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Assessing dietary patterns in Barbados highlights the need for nutritional intervention to reduce risk of chronic disease

S. Sharma[*], **X. Cao**[*], **R. Harris**[†], **A. J. M. Hennis**[†,‡], **S.-Y. Wu**[‡], and **M. C. Leske [on behalf of for the Barbados National Cancer Study Group]**[‡,1]

[*]*Cancer Etiology Program, Cancer Research Center of Hawaii, University of Hawaii, Honolulu, HI, USA*

[†]*Barbados National Cancer Study, Sir Winston Scott Polyclinic, St Michael, Barbados*

[‡]*Department of Preventive Medicine, Stony Brook University, Stony Brook, NY, USA*

Abstract

Background—The dietary habits of the Caribbean have been changing to include more fast foods and a less nutrient dense diet. The aims of this study are to examine dietary patterns in Barbados and highlight foods for a nutritional intervention.

Methods—Four-day food diaries collected from control participants in the population-based, case-control Barbados National Cancer Study (BNCS).

Results—Forty-nine adult participants (91% response) completed the diaries providing 191 days of dietary data. Total energy intake was almost identical to data collected 5-years earlier in the Barbados Food Consumption and Anthropometric Survey 2000, but the percent energy derived from fat was from 2.1% to 5.2% higher. Sugar intake exceeded the Caribbean recommendation almost four-fold, while intakes of calcium, iron (women only), zinc and dietary fibre were below recommendations. Fish and chicken dishes were the two largest sources of energy and fat. Sweetened drinks and juices provided over 40% of total sugar intake.

Conclusions—These data provide existing dietary patterns and strongly justify a nutritional intervention program to reduce dietary risk factors for chronic disease. The intervention could focus on the specific foods highlighted, both regarding frequency and amount of consumption. Effectiveness can be evaluated pre- and post-intervention using our Food Frequency Questionnaire developed for BNCS.

Keywords

African Barbadians; dietary assessment; dietary pattern; food diary; the Barbados National Cancer Study

Correspondence, Sangita Sharma, Cancer Etiology Program, Cancer Research Center of Hawaii, University of Hawaii, Honolulu, HI, USA. Tel.: 808 564 5845, Fax: 808 586 2982, E-mail: gsharma@crch.hawaii.edu.

[1]See Appendix for the Study Group Participants.

Conflict of interests, source of funding and authorship

The authors declare they have no conflicts of interest.

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Introduction

Rates of chronic noncommunicable disease such as diabetes, hypertension, cardiovascular disease and cancer have been increasing in the Caribbean (Ragoobirsingh*et al.*, 1995, 2002; Wilks*et al.*, 1998, 1999; Figueroa*et al.*, 1999; Rotimi*et al.*, 1999; Cruickshank*et al.*, 2001, Figueroa, 2001; Sargeant*et al.*, 2001; Hennis*et al.*, 2002a,b; Corbin*et al.*, 2004; Wolfe*et al.*, 2006). Approximately 10% and 20% of the population over 20 years of age suffers from diabetes and hypertension, respectively, with prevalences more than doubling at older ages (Hennis*et al.*, 2002a,b). The most striking epidemic among the Caribbean population is the high prevalence of overweight [body mass index (BMI) >25 kg m^{-2}] and obesity (BMI >30 kg m^{-2}). Approximately half of the adult Caribbean population is overweight and 25% of adult Caribbean women are obese (Henry, 2004).

The dietary habits of the Caribbean have also been changing to include more fast foods and a less nutrient dense diet (CFNI, PAHO and WHO, 2004).The shifts in disease patterns could be explained at least in part by these dietary modifications. To study associations between diet and chronic disease, methods for assessing long-term dietary intake must be developed. These methods allow information on usual dietary intake and major contributors to overall diet to be obtained, as well as data about specific nutrients of interest such as fat and sugar; such data are needed to develop nutritional intervention programs aimed at reducing risk of these chronic diseases.

The Barbados National Cancer Study (BNCS) is a population-based case-control study examining risk factors for breast and prostate cancer in an African-origin population. Both cancers are particularly important causes of morbidity and mortality in persons of African descent (IARC, 2001; Ries*et al.*, 2005). Barbados has a population of approximately 270 000 persons, 94% being of African-origin and sharing a common heredity with African-Americans. According to the United Nations Human Development Index, this country is the leading developing nation (Country fact sheets Human Development Report [Internet] 2007/2008), and its socioeconomic development and infrastructure provides an ideal environment to understand cancer risk in African-origin populations. However, potential cancer risk factors including diet, have not been examined in African Barbadians. Prior to the BNCS, there has never been a method to assess long-term dietary intake in Barbados, thus precluding association studies between diet and cancer, or indeed any other chronic disease.

