

Nutritional composition of the commonly consumed composite dishes for the Barbados National Cancer Study

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Abstract

Primary objective To provide, for the first time, the calculated nutritional composition of 32 composite dishes commonly consumed in Barbados to enable dietary intake to be calculated from a Quantitative Food Frequency Questionnaire developed specifically for this population to determine associations between diet and risk of prostate and breast cancer.

Methods and procedures Weighed recipes were collected in up to six different households for each of the 32 composite dishes. The average nutritional composition for these composite dishes was calculated using the US Department of Agriculture National Nutrient Database.

Main outcomes and results One hundred and fifty-two weighed recipes were collected for 32 composite dishes: five were fish based, two were ground beef dishes, two were chicken based, two were offal based, two were lamb dishes, one was pork based, three were rice based, three were commonly consumed home-made drinks, and the remaining were miscellaneous items.

Conclusions A total of 152 weighed recipes were collected and we provide, for the first time, nutritional composition data for 32 commonly consumed food and drink items in Barbados. Such data are essential for assessing nutrient intake and determining associations between diet and prostate and breast cancer in the Barbados National Cancer Study.

Keywords: *Nutritional composition, Caribbean, recipes, diet, Barbados National Cancer Study*

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Introduction

The Barbados National Cancer Study (BNCS) is a population-based case-control study examining genetic and environmental risk factors for breast and prostate cancer in an African-origin population. Barbados, West Indies has a population of 270,000, with over 90% of African descent. Breast and prostate cancer are the main cancers in African Barbadians, who have the highest reported incidence and mortality rates in the Caribbean region (International Agency for Research on Cancer 2001). These high rates suggest a high frequency of risk factors such as diet and susceptibility genes. However, associations with dietary risk factors have not previously been examined in this population.

To determine the relationship between diet and disease in population based studies, a Quantitative Food Frequency Questionnaire (QFFQ) is often the method of choice to assess dietary intake because it is relatively inexpensive, can be used in large population studies and can assess diet over a long period of time (usually the previous 12 months) (Willet 1998; Cade et al. 2002). However, once an appropriate QFFQ is developed, the food composition tables necessary for the analysis of the QFFQ must be readily available. The nutritional composition of foods listed in the QFFQ must be obtained by converting the reported serving size to a gram weight and obtaining the relevant nutritional composition of the portion reported for the listed food items. Only then can the energy and nutrient intake per person be calculated and nutrient-disease associations explored.

However, limited food composition data are available specifically for Barbados. Although there are food composition tables available for the Caribbean (Pan American Health Organization 1998, 2000), these contain mostly analyses values for single-item foods, such as an apple or rice. There are analyses for a few composite dishes, but these are not specific to Barbadian dishes. Furthermore, the data available for the food items listed in the Caribbean food composition tables do not contain the full range of nutrients potentially related to cancer risk. We needed to have nutritional composition data that were specific to the composite dishes eaten in Barbados. Because it was virtually impossible to biochemically analyze every composite dish, calculation of nutritional composition using weighed recipes was the method of choice, as has been done in many other studies (Bognar and Piekarski 2000; Hakala et al. 2003). Biochemical analysis is costly in terms of resources, time and expenses, and was therefore not feasible in the BNCS.

The aim of this paper is to provide, for the first time, the calculated nutritional composition of composite dishes and home-made drinks commonly consumed in Barbados. We describe the collection of the recipe data and the calculated nutritional composition per 100 g of foods that were listed in the QFFQ developed for the BNCS. This instrument is currently being used to examine the association between past dietary intake and the risk of incident breast and prostate cancer. It assesses the usual food and nutrient intake in the 12 months prior to the date of cancer diagnosis for cases or prior to a comparable reference date for controls.

Methods

The development and description of the QFFQ have been previously presented in detail (Sharma et al. 2006). In brief, in 2000 the Barbados Food Consumption and Anthropometric Surveys (BFCAS) obtained 24-h dietary recall data from a nationwide

population sample, based on a systematic random two-stage cluster design (Food and Agriculture Organization of The United Nations 2005). A total of 1,704 respondents from 1,051 households participated in the survey (average age 48.9 years (SD 17.6)), and included 945 (55.5%) women. A complete list of all foods, beverages and supplements reported during the survey was obtained from the Ministry of Health. Any food item that was reported by at least two of the Barbados Food Consumption and Anthropometric Surveys respondents was listed to provide foods for a draft QFFQ. In addition, 50 subjects completed a 24-h dietary recall in 2005 to ensure the food list was complete and up to date.

