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Development of a quantitative food frequency questionnaire for assessing food, nutrient, and heterocyclic aromatic amines intake in Japanese Brazilians for a colorectal adenoma case–control study

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Abstract

Primary objective To develop of a quantitative food frequency questionnaire (QFFQ) to assess intake of specific foods, nutrients and heterocyclic aromatic amines (HAAs) in a case–control study of colorectal adenoma.

Methods and procedures A cross-sectional survey conducted in a hospital in São Paulo, Brazil. A trained dietitian collected 24-h recalls from 60 Japanese Brazilian outpatients (29 men and 31 women; mean age 58 years and 57 years, respectively).

Main outcomes and results Fruit, vegetable and legume intake was high, with mean daily servings consumed in men and women of 8.2 and 6.9, respectively. The QFFQ contains 161 food items presented in 15 food groupings, with particular emphasis paid to the HAA content of meat, fish and chicken items.

Conclusions We have developed a QFFQ appropriate for Japanese Brazilians that will allow us to estimate HAA intake and will be used to examine our hypotheses related to foods, nutrients and HAAs, and diet–gene interactions in colorectal neoplasia in this population.

Keywords: *Quantitative food frequency questionnaire, heterocyclic aromatic amines, colorectal adenoma, Japanese Brazilians, São Paulo*

Introduction

Brazil has the largest Japanese population (1.3 million) outside Japan and this population has remained ethnically Japanese, with only 6% of admixture in the

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second-generation migrants (Nikkei Census Survey 1987–1988). About 350,000 Japanese live in the city of São Paulo and 900,000 in the state of São Paulo (Wakisaka 1998). Colorectal cancer (CRC) is the fourth most common malignancy in São Paulo, Brazil. CRC affects men and women almost equally, and the incidence has increased two-fold between 1969 and 1993 (Cancer no Brazil 2003). CRC represents 7.3% and 7.0% of all incident cancer cases in men and women, respectively, in São Paulo (Cancer no Brazil 2003). However, those figures are lower than those for western countries (North America, Europe, Australia, and New Zealand), where CRC represents 12.6% of all incident cancer in men and 14.1% in women.

The Japanese migrants to Brazil have shown a different pattern of CRC incidence and mortality compared with that of Japanese Americans (Tsugane et al. 1990a, 1990b). Cancer incidence rates in 1969–1978 for Japan-born residents of São Paulo were quite comparable with those in Japan (Tsugane et al. 1990a). A comparison of mortality rates also showed no difference in CRC rates for first-generation Japanese Brazilians, compared with Japan, or São Paulo as a whole (Tsugane et al. 1990b). Migrant data and temporal trends in CRC incidence clearly point to the importance of lifestyle. There was a sharp rise in CRC incidence observed in Japan over the past 30 years, presumably as a result of the westernization of the diet (LeMarchand et al. 1997; LeMarchand 1999). In contrast, we have identified a population of Japanese in São Paulo, Brazil, whose CRC rates did not increase upon migration despite a high meat intake and a relatively affluent western lifestyle. There is much evidence to suggest that dietary factors play a role in the etiology of CRC and adenoma, a precursor lesion for most CRCs (Hill et al. 1978; Simons et al. 1992). Many studies have shown a direct association with saturated fat or red meat intake (Hoff et al. 1986; Kune et al. 1991; Le Marchand et al. 1992, 1998; Giovannucci et al. 1992; Neugut et al. 1993; Sandler et al. 1993) and an inverse association with fiber, carbohydrates and vegetables for CRC (Hoff et al. 1986; Macquart-Moulin et al. 1987; Kune et al. 1991; Giovannucci et al. 1992; Benito et al. 1991; Kono et al. 1993; Little et al. 1993; Neugut et al. 1993; Sandler et al. 1993). Recent reviews and meta-analyses have concluded that high red meat and processed meat intakes are probable risk factors for colorectal neoplasia (Norat and Riboli 2001; Sandhu et al. 2001; World Cancer Research Fund/American Institute for Cancer Research 2007). These foods, especially when cooked well-done, may be a source of exposure to chemical carcinogens, such as heterocyclic amines (HAAs), polycyclic hydrocarbons (PAHs) and other pyrolysis products. HAAs are formed when meat or fish is cooked at high temperature for a long duration and PAHs are formed when meat is cooked directly above the heat source (e.g. on a grill) (Sugimura 1985).

