and one in three was obese, with the prevalence being higher in women than men
- Abdominal obesity was twice as high in women than men, increasing their disease risk for Type 2 diabetes, hypertension and CVD
- Approximately one in three adults were hypertensive, whilst one in 10 had diabetes
- The prevalence of hypertension, and that for diabetes, was similar in both sexes

Study population

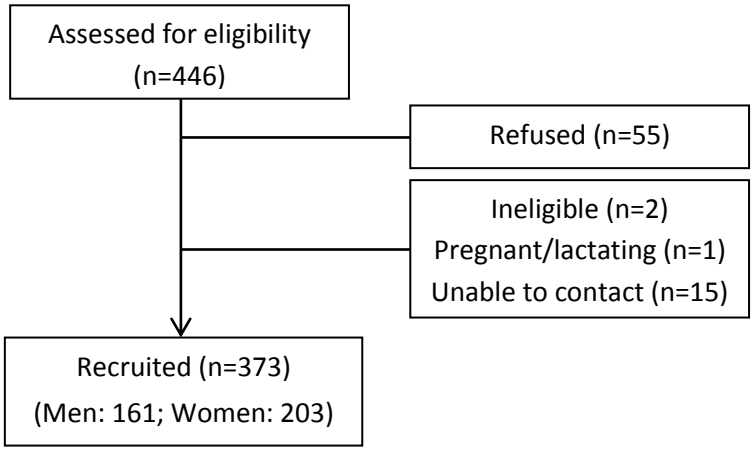

Figure 1: Study profile of the National Salt Study

Of the 446 selected, 55 (12%) refused, 15 (3%) were classified as "unable to contact", and three (1%) were excluded from the sample (Figure 1). Reasons for exclusion are shown in Table 1.

Table 1: Reasons for National Salt Study exclusion

Reason	Number of households
Pregnant/lactating	1
Heart disease	1
Renal failure	1
Unable to contact[a]	15
Eligible but refused	55

[a] Study staff unable to contact via phone, abandoned after five attempts.

The final study sample included 373 participants (166 men; 207 women), with an estimated response rate of 84% (see Figure 1).

Table 2: Characteristics of the National Salt Study sample by age, sex and educational level

	Educational Level		
	Less than Tertiary	**Tertiary**	**All**
Women			
25-44 yrs	62	28	90
45-64 yrs	92	21	113
All	154	49	203
Men			
25-44 yrs	57	19	76
45-64 yrs	63	22	85
All	120	41	161
Men and women			
25-44 yrs	119	47	166
45-64 yrs	155	43	198
All	274	90	364

The aim was to recruit 100 individuals in each age group for both sexes. The final sample had a higher number of women (203) than men (161), with slightly lower numbers being recruited in the younger age groups for both sexes. One-quarter of participants had completed up to tertiary education and three-quarters had completed only up to secondary.

Overall, two out of three study participants are overweight, and one out of three is obese. Prevalence of obesity was higher in women (46.4%) than men (25.3%). Abdominal obesity, a measure that is strongly associated with CVD, was higher in women (49.7%) than in men (21.7%). For women, the mean waist circumference (WC), 94.7 cm, was greater than the upper limit of > 80 cm (35 inches) (Appendix 1: Tables A1 and A2). For the cholesterol ratio, a greater proportion of men (62.2%) than women (46.4%) had a ratio greater than the highest cut-point of 5. (An optimal ratio is between 3.5 and 1; a higher ratio means a higher risk of heart disease.)

Sodium and Potassium Intake

Key points

- Over half the population are exceeding the World Health Organization recommended daily limit of 5 g of salt (2000 mg of sodium)
- Two out of three individuals thought that they were consuming the right amount of salt, or even too little, when in fact they were consuming too much
- The proportion consuming ≥ 1500 mg/d of sodium, the limit recommended for African Americans, is higher for men (89.4%) than for women (79.0%)
- All individuals across all age groups and for both sexes consumed less than the recommended 4700 mg/d of potassium

Table 3: Mean sodium and potassium intake, and sodium to potassium ratio (95% confidence interval), by age and sex

	Sodium (g)	Potassium (g)	Sodium to potassium ratio
Women			
25-44 yrs	2.6 (2.2, 3.0)	1.3 (1.1, 1.4)	2.1 (1.9, 2.3)
45-64 yrs	2.3 (2.1, 2.5)	1.5 (1.4, 1.7)	1.7 (1.5, 1.8)
Total	2.5 (2.2, 2.7)	1.4 (1.3, 1.5)	1.9 (1.8, 2.0)
Men			
25-44 yrs	3.0 (2.7, 3.3)	1.5 (1.4, 1.6	2.1 (2.0, 2.3)
45-64 yrs	2.8 (2.5, 3.0)	1.6 (1.4, 1.8)	2.0 (1.7, 2.3)
Total	2.9 (2.7, 3.1)	1.6 (1.4, 1.7)	2.1 (1.9, 2.3)
Men and Women			
25-44 yrs	2.8 (2.5, 3.0)	1.4 (1.3, 1.5)	2.1 (2.0, 2.3)
45-64 yrs	2.5 (2.3, 2.7)	1.6 (1.4, 1.7)	1.8 (1.7, 2.0)
Total	2.7 (2.5, 2.8)	1.5 (1.4, 1.5)	2.0 (1.9, 2.1)

*Note 1g=1000mg; to convert g sodium to g salt: multiply by 2.5.

Table 3 shows the mean values of sodium and potassium intake in the population, with 95% confidence intervals providing the range within which the true underlying population value lies. Mean sodium intake for men (2.9 g) was slightly higher than that for women (2.5 g). There were no significant differences in sodium intake by age group. The mean potassium intake for the population was 1.5 g and no real differences were seen between sexes or age groups. The mean sodium to potassium ratio for the population was 2.0, and was lowest in women aged 45–64 years, at 1.7.