The QFFQ included 148 food and drink items; for 32 of these items there were no available food composition data for Barbados. To calculate the nutritional composition of these dishes, the study nutritional epidemiologist (S.S.) trained a dietitian (R.H.) and a nurse for 3 days in how to collect, weigh and record ingredients and the final cooked weight. A recipe collection form and a manual of procedures were developed to standardize data collection.

The dietitian attempted to obtain weighed recipes from at least five different households (mostly BNCS participants and volunteers) from various socioeconomic backgrounds, to obtain wide representation of the Barbadian population. An appointment was scheduled at the home of the participants, where all ingredients were weighed, as well as the final cooked weight of the various dishes. If foods had inedible portions, such as chicken bones, edible yields were calculated by subtracting the weight of these inedible parts. All food weights were obtained using electronic Salter Aquatronic kitchen scales (Aquatronic Baker's Dream Scale 2005, Salter Houseware, Ltd., Tonbridge, Kent, UK). For most of the composite dishes, five different recipes were collected. Individuals were reimbursed for the cost of the ingredients.

All the data were entered by a graduate nutrition student (X.C.) and analyzed using Nutribase Clinical Nutrition Manager version 5.18 (2004, Cybersoft Inc., Phoenix, AZ, USA). Nutribase Clinical is a computerized dietary database based on the US Department of Agriculture National Nutrient Database for Standard Reference.

The nutritional composition of each weighed recipe collected was calculated per 100 g by entering the weight of the ingredients and the final cooked weight. The average nutritional composition of each dish was calculated per 100 g from all samples of each composite dish.

The study was approved by the University of the West Indies Research Ethics Review Committee and the Stony Brook University Committee on Research Involving Human Subjects.

Results

A total of 152 weighed recipes were collected and the average nutritional composition was calculated. Tables I–IV present the nutritional composition per 100 g.

Of the 32 composite dishes, five were fish based, two were ground beef dishes, two were chicken based, two were offal based, two were lamb dishes, one was pork based, three were rice dishes, and three were commonly consumed home-made drinks. The remaining dishes were a variety of miscellaneous dishes. A description of the composite dishes is presented in Appendix 1.

Table I. Nutritional composition (per 100 g) of some of the commonly consumed composite dishes in Barbados.