Consumption of *churrasco* or Brazilian barbecue meat in Brazil is common and it seems likely that levels of HAAs and/or PAHs in *churrasco* meat would be high, and thus associated with increasing risk of CRC. However, Japanese Brazilians also have a high intake of fruits, vegetables and legumes that are thought to be protective against CRC (Cardoso et al. 1997).

Because this epidemiology might provide critical information about protective factors for CRC, we conducted a colonoscopy-based case–control study of adenoma among Japanese Brazilians in São Paulo to investigate the intakes of meat (with regard to type, amount, cooking preparation, level of doneness and HAA content), vegetables, fruits, folate and other nutrients and its association with CRC among Japanese Brazilians in São Paulo, and also to compare findings with our ongoing

adenoma study among Japanese in Hawaii and with a third (separately funded) companion study conducted at the National Cancer Center in Tokyo.

Currently there are no dietary instruments developed specifically for the Japanese Brazilian population in São Paulo to measure usual dietary intake and HAA intake. While other quantitative food frequency questionnaires (QFFQs) have been developed (Cardoso et al. 1997), these did not fulfill all of our needs. One particular requirement was that specific meat items be listed individually on the QFFQ to capture differences in HAA content depending on the cooking method, level of doneness, use of marinades and type of meat, such as beef or chicken.

The aims of this paper are to describe the food intake of a population sample of Japanese Brazilians in São Paulo, and the development of a QFFQ that assesses food, nutrient, food group and HAA intake. We used a standardized dietary assessment methodology to ensure comparison of results with those of parallel case–control studies of colorectal adenoma being conducted among Japanese in Hawaii and Tokyo. In each setting, the studies investigate meat intake (with regard to type, amount, cooking preparation, level of doneness and HAA content) and its association with colorectal adenoma. The studies also examine the associations of vegetables, fruits and nutrient intake with adenoma, as well as the modifying effects of variants in metabolic genes on the associations of adenoma with red meat and folate as well as other nutrients.

Methods

To obtain information on usual foods consumed by Japanese Brazilians for the development of the QFFQ, adults in the clinic waiting room at the Sociedade Beneficente de Cotia Hospital in São Paulo during May and June 2005 were invited to complete a 24-h dietary recall interview if they fulfilled the following criteria: aged 40–75 years old; at least 75% Japanese (at least three grandparents of complete Japanese ancestry) and São Paulo residents for $\geq$6 months. Exclusion criteria for subjects included any previous cancer or gastrointestinal condition. To double check this, the interviewer asked and recorded the reason for attendance at the clinic, as well as any previous diagnosis of a major medical condition affecting dietary intake.

A dietitian (C.K.) fluent in English, Portuguese, and Japanese was trained, observed and certified in the collection of detailed 24-h recalls, following a manual of procedures to ensure standardization of dietary data in the three geographic settings. The 24-h recall interviews systematically sought and recorded information about foods and drinks consumed during the preceding 24-h period. Portion size was assessed using familiar household units such as bowls of rice, standard units such as a French bread roll, or three-dimensional models (NASCO MODESTO 2005) that had been carefully chosen or handmade to best estimate the amount of each food item reported. All interviews were conducted in an office at the hospital by the same dietitian. Data from each 24-h recall were recorded on dietary assessment forms developed specifically for this study. An additional list of questions was included to prompt for easily forgotten foods, such as sweets, alcohol and snacks. We also included questions on any special dietary practices the respondent followed, such as a weight loss or diabetic diet. Data were also collected on use of dietary supplements, such as multivitamins, as well as on smoking and occupation. All data were examined by a nutrition researcher; if any data were incomplete, the dietitian was asked to re-contact

the respondent for the additional information. Recalls covered both weekdays and weekend days.