We recently developed a Quantitative Food Frequency Questionnaire (QFFQ) specifically to assess food and nutrient intake in African Barbadians for the BNCS (Sharma*et al.*, 2007a). The overall aims of the current paper are to describe the diets of African Barbadians, and to highlight the new dietary data being collected in the BNCS, including the nutritional composition of the most commonly consumed foods (mostly composite dishes), which was previously unavailable. The current paper describes the diets of a subsample of the BNCS control participants who provided a total of almost 200 days of dietary data from food diaries. We present the nutrient intake and a list of the most commonly consumed foods, and compare our results with the Caribbean Recommended Dietary allowances (RDA) (CFNI, 1994). In addition, we present the major sources of energy, carbohydrate, fat, sugar and dietary fibre, as such data are necessary to guide nutritional intervention programs aimed at reducing risk of chronic disease in this population.

Materials and methods

Sampling

The dietary data were collected on a sample of individuals randomly selected from a computerized nationwide database of Barbados citizens 21 years and older, updated for 2004–

05. This sampling methodology was used to select BNCS population-based controls, as well as participants in previous epidemiologic studies (Sharma*et al.*, 2007a). BNCS controls were selected from the national database and frequency-matched to the incident cases of prostate and breast cancer in Barbados by 5-year age groups. Fifty consecutive individuals who were part of the BNCS control group completed the QFFQ between August and September 2004. Between January and February 2005, 47 of the original 50 participants were invited to take part in a second interview, both to complete the same QFFQ for the second time, and to complete a 4-day food diary at home. Three persons were not re-contacted because of difficulties during their first interviews.

Two of the 47 participants declined to complete the second interview due to ill health, and another two persons could not be located. We therefore invited seven randomly selected BNCS controls to participate. These seven individuals completed the QFFQ for the first time, and then approximately 1 month later they completed the same QFFQ for a second time and the 4-day food diary. This report therefore included a total of 54 (47 + 7) individuals who were invited to participate in both first and second interview.

In this report, we present only the 4-day food diary data. The repeat QFFQs and the food diaries were collected as part of the validation study, which is currently underway.

Data collection

Food diary collection—A trained dietitian visited the homes of all participants who agreed to complete the 4-day food diary. Appointments were scheduled either over the phone or by direct face-to-face contact. The dietitian reviewed the methods for completing the diary and showed the participant an example of a completed diary. Each participant was asked to record all foods and drink items consumed (at the time of consumption), and to estimate portion sizes using familiar household measuring units such as a pot spoon (e.g. for rice), a slice of bread, or by retaining the packets of items such as crisps and candies. The dates for completion of the diary were given as the four consecutive days after the diary was given. The dietitian called or visited the respondent each day during the period that the diary was to be completed, to answer any questions and to encourage the complete recording of all information.

The day after each diary had been completed, the dietitian went to the home of the respondents and clarified all foods and drinks recorded, particularly with regard to brand names, amounts consumed and the times of consumption. The dietitian also sought information for missing data and frequently missed items, such as whether the skin on the chicken had been consumed and the type of milk added to tea or coffee.

The dietitian also administered an additional list of questions to obtain information about easily forgotten foods such as sweets, alcohol and snacks. In addition, she determined whether any special practices were being followed such as a weight loss diet, or a low fat diet.

Recipe collection—There were no locally available food composition data for many food and drink items reported in the food diaries. To calculate the nutritional composition of these dishes, a substudy was conducted by weighing all ingredients and the final cooked dish. These methods have been explained elsewhere (Sharma*et al.*, 2007a). For most of the composite dishes, five different recipes were collected.

A total of 152 weighed recipes were collected for 32 dishes and the average nutritional composition was calculated and is available, if requested, for the following dishes: frizzled salt fish, steamed fish, fishcakes, fish soup, fried flying fish, minced meat, sautéed corned beef, chicken soup, chicken potato roti, stewed liver, fried giblets, lamb soup,lamb stew, pork stew, pilau rice, rice and peas, vegetables and rice, dumpling, chopped seasoning, coconut bread,

bakes, macaroni pie, souse, cou-cou, gravy, conkies, creamed yam, steamed pudding, roti skin, pumpkin fritters, mauby drink, ginger beer and lemonade.