Table 4: Percentage (95% confidence intervals) of individuals exceeding recommended daily levels of sodium and potassium; and the sodium to potassium ratio, by age and sex

	Sodium ≥ 1500 mg	Sodium ≥ 2000 mg	Potassium < 4700 mg	Sodium to potassium ratio ≥ 1.0
Women				
25–44 yrs	80.6 (71.0, 87.7)	64.1 (51.5, 75.0)	100	92.5 (85.6, 96.3)
45–64 yrs	77.4 (67.5, 84.9)	58.2 (46.1, 69.4)	100	77.8 (66.5, 86.1)
All	79.0 (71.8, 84.8)	61.2 (51.7, 69.9)	100	85.3 (79.4, 89.8)
Men				
25–44 yrs	91.1 (80.8, 96.2)	70.6 (60.4, 79.0)	100	90.9 (79.2, 96.3)
45–64 yrs	87.3 (77.5, 93.3)	79.4 (66.5, 88.3)	100	84.4 (75.5, 90.5)
All	89.4 (83.4, 93.3)	74.7 (66.7, 81.4)	100	87.9 (82.2, 91.9)
Men and women				
25–44 yrs	85.8 (80.0, 90.1)	67.3 (59.3, 74.4)	100	91.7 (84.9, 95.6)
45–64 yrs	82.1 (74.7, 87.7)	68.2 (58.6, 76.5)	100	80.9 (73.6, 86.5)
All	84.0 (79.2, 87.8)	67.7 (61.6, 73.3)	100	86.5 (82.8, 89.6)

Over half the population (67.7%) is consuming ≥ 2000 mg/d (equivalent to 5 g/d of salt); whilst greater than three-quarters of individuals (84.0%) exceed 1500 mg/d of sodium. The proportions of men consuming ≥ 1500 mg/d (89.4%) and ≥ 2000 mg/d (74.7 %) of sodium were higher than for women (which were 79.0% and 61.2% respectively).

All individuals (100%) for both sexes and across all age groups consumed less than the recommended 4700 mg/d of potassium. The sodium to potassium ratio was greater than 1 for 86.5% of the population, being slightly lower in older women (77.8%; Table 4). Less than 1% across all groups had a sodium to potassium ratio of < 0.5 (data not shown).

Both methods of checking for completeness of urine collection using creatinine yielded results which were very similar to those reported in Table 4. Applying these methods resulted in a reduction in sample size and only marginally higher proportions compared with those generated from the original sample (Appendix 1: Tables A3 and A4).

Table 5: Proportions (95% confidence intervals) of individuals exceeding the recommended daily limits of sodium and potassium by educational level

	Sodium ≥ 1500 mg	Sodium ≥ 2000 mg	Potassium < 4700 mg	Sodium to potassium ≥ 1
Women				
<Tertiary	76.7 (68.0, 83.6)	56.9 (45.3, 67.9)	100	84.7 (78.1, 89.6)
Tertiary	86.7 (73.1, 94.0)	75.5 (62.6, 85.0)	100	87.3 (73.6, 94.5)
Total	79.0 (71.8, 84.8)	61.2 (51.7, 69.9)	100	85.3 (79.4, 89.8)
Men				
<Tertiary	89.2 (81.4, 94.0)	73.0 (64.6, 79.9)	100	90.3 (82.5, 94.8)
Tertiary	89.8 (75.8, 96.2)	80.6 (62.3, 91.2)	100	80.1 (64.7, 89.8)
Total	89.4 (83.4, 93.3)	74.7 (66.7, 81.4)	100	87.9 (82.2, 91.9)
Men and women				
<Tertiary	82.7 (76.8, 87.4)	64.6 (57.4, 71.2)	100	87.4 (82.8, 90.8)
Tertiary	88.2 (81.1, 92.9)	77.9 (67.1, 86.0)	100	83.8 (74.9, 90.0)
Total	84.0 (79.2, 87.8)	67.7 (61.6, 73.3)	100	86.5 (82.8, 89.6)

Although confidence intervals are broad, there is a tendency for high levels of sodium intake for those with tertiary education compared with those with less than tertiary education (Table 5). Educational level does not appear to have an impact on the level of potassium consumed by the population.

Table 6: Percentage (with 95% CI) of individuals exceeding the recommended daily limits of sodium by hypertension status

	Sodium ≥ 1500 mg	Sodium ≥ 2000 mg	Potassium < 4700 mg	Sodium to potassium ≥ 1
Women				
Diagnosed hypertension	88.7 (73.8, 95.7)	67.8 (45.4, 84.2)	100	84.2 (68.9, 92.8)
Undiagnosed hypertension	79.0 (52.4, 92.8)	63.7 (34.8, 85.2)	100	91.7 (65.1, 98.5)
Not hypertensive	74.9 (64.9, 82.9)	57.9 (48.5, 66.8)	100	84.7 (77.9, 89.7)
Men				
Diagnosed hypertension	81.5 (56.9, 93.6)	65.8 (37.8, 85.9)	100	72.2 (44.6, 89.3)
Undiagnosed hypertension	97.1 (80.7, 99.6)	80.7 (60.7, 91.9)	100	91.6 (77.7, 97.2)
Not hypertensive	88.9 (80.7, 93.9)	75.0 (67.5, 81.3)	100	90.2 (81.6, 95.0)
Men and women				
Diagnosed hypertension	86.3 (73.0, 93.6)	67.1 (49.3, 81.0)	100	80.2 (65.3, 89.7)
Undiagnosed hypertension	90.6 (77.0, 96.5)	74.5 (57.8, 86.2)	100	91.6 (80.9, 96.6)
Not hypertensive	81.8 (75.5, 86.8)	66.4 (60.9, 71.4)	100	87.4 (82.2, 91.3)

Nearly two-thirds of persons with hypertension (diagnosed and undiagnosed), for both sexes, are exceeding the upper cut point of ≥ 2000 mg sodium daily. For women the proportion consuming greater than 1500 mg/d or 2000 mg/d of sodium is higher for those diagnosed with hypertension than for women with undiagnosed hypertension (Table 6).

Dietary sources of sodium

Key points

- Half of all sodium came from the top five food categories (poultry, rice, bread, fish and processed meats)
- Approximately one-quarter of all sodium is from five individual food items (rice and peas, baked chicken, macaroni pie, white rice and coconut bread)
- No differences were found in either the top 10 food categories or top 10 food items by sex, age, education or hypertension status

Food category

Table 7 presents the 10 major food category sources of sodium from the 24 hr dietary recalls.