	Frizzled saltfish	Steamed fish	Fish cake	Fish soup	Fried flying fish	Minced meat	Sauteed cornbeef	Chicken soup	Chicken potato roti
Number of weighed recipes	6	5	5	5	5	6	5	5	5
Energy (kcal)	165	78	260	56	284	263	236	74	126
Energy (kJ)	692	327	1,088	235	1,187	1,099	986	309	525
Protein (g)	15.6	7.0	10.6	2.8	18.2	11.9	21.3	3.8	10.1
Carbohydrate (g)	5.5	4.0	30.9	9.4	15.3	9.0	4.8	10.2	10.2
Fat (g)	9.1	3.1	10.5	0.8	16.6	19.9	15.2	2.1	5.0
Saturated fat (g)	1.2	0.7	1.8	0.2	2.2	6.2	0.6	0.5	0.8
Monounsaturated fat (g)	2.5	0.8	2.4	0.2	4.6	8.6	1.6	0.8	1.3
Polyunsaturated fat (g)	2.1	0.8	2.1	0.2	3.9	2.5	1.3	0.4	1.0
Omega-3 fatty acid (g)	0.2	0.1	0.3	0.0	0.3	0.1	n/a	0.0	0.0
Omega-6 fatty acid (g)	0.3	0.0	1.7	0.2	0.9	0.5	n/a	0.3	0.3
Cholesterol (mg)	32.7	20.8	46.9	6.3	55.9	41.8	n/a	11.6	28.3
Phytosterol (mg)	6.3	3.6	3.3	7.7	2.0	8.0	4.8	6.7	4.8
Sugars (g)	2.5	1.9	2.2	1.9	2.3	3.9	2.1	1.8	1.4
Total dietary fiber (g)	1.1	0.8	2.4	1.8	1.4	1.6	0.7	1.4	1.2
Thiamin (mg)	0.1	0.0	0.3	0.1	0.2	0.1	0.0	0.1	0.6
Riboflavin (mg)	0.1	0.0	0.2	0.1	0.2	0.2	0.0	0.1	0.4
Niacin (mg)	1.9	1.5	2.5	0.8	4.1	3.1	0.3	1.0	4.2
Pantothenic acid (mg)	0.2	0.1	0.3	0.3	0.3	0.4	0.1	0.3	0.6
Vitamin B-6 (mg)	0.4	0.2	0.2	0.1	0.3	0.3	0.1	0.1	0.3
Total folate (µg)	6.8	1.8	42.4	14.5	9.3	4.6	0.6	7.0	4.4
Folate, dietary folate equivalent (µg)	7.0	1.3	25.2	10.7	5.7	3.6	n/a	1.8	0.1
Vitamin B-12 (µg)	11.0	8.4	9.9	2.6	15.3	13.0	7.7	7.9	7.6
Vitamin C (mg)	19.1	9.2	4.8	10.0	6.4	19.1	13.7	10.9	10.1
Vitamin A (IU)	361	259	172	2,821	370	2,064	185	3,220	119
Vitamin E α -tocopherol equivalents (mg)	0.1	0.0	0.3	0.6	0.1	0.2	0.0	0.8	0.0
Vitamin K (µg)	4.0	2.3	0.9	0.9	1.0	5.7	3.9	2.3	2.2
Calcium (mg)	27.7	29.1	70.9	18.8	81.0	37.1	11.0	17.2	20.4
Iron (mg)	0.8	0.7	2.0	0.6	1.9	1.6	0.3	0.6	1.2
Zinc (mg)	0.5	0.2	0.6	0.3	0.5	2.5	0.1	0.4	0.8
Magnesium (mg)	31.8	19.0	26.5	15.4	39.7	19.9	6.0	14.2	24.7
Copper (mg)	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1

Table I (Continued)

	Frizzled saltfish	Steamed fish	Fish cake	Fish soup	Fried flying fish	Minced meat	Sauteed cornbeef	Chicken soup	Chicken potato roti
Manganese (mg)	0.2	0.1	0.4	0.2	0.2	0.2	0.1	0.2	0.2
Selenium (µg)	28.0	35.5	19.1	3.3	79.9	8.7	0.4	0.6	1.5
Phosphorus (mg)	149	77	102	45	205	109	16	39	104
Potassium (mg)	393	191	213	258	342	333	113	255	358
Sodium (mg)	95	717	431	112	469	576	87	196	287

Note: n/a, not available. IU, international unit.

Table II. Nutritional composition (per 100 g) of some of the commonly consumed composite dishes in Barbados.