All data were entered and analyzed using Microsoft Excel 2003 (Microsoft) and SAS version 9.1 (2005; SAS Institute Inc., Cary, NC, USA).

The study was approved by the University of Hawaii, Committee on Human Studies, as well as the Brazilian Ministries of Health, Science and Technology, and of Foreign Affairs, and the Brazilian National Ethics Commission.

Results

Sixty subjects (29 men and 31 women; mean age 58 years and 57 years, respectively) were eligible and agreed to participate in the interview. Six subjects refused, giving an overall response rate for the study of 91%. Table I presents the characteristics of the subjects. The majority of the participants was married and had lived in São Paulo for approximately 40 years. Almost one-half of the women were housewives or unemployed. Approximately 75% of the men were employed, mostly as clerks or in sales or service. The majority of the women (90%) had never smoked, compared with only 45% of men; 45% of the men had previously smoked and 10% reported being a current smoker. Of the participants, 22 (37%) attended the clinic to accompany their friend or family; other reasons for attending were gynecology (10%), ophthalmology (8%), physical or check up (8%), rheumatology (7%), endocrinology (7%), orthopedics or backache (5%), physical therapy (5%), cardiology or hyperlipidemia (5%), dermatology (3%), earache or headache (3%) or blood test (2%) (data not shown). Twenty-two subjects reported using dietary supplements (24% of men and 48% of women). Participants were interviewed during weekdays (66%) and during weekend days (34%).

Table II presents the number of people who reported consuming each food or drink item. Those food or drink items reported by at least five people are included in the table. Salad (e.g. vegetable salad and tomato salad) was the most commonly reported food, with rice the second and oranges and tangerines the third most commonly reported food items. Seventy percent reported consuming a red-meat-based dish or sausages on the day of recall (data not shown). Of the top 54 food items reported, over one-third was vegetables (including legumes), fruits or fruit juices. In addition, many of the other foods that were mixed dishes also contained vegetables or legumes. Because we were particularly interested in vegetables, legumes and fruits since these have been shown to be protective for CRC (World Cancer Research Fund/American Institute for Cancer Research 2007), we calculated the number of servings of those food groups based on the USDA food guide recommendations (US Department of Health and Human Services 2005). For example, a half-cup of cooked rice or pasta, one slice of bread or one small muffin is calculated to be one standard serving of grain.

Based on standard serving amounts in the United States, and by disaggregating the ingredients in mixed dishes that come from vegetables or legumes, we calculated the approximate servings consumed by each person. These data are presented in Table III. Men consumed a greater mean number of servings of vegetables and legumes than women, whereas the mean number of fruit servings was similar in both sexes. The recommended number of servings for Brazil is three servings for fruits, three for vegetables, and one serving for legumes. The mean intakes for men and women meet or exceed these recommendations.

Table I. Characteristics of the study participants.

	Men ($n=29$)	Women ($n=31$)
Mean age (years)	58	57
Marital status		
Single, never married	1 (3.5)	8 (26)
Married	27 (93)	20 (65)
Widowed	1 (3.5)	3 (9)
Mean years living in São Paulo	39	42
Employment[a]		
Housewife or unemployed	7 (24)	15 (48)
Profession/manager	1 (3)	2 (7)
Clerk/sales/service	12 (41)	11 (35)
Agriculture/forestry/fishery/labor	8 (28)	3 (10)
Smoking status		
Current	3 (10)	1 (3)
Past	13 (45)	2 (7)
Never	13 (45)	28 (90)
Self reported medical history		
None	17 (59)	13 (42)
Diabetes	3 (10)	1 (3)
Hypertension	6 (21)	10 (32)
Hyperlipidemia	2 (7)	4 (13)
Other	1 (3)	3 (10)
Special diet followed		
Weight loss	0 (0)	3 (10)
Low fat, low cholesterol	3 (10)	3 (10)
Low sugar, diabetic	1 (3)	1 (3)
Low salt	2 (7)	2 (6)
None	23 (80)	22 (71)
Reported food consumption for day recalled was ...		
Same as usual	28 (97)	26 (84)
More than usual	1 (3)	4 (13)
Less than usual	0 (0)	1 (3)
Dietary supplement use		
No	22 (76)	16 (52)
Yes	7 (24)	15 (48)
Calcium	0 (0)	9 (29)
Vitamin B, vitamin C, or multivitamins	3 (10)	4 (13)

Data are numbers of subjects (sex-specific percentages) unless specified otherwise. [a]Occupation was not reported for one man.