The study was approved by the University of Hawaii Committee on Human Studies, the University of the West Indies Research Ethics Review Committee and the Stony Brook University Committee on Research Involving Human Subjects. All participants signed informed consent forms before their interviews took place.

Analyses

Nutrient intakes of respondents were estimated from the 4-day food diary. All food diary data were coded and entered by a graduate nutrition student (XC) and analysed using Nutribase Clinical Nutrition Manager v. 5.18 (CyberSoft Inc., 2004). Nutribase Clinical has a research quality nutrient database analysing 121 nutrients and calories for a variety of food items by using the USDA National Nutrient Database for Standard Release as the foundation.

The nutritional composition of each weighed recipe collected was calculated per 100 grams by entering the weight of the ingredients and the final cooked weight into Nutribase Clinical (CyberSoft Inc., 2004). The average nutritional composition of each dish was calculated per 100 grams from all samples of each composite dish as previously described (Sharma*et al.*, 2007b). The food composition tables in Nutribase Clinical were updated to include the weighed recipes.

To determine the major foods contributing to the intake of energy, fat, sugar and fibre, and to highlight the foods for intervention, we combined the percentage contribution for similar foods such as fruit juices and similar crisps. All other data analyses were undertaken using SAS version 9.1 (SAS Institute Inc., 2005).

Results

Of the fifty-four persons invited to participate, two were subsequently not located. Fifty-two persons were therefore asked to complete a 4-day food diary; two refused (due to ill health), and one person did not complete the diary (response rate 91%).

Of the 49 who participated, 44 respondents completed food diaries for at least 4 days (42 completed the 4-day diary, one completed 7 days and one completed 5 days), two respondents completed 3 days, two respondents completed 2 days and one respondent completed just 1 day. A total of 191 days of food diary data were provided from 26 women and 23 men with mean (±SE) age of 54 (±2.5) years and 67 (±2.0) years respectively. One respondent who completed the 4-day food diary had 1 day where the energy exceeded 5000 kcal; these data were excluded as a result of being considered outlier information. All data were examined for completeness by the project coordinator. Diaries covered both week days and weekend days (59/190 days = 31% weekend days) during January and February 2005.

All the dietary analyses were performed on the basis of the data from the remaining 190 food records.

Table 1 presents mean and median daily energy and nutrient intake of our sampled African Barbadians, as derived from food diaries. For comparison, the table presents the RDA for the Caribbean countries (CFNI, 1994) and the data from the Barbados Food Consumption and Anthropometric Survey 2000 (BFCAS) undertaken in 1051 households in the year 2000, which used one-time 24-h dietary recall to obtain daily dietary intake (FAO & NNCMH, 2005). The median daily energy intake of African Barbadians in our sample was very similar to the median energy intake in the BFCAS [(47–84 kcal) difference: BNCS men median intake of 1979 kcal

and BFCAS men 2026 kcal; median intake of 1782 kcal for BNCS women and 1698 kcal for BFCAS women]. The median percentages of energy intake from fat of our sampled Barbadians were higher in both men (27.0% versus 22.2%) and women (28.4% versus 26.3%) compared to the BFCAS. In both studies the men had a lower median percentage energy provided by fat than the women. As noted in the table, many more nutrients are available from our sample than from the BFCAS. These nutrient intakes have been previously unknown for Barbadians.

Our sampled Barbadians had a higher mean daily percentage of energy from fat intake than recommended (CFNI, 1994) (BNCS women: 28%; recommendation: 15–20%; BNCS men: 26%; recommendation: 15–20%) (Table 1). The mean daily intake of sugar in Barbadian men and women in our sample was much higher than the Caribbean RDA (BNCS women 108 g versus 'less than 24 g' as the recommended; BNCS men 102 g versus 'less than 25.5 g' as the recommended). In contrast, dietary fibre intake was lower compared to the Caribbean RDA (20.5 g in BNCS women versus the recommendation of 30 g; 25.2 g in BNCS men versus the recommendation of 30 g). The mean daily intake of iron (12.1 mg) was lower than that recommended (15 mg) in BNCS women although higher than that recommended in BNCS men (17.2 mg versus 10 mg). The recommendation for calcium intake is 700 mg for Barbadian men and women; however, our sample reported a much lower mean daily intake of calcium (660 mg in men and 595 mg in women). Zinc intakes were also much lower in both Barbadian men and women compared to the recommendations.