	Stewed liver	Fried giblets	Lamb soup	Lamb stew	Pork stew	Pilau rice	Peas and Rice	Vegetable and rice	Dumpling	Chopped seasoning
Number of weighed recipes	5	5	5	4	2	5	5	5	5	5
Energy (kcal)	186	565	88	135	116	151	102	100	212	77
Energy (kJ)	779	2363	370	565	483	632	428	416	886	320
Protein (g)	13.5	32.6	5.8	10.3	9.7	6.5	2.4	1.9	5.1	2.0
Carbohydrate (g)	10.1	25.0	11.6	8.2	5.0	24.8	20.4	18.1	43.9	15.0
Fat (g)	10.1	36.4	2.0	6.7	6.1	2.6	1.1	2.2	2.0	0.6
Saturated fat (g)	1.9	6.3	0.7	2.1	1.4	0.5	0.4	0.3	0.6	0.1
Monounsaturated fat (g)	2.2	9.7	0.8	2.7	2.6	0.9	0.1	0.4	0.1	0.0
Polyunsaturated fat (g)	2.3	10.4	0.2	0.9	1.8	0.6	0.2	0.8	0.3	0.1
Omega-3 fatty acid (g)	0.1	0.9	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
Omega-6 fatty acid (g)	0.3	9.4	0.2	0.4	0.2	0.2	0.1	0.5	0.1	0.0
Cholesterol (mg)	285.5	241.7	15.0	34.0	25.8	12.3	1.1	n/a	2.1	n/a
Phytosterol (mg)	5.8	1.9	9.9	4.7	5.1	2.1	0.8	2.4	0.9	9.9
Sugars (g)	2.7	3.7	2.0	3.9	2.2	2.9	0.6	1.3	11.6	4.2
Total dietary fiber (g)	1.1	2.4	1.5	0.9	0.8	0.8	1.3	1.0	2.5	3.9
Thiamin (mg)	0.2	0.3	0.1	0.1	0.4	0.1	0.1	0.1	0.3	0.3
Riboflavin (mg)	1.4	0.7	0.1	0.2	0.1	0.1	0.0	0.0	0.2	0.6
Niacin (mg)	7.1	9.6	1.6	3.1	2.3	2.6	1.0	0.8	2.6	0.3
Pantothenic acid (mg)	3.8	2.2	0.4	0.5	0.4	0.5	0.3	0.2	0.3	0.1
Vitamin B-6 (mg)	0.7	0.4	0.2	0.2	0.3	0.2	0.1	0.1	0.1	0.2
Total folate (µg)	159.0	175.8	7.8	3.5	0.4	2.0	31.6	19.4	1.0	5.3
Folate, dietary folate equivalent (µg)	0.1	176.4	6.5	0.1	0.1	1.2	47.1	22.8	n/a	1.0
Vitamin B-12 (µg)	455.7	24.2	15.6	17.3	11.3	16.9	3.0	4.9	16.9	23.1
Vitamin C (mg)	36.9	14.8	9.3	11.2	12.1	6.9	5.7	9.0	0.7	30.0
Vitamin A (IU)	12,772	3,380	3,031	2,235	2,574	1,364	132	2,538	96	1,308
Vitamin E α-tocopherol equivalents (mg)	1.0	3.3	0.2	0.1	0.0	0.1	0.1	0.1	0.1	0.1
Vitamin K (µg)	50.7	0.1	3.3	3.0	2.8	5.6	0.0	4.0	0.2	0.3
Calcium (mg)	31.5	54.4	17.5	21.3	24.2	27.3	27.3	22.5	66.1	97.0
Iron (mg)	6.6	7.3	0.9	1.2	0.8	0.9	1.2	0.7	1.9	1.2
Zinc (mg)	2.3	5.1	1.4	2.6	1.1	0.6	0.4	0.2	0.7	0.3
Magnesium (mg)	23.0	45.8	17.6	20.7	18.6	24.9	20.1	8.8	29.1	19.0
Copper (mg)	0.5	0.3	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.1

Table II (Continued)

	Stewed liver	Fried giblets	Lamb soup	Lamb stew	Pork stew	Pilau rice	Peas and Rice	Vegetable and rice	Dumpling	Chopped seasoning
Manganese (mg)	0.4	0.6	0.2	0.1	0.1	0.4	0.4	0.2	0.8	0.4
Selenium (µg)	1.7	74.0	0.3	0.3	0.4	0.9	3.1	1.3	12.4	1.1
Phosphorus (mg)	214	285	73	111	113	89	49	24	161	41
Potassium (mg)	303	483	318	299	259	164	87	102	123	297
Sodium (mg)	658	897	221	496	480	268	190	251	835	936

Note: n/a, not available. IU, international unit.

Table III. Nutritional composition (per 100 g) of some of the commonly consumed composite dishes in Barbados.