Development of the QFFQ

All foods that were reported on the 24-h recall forms were entered into Excel and those reported by more than one person were listed on the QFFQ. However, foods low in energy and nutrients, such as condiments and spices, were not included as their contribution to overall dietary intake was minor. The food and drink items listed on the QFFQ are shown in Appendix 1.

Food items that were similar in nutrient composition were grouped together under one item, such as different kinds of yogurts. For seasonal fruits and vegetables, frequency of consumption is asked 'when in season'. Additional foods that did not

Table II. Food and drink items reported by at least five subjects.

Food or drink item	*n* (%)	Food or drink item	*n* (%)	Food or drink item	*n* (%)
Salad	54 (90)	Loaf bread	10 (17)	Beef (stir-fried)	6 (10)
Japanese rice	49 (82)	Papayas	10 (17)	Tofu raw or fried	6 (10)
Tangerine or orange	42 (70)	Fruit drink (artificial)	10 (17)	Vegetable soup including with beef or chicken added	6 (10)
French bread	34 (57)	Sushi or Inarisushi	9 (15)	Chocolate milk or milk shake	6 (10)
Coffee with milk	34 (57)	Spaghetti (no meat added)	9 (15)	Eggs (fried or boiled)	6 (10)
Banana	25 (42)	Persimmon	9 (15)	Fried rice, risotto, paella, rice with chicken (torigohan)	5 (8)
Coffee, no milk	25 (42)	Cake	9 (15)	Apple or pear	5 (8)
Pickled vegetables	22 (37)	Green tea	9 (15)	Tomato salad only	5 (8)
Biscuit	18 (30)	Eggplant (stir-fried, roasted, boiled)	8 (13)	Green or spring beans	5 (8)
Tea including mate	17 (28)	Chicken (stir-fried)	8 (13)	Curry with rice (include meat)	5 (8)
Regular soda	14 (23)	Chips or popcorn	8 (13)	Beef with potato (roasted)	5 (8)
Fruit drink 100% juice	14 (23)	Broccoli or cauliflower	7 (12)	Beef (*churrasco*/BBQ)	5 (8)
Carioca beans, no beef or fried beans dry	11 (18)	Milanese beef	7 (12)	Ground beef (with or without vegetables)	5 (8)
Beans carioca, beans with beef	11 (18)	Chicken (roasted)	7 (12)	Sausage	5 (8)
Cabbage, Chinese cabbage, spring greens, spinach, Swiss chard	11 (18)	Cheese (hard)	7 (12)	Sashimi	5 (8)
Missoshiru, Kenchinjiru	11 (18)	Melons	6 (10)	Pastry (minced meat or chicken)	5 (8)
Yogurt	11 (18)	Kiwi, guava, star fruit, passion fruit	6 (10)	Whole milk	5 (8)
Brazilian rice	10 (17)	Chocho	6 (10)	Soy milk	5 (8)

Table III. Daily serving intake of vegetables, legumes and fruits in Japanese Brazilians.

	Men ($n=29$)		Women ($n=31$)		Total participants ($n=60$)	
	Mean (standard deviation)	Median	Mean (standard deviation)	Median	Mean (standard deviation)	Median
Vegetables	3.9 (3.9)	2.3	2.8 (1.8)	2.6	3.3 (3.0)	2.6
Legumes	1.3 (1.4)	1.0	1.0 (1.0)	0.7	1.2 (1.2)	0.9
Fruits	3.0 (2.7)	2.8	3.1 (2.1)	2.8	3.0 (2.4)	2.8

appear in the recalls but were considered relevant to the study, such as seasonal foods that were not in season at the time of the recalls, were added to the QFFQ (e.g. mango and avocado). For all seasonal foods, we asked about consumption in season only and will adjust intake for the previous 12 months based on the length of the season for each item in São Paulo. The food items were grouped under food group headings such as 'Breads' or 'Fruits'. The QFFQ contains 161 food and drink items, grouped into 15 food groups: 11 rice and pasta dishes, six breads, 17 fruits, 25 vegetable or vegetable dishes, 21 meat or meat dishes, 13 chicken or poultry dishes, 12 fish or fish dishes, two meat alternatives, five soups, eight pizzas or pies, eight dessert or cake items, 13 dairy items, three snacks, 11 beverages and six alcoholic drinks.