Table 2 presents the ten major sources of energy, fat, sugar and dietary fibre from the 4-day food records. The greatest sources of energy are fish, chicken and rice dishes, which provided almost one-quarter of total energy intake. Fish and chicken dishes were also the largest source of fat, providing over 26% of total fat intake. Sweetened drinks and juices (including homemade drinks, chocolate drinks and honey/sugar/syrup) provided over 40% of total sugar intake. Foods high in fibre such as bread and cereal dishes (including rice-based dishes) contributed a total of almost 33% to dietary fibre intake. A more detailed description of each dish and exactly which foods are included in fish, chicken and rice dishes is available elsewhere (Sharma*et al.*, 2007b).

Table 3 presents the 20 most commonly consumed food and drink items recorded in the food diaries. The most frequently reported items were sugar, whole wheat and multigrain breads, rice dishes and bananas (reported between 66–104 times). Within the 20 most commonly reported food items, seven (35%) were fruits or vegetables.

Discussion

We have provided nutrient intakes for a sample of control participants within the BNCS and have compared our nutrient results to those provided by the BFCAS and the Caribbean RDAs. Although there are differences in methodology between the BNCS (food diary) and the BFCAS (recall), very similar median daily energy intakes were reported in both studies. However, the composition of the energy sources in each study, one undertaken in 2000 (BFCAS) and the other (BNCS) 5 years later, is consistent with a rapidly worsening diet. For example, in 2005, the BNCS showed a 2.1–5.2 higher percentage of energy provided by fat in men and women than the BFCAS. The intakes of dietary fibre, iron and zinc appeared to be lower than Caribbean RDAs in our sampled Barbadians.

Furthermore, the overall energy intake of BNCS men and women was somewhat lower than recommended (mean daily energy intake for men 2127 kcal and 1832 kcal for women) and this could be related to the special dietary practices followed during the days of data collection. Thus, we have previously shown that 28% of participants had reported eating less than usual on the day of the recall and 61% reported being on a special diet, such as low fat, low sugar,

diabetic and higher fibre diets (Sharma*et al.*, 2007a). Hence, the intake of energy, fat and sugar would have been even higher if these individuals had been excluded from our sample.

To determine the sources of energy and key nutrients, and to highlight foods for an intervention, we presented the major food sources of energy, fat, sugar and fibre intake, as well as the most frequently reported food and drink items, as have previous similar studies (Sharma*et al.*, 2007a; Sharma*et al.*, 2007c, 2008). Fish dishes, chicken dishes, whole wheat/multigrain bread, white bread/bun, porridges and rice dishes were the major sources of energy, fat and fibre intake. Sugary food items such as sweetened juices/drinks were frequently consumed in African Barbadians and hence major contributors to energy and sugar intake.

As with many Caribbean countries, there is currently a rise in diet-related chronic disease in Barbados; the high prevalence of these conditions suggests the need for nutritional interventions, if these increasing rates are to be halted. Effective nutritional intervention programs must be based on foods that either contribute significantly to overall dietary intake or to the nutrients of greatest concern, such as fat and sugar. In addition, foods that are, or are not commonly consumed by the majority of the population need to be considered. For example, sweetened juices and drinks were consumed frequently in Barbados, but these could easily be replaced by unsweetened juices, sugar free, or diet drinks, which currently did not appear in the list of frequently consumed foods.

Our study was undertaken to focus on the foods in the ‘as eaten’ form (such as chicken soup) and we are therefore able to target specific foods for intervention. However, this was not the case for the BFCAS, where foods contributing to energy and nutrients were provided as the ingredients (such as fresh meat, cooking oil, potatoes). For example, our five major contributors to fat were fish and chicken dishes, nuts, hard cheese and full fat evaporated milk. The major five contributors in the BFCAS were fresh meat, cooking oil, canned fish, cheddar cheese and margarine. Dietary data that are provided in the ‘as eaten’ form allow for very specific targeting of key foods and this is the first time such data are available for Barbadians.

Foods were identified for intervention based on existing dietary patterns and locally acceptable foods. Replacing the most common sources of fat and total energy with lower fat or lower sugar alternatives will help focus an intervention on foods that would likely have the greatest impact on diet. Intervention programs may not only target specific food items, but could focus on cooking methods that would reduce fat intake by decreasing intake of fried foods, and recommending stewing, steaming or grilling, and decreasing the addition of fats to foods during cooking.