	Coconut bread	Bakes	Macaroni pie	Souse	Coucous	Gravy	Conkies	Creamed yam	Steamed pudding	Roti skin	Pumpkin fritters
Number of weighed recipes	6	5	5	5	5	5	4	4	4	3	2
Energy (kcal)	376	309	194	173	86	98	283	178	132	289	235
Energy (kJ)	1,574	1,291	812	724	361	411	1,183	745	553	1,209	984
Protein (g)	6.7	5.3	8.0	15.2	2.1	1.9	4.0	3.0	1.3	7.2	4.9
Carbohydrate (g)	56.7	50.2	23.3	1.8	16.4	7.2	45.5	29.1	25.1	52.3	33.3
Fat (g)	15.1	10.2	7.5	11.1	1.8	7.1	10.5	6.0	3.3	5.5	10.2
Saturated fat (g)	8.1	1.5	2.8	3.8	0.5	1.0	6.0	2.7	0.5	0.7	1.6
Monounsaturated fat (g)	2.6	3.4	1.5	4.9	0.3	1.3	0.3	0.9	0.5	2.0	2.7
Polyunsaturated fat (g)	3.8	3.0	0.5	1.2	0.2	0.2	0.5	1.3	0.6	1.6	0.3
Omega-3 fatty acid (g)	0.1	0.0	0.1	n/a	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Omega-6 fatty acid (g)	3.6	0.1	0.2	1.1	0.0	0.1	0.1	1.2	0.1	0.1	0.2
Cholesterol (mg)	0.3	0.1	18.4	46.0	1.2	4.8	3.1	3.9	n/a	0.1	26.4
Phytosterol (mg)	18.7	n/a	0.7	4.4	3.3	5.4	3.3	6.0	9.7	n/a	11.1
Sugars (g)	22.7	14.0	3.0	1.1	0.3	2.5	21.9	4.4	12.2	0.8	10.8
Total dietary fiber (g)	3.8	2.1	1.0	0.4	2.6	1.1	4.3	3.3	2.2	1.3	2.0
Thiamin (mg)	0.8	0.3	0.2	0.6	0.1	0.1	0.5	0.2	0.1	0.4	0.2
Riboflavin (mg)	0.7	0.2	0.1	0.2	0.0	0.1	0.5	0.2	0.1	0.3	0.2
Niacin (mg)	2.1	2.7	1.3	3.2	0.6	0.7	1.2	0.8	0.5	3.8	2.3
Pantothenic acid (mg)	0.2	0.2	0.2	0.6	0.1	0.2	0.2	0.2	0.4	0.2	0.5
Vitamin B-6 (mg)	0.1	0.0	0.1	0.3	0.1	0.1	0.1	0.2	0.2	0.0	0.1
Total folate (µg)	55.0	32.1	35.5	1.2	14.2	5.2	9.5	23.3	9.3	73.5	21.6
Folate, dietary folate equivalent (µg)	19.1	19.3	54.6	0.1	n/a	1.9	10.3	0.2	9.0	41.1	14.7
Vitamin B-12 (µg)	0.1	6.6	2.8	9.8	1.3	11.7	6.2	0.8	4.2	0.0	8.1
Vitamin C (mg)	0.4	0.3	2.2	4.8	2.9	15.3	4.1	9.1	17.8	0.2	8.4
Vitamin A (IU)	328	46	263	194	170	1,191	2,549	134	12,892	24	1,514
Vitamin E α -tocopherol equivalents (mg)	0.5	0.0	0.1	n/a	0.1	0.0	0.2	3.1	0.2	0.0	1.0
Vitamin K (µg)	n/a	0.2	0.0	0.0	n/a	4.9	0.3	0.0	0.1	n/a	3.2
Calcium (mg)	107.8	103.7	97.2	27.0	13.7	27.0	28.7	51.7	26.2	250.5	84.3
Iron (mg)	1.9	2.2	1.1	0.9	0.8	0.8	1.3	0.7	0.6	3.2	2.2
Zinc (mg)	0.3	0.5	0.7	1.7	0.4	0.3	0.6	0.2	0.2	0.3	0.8
Magnesium (mg)	13.1	18.6	18.0	19.1	25.8	14.7	34.1	13.8	12.9	9.4	31.3
Copper (mg)	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.2

Table III (Continued)

	Coconut bread	Bakes	Macaroni pie	Souse	Coucou	Gravy	Conkies	Creamed yam	Steamed pudding	Roti skin	Pumpkin fritters
Manganese (mg)	0.4	0.6	0.2	0.1	0.2	0.2	0.2	0.3	0.3	0.5	0.8
Selenium (µg)	9.0	11.2	11.5	2.8	0.0	2.5	1.4	0.5	0.6	6.1	9.9
Phosphorus (mg)	67	154	98	144	41	40	90	48	25	281	378
Potassium (mg)	165	114	67	300	80	174	226	495	189	89	235
Sodium (mg)	752	723	293	274	196	495	264	1	218	1,288	984

Note: n/a, not available. IU, international unit.