Frequency of consumption is assessed using eight categories ranging from 'Never or hardly ever' to 'Two times or more per day'. The period recalled in the QFFQ is the past 12 months from the date the subject was interviewed and had a colonoscopy.

In order to determine the amounts consumed for each food item listed on the QFFQ, we worked with a local dietitian to identify the most appropriate methods of assessing portion size, such as a food model, household unit such as a bowl, cup or spoon, or a standard unit.

In addition, as we are particularly interested in HAA intake, we estimated consumption of food sources of HAAs by showing photographs of meat cooked at several 'doneness' levels (rare, medium rare, medium, well cooked, very well cooked) for 14 grilled, '*churrasco*' or pan-fried foods (four beef items, one pork item, six chicken items and three fish items). The colored photographs represent increasing levels of doneness and show the surface as well as a cross-section of the meat to help standardize the assessment of 'doneness'. To capture HAAs from the meat drippings, the QFFQ also questions frequency and amount of consumption of gravy made with drippings from pan-fried and roasted meats and poultry.

Since supplements were frequently consumed by the participants and these can be an important source of nutrients, the questionnaire includes questions on type, frequency, brand and dose of any supplement taken.

Appendix 2 shows a sample page of the QFFQ.

Discussion

In the first half of the century, CRC incidence was substantially lower in Japan than in the United States. These rates increased markedly among those Japanese who migrated to Hawaii and California. In the 1980s, Japanese American men in Hawaii and Los Angeles had the highest incidence rates for CRC among more than

175 populations worldwide (Ferlay et al. 1992) and rates remained high in the 1990s (Parkin et al. 1997, 2002). Similarly, rates for both colon and rectum cancers have increased in Japan since the 1970s and particularly rapidly since the 1980s, presumably because of lifestyle changes including greater red meat consumption (Kuriki and Tajima 2006; Minami et al. 2006). A recent rate comparison for Japan and the United States showed that overall rates are similar between the two countries and are even higher in Japan in recent birth cohorts (Moore et al. 2005). The highest CRC incidence rates in the world are now reported from Japan (Parkin et al. 2002). Japanese, thus, may be particularly susceptible to this disease particularly when they are exposed to a western diet, and possibly due to the modifying influence of common genetic susceptibility factors (Le Marchand 1999). Indeed, in Hawaii, Japanese were shown to consume more beef and processed meats than Caucasians (Le Marchand 1999).

In contrast to Japanese in Japan and Japanese Americans, CRC incidence rates had not increased among first-generation Japanese migrants to São Paulo, despite a high red meat intake, a relatively affluent urban lifestyle, and a higher body mass index than Japanese in Japan (Tsugane et al. 1994; Tsugane 1996). However, most recent data have shown that the standardized mortality ratio of CRC for Japanese in Brazil has become similar to Japanese in Japan (Iwasaki et al. 2008). Japanese Brazilians have been reported to have high intakes of fruits and vegetables and legumes (Cardoso et al. 1997) thought to be protective for CRC (Le Marchand et al. 1997; Millen et al. 2007; Park et al. 2007). However, our study also found that the mean intakes of these food groups for men and women met or exceeded the recommendations and were higher than the amounts others have reported in Japanese Brazilians, in Bauru, Brazil, using a food frequency questionnaire that has been developed and validated for that community (Freire et al. 2003). Japanese Brazilians in our study also consumed meat frequently, and thus may provide critical information about dietary risk and protective factors for CRC.