For almost all the foods that are major contributors to energy, fat and sugar, a healthy alternative could be recommended and incorporated into the diet with a small effort and little change to taste. For example, for fish dishes, steaming could be recommended rather than frying; for the chicken dishes, the prefrying stage could be eliminated and the chicken skin removed; rice dishes could be prepared with less oil and more beans, or vegetables could be added; white bread could be replaced by whole meal or multigrain breads; for porridges and cereals, less sugar or a sugar free sweetener could be used, along with a low sugar, high fibre cereal; roasted rather than fried nuts, maybe a better snack food; an effort to increase fruit and vegetable intake may also be beneficial.

We have already developed the QFFQ for the BNCS and this instrument could be further modified to list, not only the original foods already included, but also the healthier alternatives, so we will be able to track changes in consumption pre- and post-intervention, enabling an evaluation of effectiveness of the intervention.

One of the strengths of this study is its population-based sampling frame, with high participation. An important limitation is its small sample size and results must be interpreted accordingly. Nonetheless, the primary purpose of the food diaries was to help us identify foods that contribute significantly to the diet, so we may develop a culturally appropriate nutritional intervention program to reduce risk of chronic disease. Such data were not previously available for implementing dietary intervention studies in Barbados. We believe that such purpose was achieved. While the small sample size limited a meaningful evaluation of the impact on food consumption of factors such as socio-economic status, including education and occupation, as well as of dietary patterns by age, future investigations of these issues will be conducted on the overall BNCS participants. Likewise, the representativeness of the small subsample included in this report may have been limited. However, the subsample and the overall BNCS controls had a similar age distribution, with mean ages being 60 and 61 years respectively.

The food diaries have determined nutrient intake and food sources of energy and macronutrients in the diets of a population-based sample of Barbadians, and provided strong justification for a nutritional intervention program to reduce dietary risk factors for chronic disease in this population undergoing a rapid transition in diet. The intervention could focus on specific foods, both in terms of frequency of consumption and the amount consumed. The BNCS QFFQ is a new assessment tool that could be used at baseline and then at follow-up to assess the impact of the nutritional intervention on the overall diet of Barbadians and similar populations.

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Appendix

Coordinating Center, Department of Preventive Medicine, Stony Brook University. Stony Brook, NY: M. Cristina Leske, Barbara Nemesure, Suh-Yuh Wu. Clinical Center, Ministry of Health, Barbados, and University of the West Indies, Bridgetown, Barbados: Anselm Hennis, Rachel Harris, Lynda Williams, Lyndon Waterman. NHGRI Center, National Human Genome

Research Institute, Bethesda, MD: Joan Bailey-Wilson. Gene Discovery Center, Translational Genomics Institute, Phoenix Arizona: John Carp-ten, Jeffrey Trent. Cancer Etiology Program, Cancer Research Center of Hawaii, University of Hawaii, Honolulu, Hawaii: Sangita Sharma, Xia Cao.

Table 1

Mean and median daily energy and nutrient intake of Barbadians obtained from 4-day food diary from the Barbados National Cancer Study (BNCS) compared with the Barbados Food Consumption and Anthropometric Survey 2000 (BFCAS)[*] and the Recommended Dietary Allowance (RDA) for the Caribbean[†]

	Women				Men			
		Mean ± SE[‡]	Median	Median		Mean ± SE[‡]	Median	Median
	RDA[†]	BNCS	BNCS	BFCAS[a]	RDA[†]	BNCS	BNCS	BFCAS[*]
Number (*n*)	—	26	26	199	—	23	23	149
Age (years)	30–60	54 ± 2.5	52	50–64	>60	67 ± 2.0	67	>64
Energy (kcal)	—	1832 ± 64	1782	1698	—	2127 ± 82	1979	2026
Protein (g)	45	70 ± 3	68	69.5	53	92 ± 4	85	84.8
Carbohydrate (g)	—	258 ± 11	247	245	—	297 ± 13	283	270
Fat (g)	—	59.4 ± 3.3	51.7	49.7	—	64 ± 4	55.5	51.0
Saturated fat (g)	<24	15.7 ± 1.3	13.0	—	<25.5	16.3 ± 1.1	13.9	—
Monounsaturated fatty acid (g)	—	15.4 ± 1.3	14.1	—	—	16.9 ± 1.2	14.1	—
Polyunsaturated fatty acid (g)	—	7.9 ± 0.5	6.6	—	—	9.7 ± 0.7	7.5	—
Omega-3 fatty acid (g)	—	0.6 ± 0.1	0.3	—	—	0.8 ± 0.1	0.5	—
Omega-6 fatty acid (g)	—	3.7 ± 0.3	3.0	—	—	4.9 ± 0.4	3.6	—
Cholesterol (mg)	<300	221 ± 17	182	—	<300	271 ± 21	233	—
Sugar (g)	<24	108 ± 7	97	—	<25.5	102 ± 7	83	—
Dietary fibre (g)	30	20.5 ± 1.3	17.2	—	30	25.2 ± 1.5	22.7	—
Vitamin C (mg)	60	117 ± 10	83	62.1	60	143 ± 11	117	74.8
Vitamin A (μg-RE[¶])	560	1631 ± 199	982	760	650	1571 ± 166	898	963
Vitamin B6 (mg)	0.8	1.5 ± 0.1	1.4	—	0.7	2.1 ± 0.1	2.0	—
Vitamin B12 (μg)	1.5	54 ± 4	48	—	1.5	76 ± 6	63	—
Total folate (μg)	200	167 ± 13	138	189	200	222 ± 18	198	208
Calcium (mg)	700	595 ± 34	550	427	700	660 ± 39	538	507
Iron (mg)	15	12.1 ± 0.6	11.2	11.9	10	17.2 ± 0.9	15.9	14.5
Zinc (mg)	12	5.9 ± 0.4	4.9	5.4	15	7.6 ± 0.4	6.4	7.2
% energy from total fat	15–20	28.1 ± 1.0	28.4	26.3[§]	15–20	25.9 ± 0.9	27.0	22.2[§]
% energy from protein	—	15.5 ± 0.4	14.9	16.4[§]	—	17.4 ± 0.5	16.4	17.1[§]