These food categories contribute approximately 79.0% of total dietary sodium. The five most frequently reported food categories were vegetables (7.1%), poultry (5.9%), bread (5.6%), ground provisions (5.1%) and rice dishes (4.6%).

Table 7: Top 10 food category sources of dietary sodium for men and women, by % sodium

Food category	Frequency* (%)	% Sodium	95% CI
Poultry	487 (5.9)	13.5	13.5, 13.6
Rice	385 (4.6)	13.0	13.0, 13.1
Bread	468 (5.6)	12.5	12.4, 12.5
Fish	339 (4.1)	6.7	6.7, 6.8
Processed meats	204 (2.5)	6.2	6.1, 6.2
Cakes, sweet breads	213 (2.6)	5.8	5.8, 5.9
Pasta	184 (2.2)	5.8	5.7, 5.8
Vegetables	588 (7.1)	5.4	5.4, 5.5
Ground provisions	424 (5.1)	5.2	5.2, 5.2
Red meat	231 (2.8)	5.0	5.0, 5.1

*Frequency: number of times food category was reported, as a percentage of all food items reported.

The top three food categories that contributed most to sodium consumption in the study participants were poultry (13.5%) rice dishes (13.0%) and bread (12.5%), which combined provided 39% of total sodium intake. No real differences were found in the top food category sources of sodium by sex, age, level of education or hypertension status.

The top three food items within each food category are presented in Figure 2. Several food items or dishes made large contributions within each broad food category. These include: Bajan macaroni pie (73.8% of the pasta category), coconut bread (65.0% of the cakes and

sweet breads), rice and peas (46.3% of rice dishes), fried fish (45.9% of fish dishes), baked/roasted/rotisserie chicken (41.1% of chicken preparations), French fries/wedges (38.4% of ground provisions), vegetables boiled with salt (31% of all vegetable dishes) and hot dogs (30.1% of processed foods).

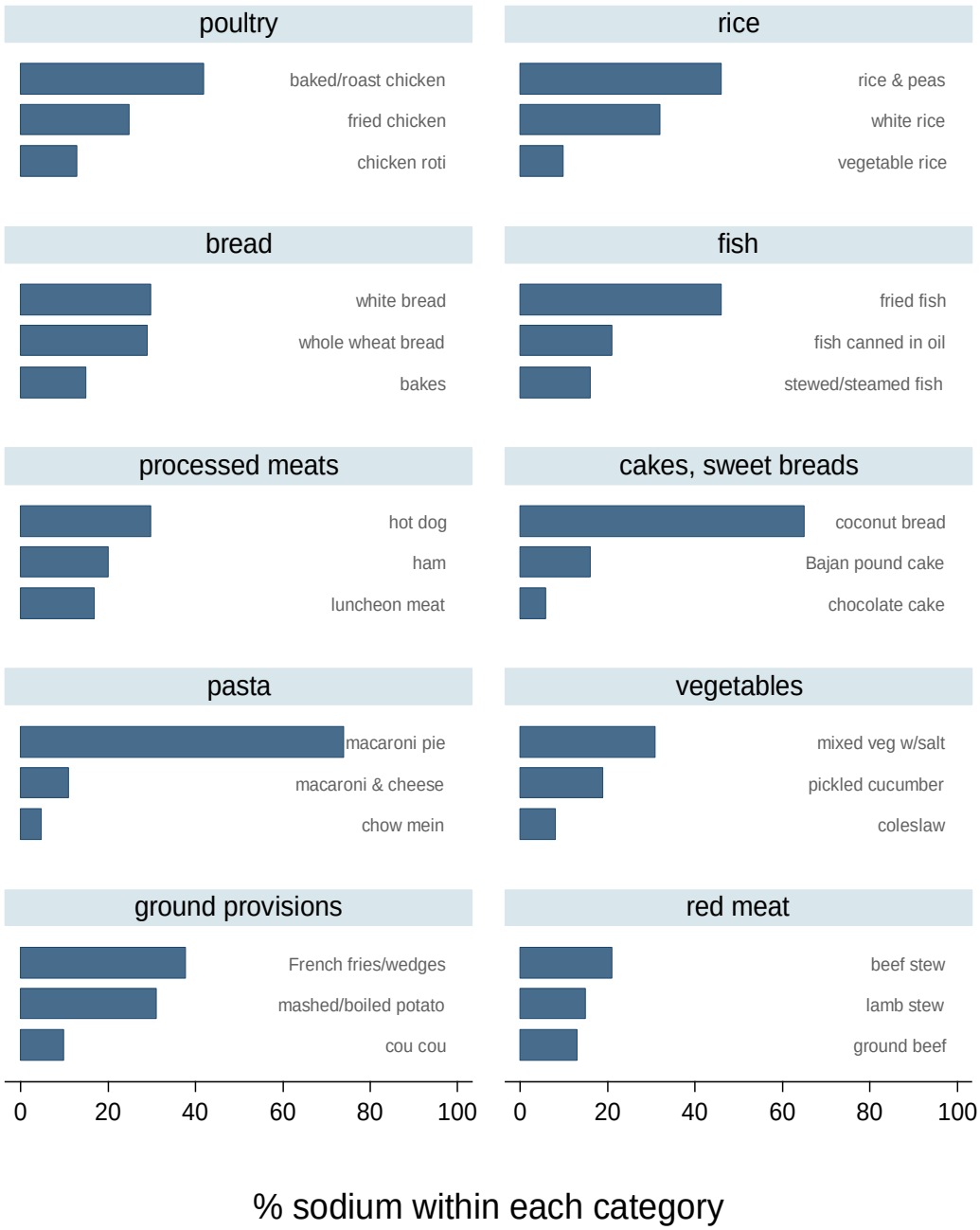

Figure 2: The proportion of sodium in each of the top three individual food items within each of the top 10 food categories

Food item

Table 8: The top 15 individual food items which each contribute to > 1% of sodium intake in the population

Food item	Frequency (%)	% Sodium	95% CI
Rice and peas	217 (2.6)	6.0	6.0, 6.1
Chicken – baked	180 (2.2)	5.6	5.6, 5.6
Macaroni Pie – Bajan	73 (0.9)	4.3	4.2, 4.3
Rice – white	98 (1.2)	4.2	4.2, 4.2
Coconut bread	77 (0.9)	3.8	3.8, 3.8
Bread – white	153 (1.8)	3.7	3.7, 3.8
Bread – whole wheat	172 (2.1)	3.7	3.6, 3.7
Chicken – fried	118 (1.4)	3.3	3.3, 3.3
Crackers – white	146 (1.8)	3.1	3.1, 3.1
Fish – fried	83 (1.0)	2.6	2.5, 2.6
Cheddar cheese	146 (1.8)	2.0	2.0, 2.0
French fries/wedges	76 (0.9)	2.0	2.0, 2.0
Hot Dog	54 (0.7)	1.9	1.8, 1.9
Bakes	28 (0.3)	1.9	1.4, 1.9
Mixed vegetables, boiled with salt	106 (1.3)	1.7	1.7, 1.7

*Frequency: number of times food item was reported, as a percentage of all food items reported.