Table IV. Nutritional composition (per 100 g) of the commonly consumed home-made drinks in Barbados.

	Mauby drink	Ginger beer	Lemonade
Number of weighed recipes	6	5	5
Energy (kcal)	53	42	58
Energy (kJ)	222	176	243
Protein (g)	0.0	0.1	0.1
Carbohydrate (g)	13.8	11.0	14.7
Fat (g)	0.0	0.0	0.0
Saturated fat (g)	n/a	0.0	0.0
Monounsaturated fat (g)	n/a	0.0	n/a
Polyunsaturated fat (g)	n/a	0.0	n/a
Cholesterol (mg)	n/a	n/a	n/a
Phytosterol (mg)	n/a	0.8	n/a
Sugars (g)	13.8	10.2	13.1
Total dietary fiber (g)	n/a	0.1	0.0
Thiamin (mg)	0.0	0.0	0.0
Riboflavin (mg)	0.0	0.0	0.0
Niacin (mg)	0.0	0.0	0.0
Pantothenic acid (mg)	0.0	0.0	0.0
Vitamin B-6 (mg)	0.0	0.0	0.0
Total folate (μg)	n/a	0.6	n/a
Folate, dietary folate equivalent (μg)	n/a	n/a	n/a
Vitamin B-12 (μg)	n/a	n/a	n/a
Vitamin C (mg)	n/a	0.3	6.7
Vitamin A (IU)	n/a	n/a	7
Vitamin E α-tocopherol equivalents (mg)	n/a	0.0	n/a
Vitamin K (μg)	n/a	n/a	n/a
Calcium (mg)	1.8	3.2	4.9
Iron (mg)	0.0	0.0	0.1
Zinc (mg)	0.0	0.1	0.0
Magnesium (mg)	0.9	3.5	0.9
Copper (mg)	0.0	0.0	0.0
Manganese (mg)	0.0	0.0	0.0
Selenium (μg)	n/a	n/a	n/a
Phosphorus (mg)	0	2	0
Potassium (mg)	1	23	1
Sodium (mg)	3	4	4

Note: n/a, not available. IU, international unit.

Discussion

There are no nutritional composition data available for Barbados and the existing Caribbean food composition tables are insufficient to meet the needs of the BNCS, both in terms of the number of nutrients they contain and the number of dishes included. To our best knowledge, no studies, to date, have collected weighed recipes of composite dishes selected to represent the most commonly consumed items in Barbados. Evaluating the nutritional composition of these composite dishes is of critical importance for defining average daily nutrient intakes (Greenfield and Southgate 2003), a step to enable studies of associations between nutrient intakes and diet-related diseases, such as breast and prostate cancer for the BNCS (Kunachowicz and Klys 2000).

The most precise method of producing nutrient values of composite dishes is to analyze them directly (Greenfield and Southgate 2003). This was too expensive

financially and also not feasible for the BNCS. Therefore, calculating nutritional composition of composite dishes was necessary.

Several researchers have attempted to compare nutritional composition data estimated by calculation from food composition tables, with direct chemical analyses. Boulous et al. (1996) and Porrini et al. (1986) reported a good agreement between calculation and chemical analysis, when comparing the nutritional composition of different dishes and food items consumed in their countries. Porrini et al. reported reliable data for macronutrients, but less reliable values for vitamins. Both sets of authors attributed the reason for the slight discrepancies to variations in food composition tables, as well as to possible nutrient modifications during the cooking process. Our data are limited in that we were unable to account for vitamin losses that could have occurred during cooking. In addition, we are also not able to account for any differences in soil content between the United States and Barbados.

Reliable nutritional composition data are essential when calculating the nutritional composition of composite dishes. We used a dietary analysis software package Nutribase that uses the extensive US Department of Agriculture food composition tables as the primary database.

Conclusion

We have provided for the first time the nutritional composition of the 32 most commonly eaten composite dishes in Barbados. This will allow the calculation of energy and nutrient intakes for the BNCS participants and therefore associations between diet and cancer to be determined. The availability of this new data will also facilitate further nutrition-related studies.