	Women				Men			
		Mean ± SE‡	Median	Median		Mean ± SE‡	Median	Median
	RDA†	BNCS	BNCS	BFCAS[a]	RDA†	BNCS	BNCS	BFCAS*
% energy from carbohydrate	55–60	55.3 ± 1.2	55.1	57.7§	55–60	55.0 ± 1.1	55.1	55.3§
% energy from alcohol	—	1.0 ± 0.3	0	—	—	1.7 ± 0.5	0	—

*Only median available in this study (FAO & NNCMH, 2005).

†Recommended dietary allowance for the Caribbean (CFNI, 1994).

‡Standard error.

§Comparable data not available, therefore calculated by authors.

¶Retinol equivalent.

Table 2

Ten major food sources of energy and macronutrients from four-day food diaries in a subsample of the Barbados National Cancer Study

Food sources of energy	% contribution to energy	Food sources of total fat	% contribution to total fat	Food sources of total sugar	% contribution to sugar	Food sources of fibre	% contribution to fibre
Fish dishes	9.8	Fish dishes	16.7	Sweetened fruit juices/drinks	20.4	Wheat/multigrain bread	11.8
Chicken dishes	7.0	Chicken dishes	9.7	Homemade drinks incl. ginger beer, mauby drink and lemonade	6.8	Hot porridges	8.2
Rice dishes	6.1	Nuts	5.7	Honey/sugar/syrup	5.6	Rice dishes	4.8
White bread/bun	5.2	Hard cheese	3.8	Cakes	5.2	Apple	4.3
Sweetened fruit juices/drinks	4.8	Evaporated milk-full cream	3.3	Regular carbonated soft drinks	4.1	Fish dishes	3.9
Wheat/multigrain bread	4.7	White bread/bun	2.5	Banana	4.1	Cold cereals	3.7
Hot porridges	2.7	Margarine/butter	2.4	Chocolate drinks, malt and cocoa drinks	4.0	White bread/bun	3.6
Cakes	2.6	Eggs	2.4	Apple	3.8	Coucou	3.4
Crackers	2.2	Wheat/whole wheat bread	2.3	Mango	3.4	Chicken dishes	3.1
Nuts	2.0	Rice dishes	2.3	Orange/tangerine	2.4	Orange/tangerine	2.9
Total	47.1	Total	51.1	Total	59.6	Total	49.7

Table 3

Most commonly consumed food and drink items reported in the food diaries in a subsample of the Barbados National Cancer Study

Most commonly reported foods	No. of times Reported
Sugar	104
Oat bran bread, multigrain bread, whole wheat bread	88
Rice and peas or plain rice Banana	68
Evaporated milk (whole)	66
White bread including buns	61
Crackers	57
Carrots	57
Vegetable salad	49
Apple	46
Sweetened juice	44
Oat porridge or cream of wheat	44
Fried flying fish or frizzled salt fish	36
Evaporated milk (partly skimmed)	33
Cheddar cheese	33
Orange	32
Sweet potato	32
Cakes	32
Plantain	27
Gravy	27
Evaporated milk (whole)	26