The top five individual food items contributing to sodium intake in the Barbadian population were rice and peas (6.0%), baked chicken (5.6%), macaroni pie (4.3%), white rice (4.2%), and coconut bread (3.8%), which together contributed nearly one quarter (23.9%) of total sodium intake (Table 8). The top 27 food items each contributing >1% of total sodium intake together contribute to nearly two-thirds of total sodium intake (64.7%; Appendix: Table A5). Similar food items were in the top 10 for men and women, although there were some slight differences. For example, for men, chicken and potato roti (2.4%) ranked as the tenth food item and the contribution made to overall dietary sodium by coconut bread (5.7%) was higher than for both men and women together (Table 8). The top five most frequently reported food items were brown rice, rice and peas, tea, evaporated milk and baked/roasted/rotisserie chicken (Appendix 1: Table A7).

Some of the individual food items which appear at the top of the list for sodium content are there because the individual food item contains a high level of sodium per 100 g of the food item. For example, traditional Barbadian dishes which are sodium-dense are Bajan macaroni pie (293 mg/100 g), fried fish (469 mg/100 g) and coconut bread (752 mg/100g). Other foods which appear at the top of the list may not be sodium-dense, but are there because of their

high frequency of consumption. For example, rice and peas is not a highly sodium-dense food (190 mg/100g) but its frequency of consumption is 2.6%, second only to brown rice (3.1%) of the several thousand individual food items listed (Appendix 1: Table A5, Table A6).

Knowledge, attitudes and practices (KAP)

Key points

- Approximately three-quarters of individuals eat out at least once a week, with one in three of these purchasing food out between two and six times each week
- Over half the population reported using dry and chopped seasonings, ketchup, barbeque sauce and lime and salt in the preparation and flavouring of food
- Nearly all participants (94.7%) identified that a diet high in salt can cause serious health problems; with three in every four participants linking a high salt diet to high blood pressure
- Two in three individuals (66%) who thought they were consuming "just the right amount" of salt, were in fact consuming too much
- Less than half of respondents placed great importance on the lowering of the amount of salt consumed

Table 9: Food practices

Food practices	Frequency of consumption (%)			
	Never	At least once a month	At least once a week	At least four times a week
Sauces: ketchup, barbecue	6.4	80.2	28.2	69.6
Any type of fresh chopped or dry seasoning (homemade or store-bought), seasoned breadcrumbs, stock cubes	0.5	86.1	84.8	48.3
Lime and salt (meat/fish), salt in cooking	3.1	83.6	81.8	46.3
Consumption of bought food (take-out, vendor canteen, restaurant, fast food)	9.7	53.6	89.5	17.7
Salt fish/herring	17.6	69.0	18.6	1.1
Sauces: Hoisin, soy, Worcestershire	39.2	47.4	28.8	6.9
Salted meat/pigtail/bacon	45.1	41.5	21.4	3.1
Canned soup and soup mixes	72.1	14.1	3.9	0.5

There is a great reliance on foods prepared outside of the home. Almost three in every four (71.0%) individuals reported eating out at least once a week, with almost all (90%) of these reporting that they ate bought food at least once a week and almost one in five (18%) eating

bought food at least four times each week. Sources of purchased food included fast food outlets, food vendors, canteen, take-away or restaurants (Table 9).

Sauces, including ketchup and barbeque sauce (70%), and any type of chopped or dry seasoning (48%) were frequently reported (at least four times per week) as being used in the cooking of food. Stock cubes were included in the dry seasoning category. The practice of cleaning meat and fish with lime and salt and the addition of salt in cooking (46% at least four times per week) were very common. High salt foods such as salted fish/herring were consumed by more than half of participants (69%) at least once a month. There was no real difference noted in the reported food practices by hypertension status (data not shown).

Table 10: Willingness to change

	Willingness to change			
Salt-use habit	**n**	**N***	**%†**	**95% CI**
Use low salt/salt-free seasoning	227	306	61.0	55.3, 66.3
Reduce salt in cooking	187	281	50.1	45.0, 55.2
Reduce salty snacks	180	254	49.1	43.5, 54.8
Reduce the amount of salted meat in dishes	147	223	39.3	33.6, 45.3
Eating less foods with salted meats	147	227	39.2	34.6, 44.1
Reduce pickled foods	138	213	37.4	33.0, 42.1
Use low salt dressing/dips/condiments	119	183	32.7	27.3, 38.6
Reduce salt at the table	97	166	24.7	20.8, 29.2

*Denominator (i.e. total number of participants who responded to this question).
†Weighted proportions

Individuals were generally willing to change their salt-use habits. The use of low salt or salt-free seasoning (61%), the reduction in the amount of salt in cooking (50%) and in the consumption of salty snacks (49%) were the top three responses (Table 10).

Table 11: Perceived types of adverse health effects from a high-salt diet (n=347)

Adverse health effect	n	%*	95% CI
High blood pressure (BP)	333	95.3	91.0, 97.5
Kidney stones	56	15.6	11.8, 20.4
Stomach cancer	25	7.7	4.8, 12.1
Osteoporosis	27	7.6	4.7, 12.1
None of the above	1	0.2	0.0, 1.3
Don't know	10	3.5	1.9, 6.5

*Weighted proportions.