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References

- Bognar A, Piekarski J. 2000. Guidelines for recipe information and calculation of nutrient composition of prepared foods (dishes). *J Food Comp Anal* 13:391–410.
- Boulous C, Kanellou A, Trichopoulou A, Foods and Nutrients Working Group. 1996. Computer and chemically determined nutrient content of foods in Greece. *Int J Food Sci Nutr* 47:507–511.
- Cade J, Thompson R, Burley V, Warm D. 2002. Development, validation and utilization of food frequency questionnaires—a review. *Pub Health Nutr* 5(4):567–587.
- Food and Agriculture Organization of The United Nations. 2005. The Barbados food consumption and anthropometric surveys (BFCAS) 2000. Rome: FAO.
- Greenfield H, Southgate DAT. 2003. Food composition data production, management, and use. 2nd ed. Rome: Food and Agriculture Organization of The United Nations.
- Hakala P, Knuts L-R, Vuorinen A, Hammar N, Becker W. 2003. Comparison of nutrient intake data calculated on the basis of two different databases. Results and experiences from a Swedish–Finnish study. *Eur J Clin Nutr* 57:1035–1044.

- International Agency for Research on Cancer. 2001. GLOBOCAN 2000: cancer incidence, mortality and prevalence worldwide. Version 1.0. IARC Cancer Base No. 5. Lyon: IARC Press.
- Kunachowicz H, Klys W. 2000. Comparison of results of average diet composition calculated according to FRI-FAO programme 'ALIMENTA', Polish programme 'FOOD2' and results of chemical analysis. *J Food Comp Anal* 13:475–493.
- Pan American Health Organization. 1998. Food composition tables for use in the English-speaking Caribbean. 2nd ed. Pan American Sanitary Bureau, Regional Office of the World Health Organization. Kingston, Jamaica: Caribbean Food and Nutrition Institute.
- Pan American Health Organization. 2000. Food composition tables for use in the English-speaking Caribbean—supplement. Pan American Sanitary Bureau, Regional Office of the World Health Organization. Kingston, Jamaica: Caribbean Food and Nutrition Institute.
- Porrini M, Ciappellano S, Simonetti P, Testolin G. 1986. Chemical composition of Italian cooked dishes. *Int J Vit Nutr Res* 56:263–268.
- Sharma S, Cao X, Harris R, Hennis AJM, Leske MC, Barbados National Cancer Study Group. 2006. Dietary intake and development of a quantitative food frequency questionnaire (QFFQ) for the Barbados National Cancer Study (BNCS). *Pub Health Nutr*. 10(5):464–470.
- Willet W. 1998. *Nutritional Epidemiology*. New York: Oxford University Press.