A comprehensive and valid dietary assessment strategy is essential for understanding the relationship between nutrition and disease. Food frequency questionnaires have advantages over other dietary assessment methods, such as short-term recalls and diet records, because they can measure usual long-term dietary intake, especially for large population samples (Willet 1998; Solomons and Valdes-Ramos 2002; Taren et al. 2002).

To develop a QFFQ, three steps are needed: compose the food list, define the portion sizes and classify the categories of frequency of consumption (Shahar et al. 2003). Obtaining an appropriate food list for a specific population is the most critical step in the process of developing a QFFQ. The foods selected must: be commonly consumed by a substantial segment of the population; contain significant amounts of nutrients or food constituents of interest; and have a great variety of consumption across individuals (Willet 1998; Cade et al. 2002; Stark 2002). Our QFFQ food list is comprehensive and culturally appropriate and it was developed using this standard methodology, as we have done in several other studies (Sharma et al. 2002, 2007a, 2007b, 2008). Food and drink items were also combined or separated according to their energy/nutrient content and the eating habit of Japanese Brazilians.

This QFFQ for Japanese Brazilians contains more items than anticipated because similar foods could not always be grouped together. For example, Japanese rice and Brazilian rice are similar nutritionally but were listed separately since each rice dish is

consumed in a very different portion bowl. Fried rice was also listed separately because it is more caloric and provides more nutrients due to the vegetable and meat items included. Sushi, onigiri and omoti are all rice-based 'finger foods' that are similar nutritionally; but because they are consumed in different sizes, they were listed as three separate items.

Because of our focus on total meat intake, we also listed items with meat separately. For example, 'spaghetti in tomato sauce' separately from 'spaghetti in tomato sauce with meat', as well as 'Feijao with meat' and 'Feijao without meat'.

In Brazil, cheese bread is commonly consumed and is available as small and big bread balls with exactly the same nutrition content per 100 g. However, these items were also listed separately to account for the large difference in serving size. Salads are frequently consumed items and the type of salad may vary nutritionally substantially. We therefore listed the main types of salads separately. For example, tomato salad, vegetable salad and finely chopped vegetable salad.

The most unique food listings on this QFFQ relate to meat to enable estimation of HAAs intake. All meat items that could contain HAA are listed separately by cooking methods for ease of recall. For HAA intake calculations, we listed all parts of the chicken separately and by cooking method (grilled, *churrasco*, pan-fried, stir-fried, roasted, and deep-fried). For example, *churrasco* chicken was broken down into wings, thighs, drumsticks and breast, as was roasted chicken. While this resulted in eight line items, this was essential to meet the needs of our project. The same was done for fish and in addition, we also distinguished between the volume: surface area ratio. For example, fish filet was listed separately because the larger surface area in contact with the heat source would result in a greater HAA content than fish steak or a whole fish.

Additional questions asked the participant their preferred doneness level for many meat items such as pan-fried hamburger, pan-fried steaks, grilled beef and *churrasco* beef. To standardize the doneness levels, photographs are shown to each participant for every food.

Validation of the QFFQ will be underway during the next 12 months using three 24-h recalls.

Briefly, to compute the daily nutrient intake from the QFFQ, a food composition database was constructed specifically for all the items listed on the QFFQ. Daily nutrients for each subject were obtained by summing the amounts for each subject across food items.

Conclusions

We have developed for the Japanese Brazilian population a specific and up-to-date QFFQ that contains 161 items and will assess food, nutrient, and food group intake. The QFFQ will also allow us to estimate HAA intake and will be used to examine our hypotheses related to foods, nutrients and diet–gene interactions in colorectal neoplasia.

The preliminary dietary data in this study support the notion that red meat and fruit and vegetable intakes are both high in this population. Unlike Japanese living in Hawaii and Japan who are at high risk for CRC, Japanese residents of São Paulo have a low risk for this disease despite a high exposure to known or suspected risk factors (red meat, western lifestyle). This study reveals the existence of specific protective factors (e.g. high fruit intake) for colorectal cancer.