Almost all participants (94.7%) identified that a diet high in salt can cause serious health problems with three quarters of participants (95.3%) linking a high salt diet to raised blood pressure. A lower proportion (15.6%) of participants linked a high salt intake with kidney stones (Table 11). For all other listed conditions, the proportions were less than 10.0%.

Table 12: Self-reported frequencies of discretionary salt use and taste preference

Salt-use habit	Frequency of use		
	Never/rarely	*Sometimes*	*Often/always*
Add salt at table	62.9	30.6	6.5
Add salt in cooking	23.6	31.4	45.1
	Salt preference (weighted %)		
	None/not very	*Salty*	*Very salty*
Preference for salty taste	94.3	5.7	0.0
	Salt consumption		
	Far too much/too much	*Just right*	*Too little/far too little*
Self-reported salt consumption	20.8	68.4	10.8
	Importance of lowering own salt consumption		
	Very	*Somewhat*	*Not at all*
Self-reported importance of lowering salt in own diet	42.4	38.3	19.3

Perception of salt was explored, with most respondents (94.3%) reporting a taste preference for foods with no salt or not too salty. Only 42.4% of individuals placed great importance on the lowering of salt consumed. For self-reported salt consumption, 68.4% thought they consumed just the right amount of salt while 20.8% thought they consumed too much salt (Table 12).

Discretionary salt use

Over half (62.9%) of the respondents reported that they never or rarely added salt at the table, whilst nearly one in four (23.6%) reported that they never or rarely added salt in cooking. Almost half of the study sample reported that they often or always used salt in cooking (45.1%) and sometimes at the table (30.6%); yet 94.3% of respondents reported to prefer their foods without salt or not very salty (Table 12).

Table 13: Percentages (95% confidence intervals) with high sodium consumption by category of self-perceived salt consumption

Self-perception	Sodium ≥ 1500 mg	Sodium ≥ 2000 mg
Eating too much	90.3 (76.0,96.5)	73.0 (57.4, 84.5)
Right amount	81.3 (74.6, 86.6)	64.3 (56.7, 71.3)
Eating too little	84.1 (68.9, 92.7)	63.8 (44.7, 79.3)

Table 14: Percentages (95% confidence intervals) with high sodium consumption by frequency of eating out

Eating out	Sodium ≥ 1500 mg	Sodium ≥ 2000 mg
Up to once per week	81.5 (75.0, 86.6)	66.6 (59.3, 73.1)
More than once per week	88.2 (80.2, 93.2)	69.3 (60.5, 76.9)

Most participants who felt they were consuming the 'right amount' of salt in fact were consuming excessive amounts. Of those who thought they were eating just the right amount of salt 81.3% were consuming more than 1500 mg/d and 64.3% more than 2000 mg/d. The percentages are generally higher for those participants reporting a high frequency of eating out and higher intake of sodium (≥ 2000 mg Na/d), but these differences are not statistically significant (Tables 13 and 14).

Implications for Prevention

Over six out of 10 Barbadian adults exceed the current WHO recommendation of < 2000 mg/d of sodium, and over eight out of 10 exceed the recommended intake of < 1500 mg/d for African Americans. The higher sodium intakes in men may be the result of a higher overall food intake and differences in food habits. Two in three adults are overweight and three-quarters of women are obese. The high prevalence of abdominal obesity in women puts them at increased risk of Type 2 diabetes, hypertension and CVD.

The extremely low levels of urinary potassium and the alarming sodium to potassium ratios for all age groups and sexes, irrespective of hypertension status, is a major concern. This ratio is an important factor in the prediction of hypertension and cardiovascular events. The high sodium to potassium ratio in Barbadian adults is indicative of an eating pattern low in vegetables, fruits and legumes, which are rich sources of potassium. This is backed up by the findings from the HotN Survey,[5] which showed that most Barbadians (90%) did not consume sufficient fruit and vegetables each week. Only two fruits (banana, apples) and two forms of vegetables (vegetables cooked with salt, salad) were listed in the top 50 foods. We were able to capture the seasonality of fruits, as data collection occurred over the period of 1 year. Despite this, however, only one local fruit was reported in the top 50 foods (Appendix 1, Table A8).

Vegetables were recorded at a slightly higher frequency than fruits, but failed to make an impact great enough for Barbadians to have an adequate intakes of potassium. This suggests that serving sizes are inadequate for vegetables and Barbadians are currently not meeting the recommended target of five daily servings of fruits and vegetables. Ideally, a serving of vegetables should be a minimum of half a plate, for each of two meals each day. An effort to increase both fruit and vegetable intake would be beneficial. This study did not investigate the impact of cost on food choice. Fresh, frozen or canned vegetables in water are all nutritious options. Homegrown fruits and vegetables maybe a viable option to help reduce the expense of these food items.

A diet high in processed foods (such as bread, processed meats and condiments) and low in fresh fruits and vegetables is often high in sodium. To determine the sources of sodium, and to highlight foods for an intervention, we present the major food sources of sodium, as well as the frequency of reporting for each food item. Poultry, rice, bread, fish, and processed meats

emerge as major food category sources of sodium, contributing a combined 52% of total sodium intake.

By focusing on the foods in the "as eaten" form (such as macaroni pie), we are able to target specific foods for an intervention. Included among the top individual food items contributing to sodium intake in our population are rice and peas, baked chicken, macaroni pie, white rice and coconut bread. Per 100 g serving, coconut bread alone contains 752 mg of sodium, which is more than half of the total recommended intake per day. Dishes such as rice and peas, and macaroni pie, contain 190 mg and 293 mg of sodium, respectively, per 100 g serving.[16] No differences were found in the sources of sodium between men and women, by age group or hypertension status. The composite foods to be targeted by an intervention are therefore the same for all Barbadians.

Focusing on cooking methods, seasoning used and food practices, would be one target area for a salt intervention. For almost all the foods that are major contributors to sodium, a healthier alternative could be recommended and incorporated into the diet with minimal changes to taste and palatability. Replacement of ketchup with fresh tomatoes, the use of salt-free seasonings and increased use of fresh or dried herbs, the omission of salt in the cleaning of meat or fish and just using lime, and reduced consumption of processed meats, are a few suggestions. Potassium is easily leached into the cooking water when vegetables are boiled; this cooking water is then normally discarded and the beneficial potassium lost. Hence, cooking styles to retain potassium should be encouraged. Some recommendations could include the use of more steaming, baking or sautéing of vegetables, rather than boiling.