Appendix 1: Description of the commonly consumed composite dishes in Barbados

Dish	Description
Cou-cou	Part of the National dish made from ground corn (cornmeal) and boiled okras, cooked into a firm paste. Usually served with steamed fish and frizzled salt fish.
Chopped seasoning	A blended mixture of chopped onions, fresh herbs (e.g. thyme, marjoram) and hot peppers, to which salt and ground black pepper are added for preservation. This raw mixture is then added to meats and fish as a seasoning and marinating agent prior to cooking.
Fish cakes	Deep-fried dumpling made with flour, salted fish (usually cod) and herbs (scallion, hot pepper, onion). Eaten mainly as a snack.
Coconut bread	Dense cake made with grated coconut, vanilla essence and dried fruit (raisins, cherries). This is a traditional Barbadian delicacy.
Conkies	It is traditional in Barbados for conkies to be made during the month of November. They are a mixture of corn flour, grated pumpkin, sweet potato and grated coconut, to which raisins and powdered mixed spice and nutmeg are added. A small amount of the mixture is then wrapped in banana leaves and steamed until firm. Conkies are usually eaten alone as a snack.
Bakes	A flour-based dumpling, which is shallow-fried in oil. Usually eaten as a breakfast item or snack, with fish cakes or on their own.
Pumpkin fritters	A flour-based dumpling to which grated or boiled, pureed pumpkin is added. The mixture is sweetened with sugar and cinnamon, and shallow or deep-fried in oil. Usually eaten as part of a main meal.
Creamed yam	Boiled yam is mashed with butter or margarine. Milk and cheddar cheese (optional) are then added until a soft consistency is formed. This dish is then served as a main starchy food at mealtime.
Dumplings	Flour-based or corn-flour-based sweetened dough balls added to soups or stews.
Roti skin	Unleavened flat bread made from white or whole-wheat flour. Cooked on a flat griddle. They are eaten as the starchy food with curried dishes mainly.
Mauby drink	Sweet traditional Barbadian drink made from the steeped infusion of the 'mauby bark'. Spices, vanilla/mixed essences and sugar are used to enhance the bitter flavor of this popular drink.
Ginger beer	A drink served chilled made from steeped grated ginger, or a boiled and cooled ginger infusion, to which sugar is added.
Lemonade	A blend of limejuice, vanilla essence, sugar and water. Served chilled.
Frizzled salt fish	A popular dish of boiled salted cod sautéed with tomatoes, onions, chopped and fresh seasoning/herbs, to form a thick sauce. This dish is usually served with rice, coucou or creamed yam.
Peas and rice	A mixed dish of dried or fresh legumes (kidney beans, lentils, black-eye peas) and parboiled rice. Boiled in salted water seasoned with onion and herbs until dry. Salted cured meat may also be added during boiling. This dish is a staple in the Barbadian diet.
Chicken/lamb soup	A thick soup made with either chicken/lamb cooked with mixed vegetables (pumpkin, carrots, spinach), root tubers (yam, eddoes), onions and herbs. Eaten as a main meal with dumpling usually added.
Fish soup	A thin broth made with fish, vegetables, onions and herbs. Eaten usually as a main meal, which may have dumplings added as well.
Pork/lamb/chicken stew	A dish made with meat, tomatoes, onions, vegetables and herbs. Root tubers may also be added to this dish, which is then eaten with a starchy food, such as rice and peas.
Sautéed corn beef	A dish of tinned corn beef, onion, tomato, sweet pepper and other seasonings sautéed to form a soft mixture in thick gravy.
Fried giblets	Chicken giblets, coated in seasoned breadcrumbs and flour, deep-fried until crisp. Usually served with bread as a light meal or snack.
Stewed liver	A dish made with liver (pig, beef or chicken in origin), tomatoes and onions cooked to a thick sauce. Served with rice and peas, coucou or root tubers.

Appendix (*Continued*)

Dish	Description
Souse	A dish of boiled pig's feet and head meat (ears, snout, tongue), seasoned with a brine mixture of cucumber, hot pepper and parsley. This a traditional delicacy usually served with pickled breadfruit/sweet potato or steamed pudding, especially on Saturdays.
Steamed pudding	A mixture of grated sweet potato, hot pepper, herbs, clove and sugar, steamed until a firm consistency is reached. Usually served with souse as a main meal, especially on Saturdays.
Steamed fish	A dish of fish poached in a mixture of tomatoes, onions, herbs and other seasonings, until thin gravy is formed. Usually served with rice and peas, coucou or root tubers.
Minced meat	Sautéed ground beef, seasoned with onions, tomatoes and herbs. May be served with macaroni, chow mien or rice as part of a main meal.
Chicken and potato roti	Chicken and potato curry wrapped in a roti skin and eaten as a meal.
Pilau rice	A mixture of seasoned meat or chicken, parboiled rice and seasonal vegetables blended to form a composite main meal dish.
Vegetable rice	A mixture of seasonal vegetables, most commonly carrots, beans or spinach, cooked with parboiled rice to form this composite dish. It is eaten as a starchy food.
Macaroni pie	Baked dish of macaroni mixed with a seasoned cheese-based sauce, a popular Barbadian starchy food dish.
Gravy	A blend of onions, tomatoes, sweet peppers and dried and fresh herbs, used as an accompaniment to a starchy food.
Fried flying fish	Part of the National dish. Breaded flying fish seasoned with chopped seasoning is shallow-fried in oil. This fried fish is the eaten with coucou, rice and root tubers. Fried flying fish may also be eaten with bread as a lighter meal.

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