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Supplementary Material

Appendix 1: Food and drink items listed on the final QFFQ

Category	
Rice, pastas (11)	Japanese rice; Brazilian rice; Fried rice; Sushi or Inarisushi; Onigiri; Omoti; Spaghetti in tomato sauce with meat; Spaghetti in tomato sauce with no meat; Lasagna; Nhoque; Polenta (fried)
Breads (6)	French bread, homemade bread, Italian bread; Loaf bread (include toast), Multigrain bread; Cheese bread (small); Cheese bread (big); Margarine or butter; Jelly and flavor
Fruits (17)	Ponkan (Tangerine) and/or Orange; Banana Milanese; Banana; Any papayas; Persimmon (in season); Any melons and watermelon; Pineapple (in season); Apple, Pear; Kiwi, Guava, Star fruit, Passion fruit (in season); Mango (in season); Avocado (in season); Strawberry (in season); Plums (in season); Grapes (in season); Peach or nectarine (in season); Jabuticaba (in season); Soursop (in season)
Vegetables (25)	Tempura (vegetable only); Feijão (carioca beans) without meat; Feijão (carioca beans) with meat; Tomato salad; Finely chopped salads with vinaigrette; Vegetables salad including lettuce, tomato, onion, cucumber, pepper, ruccola, water cress, or chicory; Beetroot salad (include boiled); Olive oil or oil-based salad dressing; Green beans; Chicory (stir-fried); Chocho (stir-fried or boiled); Jilo (stir-fried or boiled) in season; Eggplant (stir-fried, roasted or boiled); Any broccoli (include stir-fried, boiled), Cauliflower (include stir-fried); Any cabbage, any spring greens, any spinach (include stir-fried, boiled); Any carrot (include boiled but not in mayonnaise salad); Any pumpkin, any squash (include stir-fried); Any sweet potato (include boiled); Potato fried, (stir-fried potato), French fries, roasted; Mayonnaise salad (potato, carrot, chayote), coleslaw; Fried cassava (in-season); Boiled cassava (in season); Gobo (stir-fried); Okra (stir-fried); Turnip (stir-fried)
Meats (21)	Curry with rice (includes meat curry); Stroganoff (beef or chicken); Nishime (with beef or chicken); Beef (stir-fried) (with or without vegetables); Ground beef (stir-fried) (with or without vegetables); Beef Milanese; Beef (roasted); Beef (pan-fried); Beef (grilled in a frying pan without oil or fat); Beef (Churrasco, grelha); Beef (Churrasco, espeto); Feijoada; Sausage (stir-fried or stewed with vegetables); Pork (stir-fried) (with or without vegetables); Hamburger (pan-fried); Sausage (pan-fried or fried); Sausage (Churrasco, grelha); Pork (pan-fried); Pork (Churrasco, grelha); Farofa; Ham (beef or pork) or Mortadella

Appendix 1 (*continued*)