Barbadians need to be made more aware of hidden sources of salt, such as in condiments (ketchup, soy sauce, and Worcestershire sauce), stock cubes, cheese and chopped seasoning. In many recipes, several sources of salt were combined in addition to "pot salt" to flavor a dish, resulting in a very sodium-dense meal. For example, macaroni pie includes the ingredients cheese and milk, which naturally contain sodium. To this dish, additional seasoning would then be added, such as ketchup, stock cubes and salt. The taste for salt, however, is an acquired taste. Gradual reductions of the level of salt used in food preparation would perhaps improve the acceptability of any recommended changes.

There is a heavy reliance on purchased meals prepared outside of the home. The quality of bought foods and serving sizes are largely beyond the control of the consumer. Creating supportive environments, by encouraging vendors to reduce the amount of sodium in foods sold and purchased in cafeterias, fast food outlets and restaurants, at worksites, and public institutions, should be incorporated into the design of a salt reduction programme. Removal of salt shakers from restaurant tables and the coding of menu items so that a more informed choice can be made are measures that could be introduced. Barbadians should also be encouraged to do more home cooking as a means of controlling the quality, portion size and salt content of foods consumed. Our results highlight the fact that most sodium is added during food preparation.

Increased public awareness on the daily targets for salt should be another aim of educational programmes and public health promotion efforts. We did not assess whether consumers in this study understood the difference between salt and sodium. This lack of nutrition knowledge could lead to misinterpretation of, or inability to read nutrition labels on food packages. Mandatory nutrition labeling and simple messages should be clearly displayed on food products. Some locally produced breads currently only have a list of ingredients on the packaging. Development of an easy, highly visual system, similar to the “traffic light” system in the UK, would be ideal. Supermarkets could promote healthier options, lower in sodium, with shelf labeling to help guide consumer choice. These steps potentially would impact on dietary habits and allow the consumer to make more informed choices.

Population knowledge, attitudes and behaviors towards salt consumption are considered modifiable mediating factors that are amenable to change. Barbadians do recognize the relationship between a high salt diet and hypertension, and most individuals stated a preference for foods with no salt or which were not too salty. Our findings, however, clearly show that the levels of sodium intake in Barbados are over the recommended levels, and that conversely, potassium intakes are unacceptably low. The fact that only 42% of individuals placed great importance on the lowering of salt consumed implies a need for education to change misconceptions and beliefs around salt. In addition, the vast majority of individuals who thought they were consuming the right amount of salt were actually consuming too much.

The introduction of new and modified food products by manufacturers is a cost effective measure that will take time before the impact can be felt at the population level. A combined

strategy of consumer education, changes in the food environment, and reformulation of processed and prepared foods to achieve the lowest possible sodium content is required. A comprehensive mass media campaign to promote heart healthy, lower-sodium food choices can be designed based on results from this National Salt Study.

Conclusions

Few studies exist on sodium intake which identify and describe foods and food group sources. Our survey captured important food consumption data: the foods that people eat and frequency of consumption; salt content of the most commonly consumed foods; the use of salt added at the table and in cooking, as well as the intake of high salt foods that are culturally specific. The urinary measurements allowed for a more accurate and objective determination of both sodium and potassium intake for the population. These baseline data identify where emphasis should be placed, which targets should be set and allow for ongoing monitoring in the future. Diet is a modifiable risk factor, and a reduction in sodium could help to slow the current CVD epidemic through evidence-based policy as part of a well-designed, population-based, salt reduction programme.

References

1. WHO. Diet, nutrition and the prevention of chronic disease. Report of a Joint WHO/ FAO Expert Consultation. Geneva, World Health Organization (WHO), 2003 (http://whqlibdoc.who.int/trs/WHO_TRS_916.pdf).
2. Pan American Health Organization. Health in the Americas. Volume I. 2002 ed. Washington, DC: PAHO; 2002.
3. World Health Organization. The World Health Report 2002: Reducing risks, promoting healthy life. Available at: http://www.who.int/whr/2002/en/ Accessed September 13, 2009.
4. Hsu C, McCulloch CE, Darbinian J, Go AS, Iribarren C. Elevated blood pressure and risk of end-stage renal disease in subjects without baseline kidney disease. Arch Intern Med. 2005; 165:923-28.
5. Unwin N, Rose AMC, George KS, Hambleton IR, Howitt C. The Barbados Health of the Nation Survey: Core Findings. Chronic Disease Research Centre, The University of the West Indies and the Barbados Ministry of Health: St Michael, Barbados, January 2015; 53 pp.
6. He FJ, MacGregor GA. Salt reduction lowers cardiovascular risk: meta-analysis of outcome trials. The Lancet. 2011:378-380-2.
7. Institute of Medicine of the National Academies. Report brief – Sodium intake in populations. Assessment of evidence. May 2013.
8. CARICOM Heads of Government. Declaration of Port-of-Spain: Uniting to Stop the Epidemic of Chronic Non-communicable Diseases [Internet]. CARICOM Secretariat; 2007. Available from: http://www.caricom.org/jsp/pressreleases/pres212_07.jsp
9. Barbados Strategic Plan for the Prevention and Control of Non-Communicable Diseases 2015-2019. National NCD Commission Barbados. December 2014
10. Pan American Health Organisation. Draft Policy Statement – Reducing dietary salt in the Americas as a population-based approach to cardiovascular disease prevention. 2009.
11. Pan American Health Organization. Salt-Smart Americas: A Guide for Country-Level Action. Washington, DC: PAHO, 2013
12. Pan American Health Organization. Protocol for population level sodium determination in 24-hour urine samples. 2010.
13. Liu et al. Assessment of the association between habitual sodium intake and high blood pressure: methodological problems. Am J Epidemiol 1979, 110:219-226.
14. Bingham SA, Cummings JH. The use of creatinine output as a check on the completeness of 24-hour urine collections. Hum Nutr Clin Nutr. 1985 Sep;39(5):343-53.
15. Raper N, Perloff B, Ingwersen L, Steinfeldt L, Anand J. An overview of USDA's dietary intake data system. *J Food Compos Anal* 2004;**17**:545–55.
16. Sharma S, Harris R, Xia C, Hennis AJM, Leske C, Suh-Yuh W and the Barbados National Cancer Study Group. Nutritional composition of the commonly consumed composite dishes for the Barbados National Cancer Study. Int J of Food Sci and Nutrition, Sept 2007; 58(6): 461-474.