Chicken (13)	Chicken (stir-fried) (with or without vegetables); Chicken Milanese (breast); Chicken breast (pan-fried); Chicken breast (grilled in a frying pan without oil or fat); Chicken breast (Churrasco, grelha); Chicken drumstick (Churrasco, grelha); Chicken wing (Churrasco, grelha); Chicken thigh (Churrasco, grelha); Chicken breast (roasted); Chicken drum stick (roasted); Chicken wing (roasted); Chicken thigh (roasted); Chicken deep-fried include wing, thigh, drumstick, breast
Fish (12)	Sashimi (salmon, tuna, mackerel); Moqueca; Any whole fish (pan-fried); Any fish, steak (pan-fried); Any fish, fillet (pan fried); Any whole fish (Churrasco, grelha); Any whole fish (deep-fried); Any fish, fillet (deep-fried); Any whole fish (roasted); Any whole fish (stir-fried); Any fish, steak (stir-fried); Tomato based seasoning with any fish
Meat Alternatives (2)	Tofu (raw); Tofu fried
Soups (5)	Missoshiru; Ramen or Udon; Vegetable soup with beef or chicken; Vegetable soup no meat or chicken; Bean soup (no meat)
Pizza and Pies (8)	Any Pizza; Coxinha (small); Coxinha (big); Pastel, any kind; Pie with chicken, onion, palm heart, Pie with palm heart; Esfira; Kibe; Empada
Cake, Biscuits, Desserts, Sweets (8)	Sweet biscuit; Any salty biscuit; Cheese cake (Brazilian); Any cake (include coconut cake, chocolate cake, corn cake, cake with filling, chocolate filled bread); Any puddings; Manju; Sweet pies: lime pie, strawberry pie; Gelatine
Dairy (13)	Any yogurt (include yogurt with lactobacillus); Chocolate milk or milk shake; Liquid milk: fat free or skimmed milk (total per day including milk drink alone, do not include milk in other dishes or café con leite); Liquid milk: low fat milk (1% or 2%) (total per day including milk drink alone, do not include milk in other dishes or café con leite; Liquid milk: whole milk (total per day including milk drink alone, do not include milk in other dishes or café con leite; Milk powder; Soy milk; Eggs other than omelet (include fried, boiled); Omelet; Any hard cheese (Prata, cheddar, mozzarella, provolone); Fresh cheese (minas); Cream cheese; Ice cream
Snack Foods (3)	Any chips; Peanuts; Chocolate
Drinks (11)	Café com leite or any coffee with any milk; Any coffee no milk, expresso or Italian; Black tea; Tea mate; Green tea; Any other tea (include herbal tea, fruit tea, gobo tea, guava tea, rice tea, tea biwa, agaricus blazei tea); Any real fruit juice; Any sweetened artificial fruit drink or artificial juice; Any regular soda (include cola, sprite, guarana, lemonade); Any diet soda (include diet guarana, diet coke); Water
Alcohol drinks (6)	Any Beer; Wine; Sake; Caipirinha; Whisky, vodka, pinga (alone NOT in caipirinha), or hard liquor; How many teaspoon sugar per day total do you add to ANY drinks such as coffee, tea, fruit juice, or caipirinha?

Appendix 2: Sample page of the QFFQ

No.	Description of food item (English)	Portion			Never or hardly ever	Once a month or 12 times a year	2-3 times a month	Once a week	2-3 times a week	4-6 times a week	Once a day	2 times a day or more
		Complete	Unit	Office use only								
61	Stroganoff (beef or chicken)	____	# D flat	1025	1	2	3	4	5	6	7	8
62	Nishime (with beef or chicken)	____	# T	1025	1	2	3	4	5	6	7	8
63	Beef (stir-fried) (with or without vegetables)	____	# GG heaped	1025	1	2	3	4	5	6	7	8
64	Ground beef (stir-fried) (with or without vegetables)	____	# GG heaped	1025	1	2	3	4	5	6	7	8
65	Beef Milanese	____	# EE	1026	1	2	3	4	5	6	7	8
66	Beef (roasted)	____	# W	1026	1	2	3	4	5	6	7	8
67	Beef (pan-fried)	____	# Y	1026	1	2	3	4	5	6	7	8
68	Beef (grilled in a frying pan without oil or fat)	____	# Y	1026	1	2	3	4	5	6	7	8
69	Beef (Churrasco, grelha), (Please refer to the explanation drawing)	____	# W	1026	1	2	3	4	5	6	7	8
70	Beef (Churrasco, espeto), (Please refer to the explanation drawing)	____	# W	1027	1	2	3	4	5	6	7	8
71	Feijoada	____	# D heaped	1027	1	2	3	4	5	6	7	8
72	Sausage (stir-fried or stewed with vegetables)	____	# GG heaped	1027	1	2	3	4	5	6	7	8
73	Pork (stir-fried) (with or without vegetables)	____	# GG heaped	1027	1	2	3	4	5	6	7	8
74	Hamburger (pan-fried)	____	# BB	1028	1	2	3	4	5	6	7	8
75	Sausage (pan-fried or fried)	____	# TT	1028	1	2	3	4	5	6	7	8
76	Sausage (Churrasco, grelha)	____	# TT	1028	1	2	3	4	5	6	7	8
77	Pork (pan-fried)	____	# Q	1028	1	2	3	4	5	6	7	8