Appendix 1: Additional tables

Table A1: Clinical characteristics of participants in the National Salt Study

	Women	Men	Total
BMI (Kg/m^2)	30.3 (29.0,31.6)	27.1 (26.0,28.2)	28.7 (27.9,29.6)
WC (cm)	94.7 (91.9,97.4)	92.4 (89.7,95.1)	93.6 (91.9, 95.2)
Systolic BP (mmHg)	124.4(121.6,127.2)	130.5 (127.4,133.7)	127.3 (125.3,129.4)
Diastolic BP (mmHg)	78.1 (76.1, 80.0)	79.5 (77.1, 81.8)	78.7 (77.3, 80.2)
Fasting glucose (mmol/l)	5.5 (5.2, 5.8)	5.4 (5.2, 5.6)	5.4 (5.3, 5.6)
Total/HDL cholesterol ratio	5.4 (5.0, 5.8)	6.5 (5.9, 7.0)	5.9 (5.5, 6.2)

Table A2: Prevalence of overweight, obesity (based on body mass index and waist circumference)

	Women	Men	Total
Overweight*	73.9 (64.1, 81.8)	57.9 (47.2, 67.9)	66.0 (58.4, 72.9)
Obese	46.4 (38.4, 54.6)	25.3 (19.0, 32.8)	36.0 (30.8, 41.5)
Abdominal obesity	49.7 (41.4, 58.1)	21.7 (15.6, 29.5)	36.1 (30.6, 42.1)
Reported hypertension	25.8 (17.8, 36.0)	14.4 (9.6, 21.0)	20.4 (15.5, 26.3)
Total hypertension	35.5 (27.5, 44.4)	32.7 (23.2, 43.8)	34.1 (27.7, 41.2)
Reported diabetes	9.9 (5.7, 16.5)	9.0 (5.0, 15.6)	9.4 (6.6, 13.3)
All diabetes	15.1 (9.8, 22.5)	10.9 (6.1, 18.7)	13.1 (9.6, 17.6)
Total/HDL chol > 5	46.4 (39.2, 53.8)	62.2 (52.7, 70.9)	53.9 (48.3, 59.4)

*Overweight = body mass index (BMI) ≥ 25 kg/m^2; obese = BMI ≥ 30 kg/m^2; abdominal obesity in women = waist circumference (WC) ≥ 80 cm, in men = WC ≥ 94 cm.

Table A3: Proportion of participants with sodium or potassium levels outside recommended limits, restricted to those with at least 500 mg creatinine in their urine (n=317)

	Sodium ≥ 1500mg	Sodium ≥ 2000mg	Potassium < 4700mg	Sodium/potassium ≥1.0
Women				
25-44 yrs	83.5 (72.7, 90.6)	65.6 (52.2, 76.9)	100	92.2 (84.4, 96.2)
45-64 yrs	86.0 (75.2, 92.5)	66.9 (55.0, 76.9)	100	77.3 (63.4, 87.0)
Total	84.6 (77.4, 89.8)	66.2 (56.3, 74.8)	100	85.4 (78.4, 90.4)
Men				
25-44 yrs	91.5 (80.2, 96.6)	71.4 (61.0, 79.9)	100	91.2 (78.2, 96.8)
45-64 yrs	89.0 (78.8, 94.6)	81.4 (68.2, 89.9)	100	84.6 (75.4, 90.8)
Total	90.3 (84.0, 94.3)	76.0 (67.6, 82.7)	100	88.2 (82.3, 92.4)
Men and women				
25-44 yrs	87.5 (81.4, 91.8)	68.5 (60.4, 75.6)	100	91.7 (84.3, 95.8)
45-64 yrs	87.5 (80.1, 92.4)	74.2 (65.1, 81.6)	100	81.0 (72.7, 87.3)
Total	87.5 (83.2, 90.9)	71.1 (65.0, 76.5)	100	86.8 (82.6, 90.1)

Table A4: Proportion of participants with sodium or potassium levels outside recommended limits, restricted to those within WHO (1985) proposed ranges of creatinine per kg body weight (n=235)

	Sodium ≥ 1500mg	Sodium ≥ 2000mg	Potassium < 4700mg	Sodium/potassium ≥ 1.0
Women				
25-44 yrs	87.3 (74.7, 94.1)	71.4 (53.8, 84.2)	100	93.3 (84.7, 97.3)
45-64 yrs	85.0 (72.0, 92.6)	69.9 (57.4, 80.0)	100	73.6 (59.0, 84.3)
Total	86.2 (76.9, 92.1)	70.6 (59.7, 79.6)	100	83.4 (73.6, 90.1)
Men				
25-44 yrs	93.3 (78.5, 98.1)	76.1 (63.8, 85.2)	100	89.6 (74.9, 96.1)
45-64 yrs	94.5 (82.8, 98.4)	86.9 (73.0, 94.2)	100	89.5 (78.7, 95.2)
Total	93.8 (85.8, 97.4)	80.6 (71.8, 87.2)	100	89.6 (82.0, 94.2)
Men and women				
25-44 yrs	90.7 (83.5, 95.0)	74.1 (64.1, 82.0)	100	91.2 (81.3, 96.1)
45-64 yrs	89.7 (81.5, 94.5)	78.3 (69.3, 85.1)	100	81.4 (72.3, 88.0)
Total	90.2 (85.6, 93.5)	76.0 (69.7, 81.3)	100	86.7 (81.3, 90.7)

Table A5: Individual food items each contributing to > 1% of sodium intake

Food item	Frequency (%)	% Sodium	95% CI
Rice and peas	217 (2.6)	6.0	6.0, 6.1
Chicken – baked	180 (2.2)	5.6	5.6, 5.6
Macaroni Pie – Bajan	73 (0.9)	4.3	4.2, 4.3
Rice – white	98 (1.2)	4.2	4.2, 4.2
Coconut bread	77 (0.9)	3.8	3.8, 3.8
Bread – white	153 (1.8)	3.7	3.7, 3.8
Bread – whole wheat	172 (2.1)	3.7	3.6, 3.7
Chicken – fried	118 (1.4)	3.3	3.3, 3.3
Crackers – white	146 (1.8)	3.1	3.1, 3.1
Fish–fried	83 (1.0)	2.6	2.6, 2.6
Cheddar cheese	146 (1.8)	2.0	2.0, 2.0
French fries/wedges	76 (0.9)	2.0	2.0, 2.0
Hot Dog	54 (0.7)	1.9	1.8, 1.9
Bakes	28 (0.3)	1.9	1.8, 1.9
Mixed vegetables, boiled with salt	106 (1.3)	1.7	1.7, 1.7
Roti – chicken and potato	32 (0.4)	1.7	1.7, 1.7
English potato, boiled/mashed	69 (0.8)	1.6	1.6, 1.6
Bread –bran	66 (0.8)	1.6	1.6, 1.6
Chicken soup	23 (0.3)	1.3	1.3, 1.3
Vegetable rice	37 (0.4)	1.3	1.3, 1.3
Ham	36 (0.4)	1.2	1.2, 1.2
Pilau rice	19 (0.2)	1.1	1.1, 1.1
Beef stew	53 (0.6)	1.1	1.1, 1.1
Luncheon meat	27 (0.3)	1.1	1.1, 1.1
Pizza	19 (0.2)	1.1	1.0, 1.1
Fish – steamed	19 (0.2)	1.0	1.0, 1.1
Cucumber – pickled	18 (0.2)	1.0	1.0, 1.0

Table A6: Sodium content (per 100g) of the composite dishes, included in the top 27 foods contributing towards sodium in Barbados

Food items	Sodium (mg)
Rice and peas	190
Macaroni Pie - Bajan	293
Coconut bread	752
Flying fish-fried	469
Bakes	723
Roti – chicken and potato	287
Chicken soup	196
Vegetable rice	251
Pilau rice	268
Fish – steamed	717

Table A7: Sodium content of breads found in the Nutribase database used in dietary analyses (for American breads)

Bread Type	Weight of 1 slice (g)	Sodium level (mg)
White (commercial)	25	127.75
White – toasted (commercial)	22	130.24
Average for white bread	24	129.00
Oat Bran	30	122.00
Whole wheat (commercial)	28	132.16
Multigrain	32	135.00
Average for whole wheat bread	30	129.72

Table A8: Frequency of the top 50 reported food items

Food item	Frequency (%)
Brown rice	256 (3.1)
Rice and peas	217 (2.6)
Tea, black	207 (2.5)
Evaporated milk	203 (2.4)
Chicken-baked/roasted/rotisserie	180 (2.2)
Whole wheat bread	172 (2.1)
White bread	15.3 (1.8)
Cheddar cheese	146 (1.8)
Crackers	146 (1.8)
Juice drinks (made from sugar-flavoured crystals)	125 (1.5)
Egg	123 (1.5)
Fried chicken	118(1.42)
Mixed vegetables, boiled with salt	106 (1.3)
Banana	98 (1.2)
White rice	98 (1.2)
Coca Cola	92 (1.1)
Salad	90 (1.1)
Stewed/curried chicken	86 (1.0)
Fried fish	83 (1.0)
Mauby	78 (0.9)
Coconut bread	77 (0.9)
Herbal tea	77 (0.9)
French fries/wedges	76 (0.9)
Sprite	76 (0.9)
Condensed milk	75 (0.9)
Baked fish	73 (0.9)
Macaroni pie-Bajan	73 (0.9)
Coffee	72 (0.9)
Sweet potato	71 (0.9)
English potato, boiled/mashed	69 (0.8)
Chocolate drink	66 (0.8)
Macaroni/spaghetti	66 (0.8)
Bran bread	66 (0.8)
Apple	62 (0.7)
Beer	60 (0.7)
Margarine	57 (0.7)
Hotdog	54 (0.7)
Porridge	54 (0.7)
Green tea	54 (0.7)
Beef stew	53 (0.6)
Fruit juice-sweetened	53 (0.6)
Cake – plain/pudding	52 (0.6)
Chocolate bar	52 (0.6)
Mints	52 (0.6)

Table A9: Top 10 food category sources of potassium in the diet for men and women

Food group	Frequency (%)	% Potassium	95% CI
Ground provisions	328 (3.9)	21.0	21.0, 21.1
Poultry	456 (5.5)	11.1	11.0, 11.1
Fruit	454 (5.5)	9.5	9.4, 9.5
Fish	339 (4.1)	6.8	6.8, 6.9
Vegetables	588 (7.1)	6.0	5.9, 6.0
Red meat	231 (2.8)	5.6	5.6, 5.6
SSB	667 (8.0)	5.1	5.1, 5.2
Rice	385 (4.6)	4.9	4.8, 4.9
Dairy	549 (6.6)	4.8	4.7, 4.8
Bread	468 (5.6)	4.2	4.2, 4.3

Table A9 presents the 10 major food category sources of potassium. No real difference was observed between sexes or age groups. These food categories combined contribute approximately 79% of total potassium in the Barbadian diet. The top three food categories that contribute most to potassium consumption in the population are ground provisions (21%), poultry (11%) and fruit (9%), which combined provided 41% of total potassium intake.

Table A10: The top 10 individual food items contributing to potassium intake in the population

Food item	Frequency (%)	% Potassium	95% CI
Breadfruit	32	4.5	4.5, 4.6
Banana	98	4.0	4.0, 4.1
French fries/wedges	76	3.7	3.7, 3.8
Rice and peas	217	3.0	3.0, 3.0
English potato–boiled	69	2.5	2.5, 2.5
Juice drink mixes	53	2.5	2.5, 2.5
Roti – chicken and potato	32	2.3	2.3, 2.3
Bread – whole wheat	172	2.1	2.1, 2.1
Plantain	48	2.0	2.0, 2.1
Yam	22	1.9	1.9, 2.0

French fries (6.1%) are the top contributors to potassium intake in the young, whilst for the older age group breadfruit (5.7%) remains as the primary source of potassium.