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Food frequency questionnaire for adults from a population-based study

ABSTRACT

The objective of the study was to develop a food frequency questionnaire for each of the following groups: female adults, male adults and male and female adults, based on dietary data obtained in a population-based study comprising individuals from different income levels. Dietary data was obtained from a 24-hour Dietary Recall applied to a probabilistic sample of 1,477 subjects in the city of São Paulo (Southeastern Brazil) in 2003. Food items accounting for at least 90% of total daily calorie intake and nutrients were selected. The reference time frame was the year preceding the interview and subjects had the choice of four serving sizes.

DESCRIPTORS: Food Consumption. Diet Surveys. Food Frequency Questonnaire.

INTRODUCTION

A major challenge in the science and practice of nutrition and dietetics is accurately measuring food intake given the limitations of methods available. The Food Frequency Questionnaire (FFQ) and 24-hour Dietary Recall (24HR) are the main instruments used for dietary data collection. The 24HR has been primarily applied in surveillance studies and the FFQ has been the first choice for epidemiological studies. FFQ's main feature can accurately provide what 24hR cannot, i.e., it captures the likelihood of intake of most food items over a preceding period of time, usually the prior year.[4] This feature allows to assess the habitual diet, which is crucial for estimating the measure of exposure to dietary factors and to investigate potential associations with outcomes of interest.[5]

The purpose of the present study was to develop three different FFQs for adults, one for women, one for men and one for both men and women, based on dietary data from a previous population-based study comprising individuals from different income levels.

METHODS

The FFQ was designed to assess habitual food intake in adults in the year prior to its administration. Dietary information obtained through a 24HR was used. The 24HR included 1,477 adults (708 men and 769 women) aged between 20 and 101 years, mean age 37 (± 18) and 35 (± 18) years, respectively, and from different socioeconomic levels. This data was obtained from "Food Surveys in the City of São Paulo," which was part of a large study, "Health Survey in the State of São Paulo – Population-Based Household Health Survey". Detailed study

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Received: 5/24/2007
Reviewed: 9/20/2007
Approved: 12/6/2007

methods have been published.[a] Cluster-based stratified sampling was carried out in two steps (census tract and household). Census tracts were grouped into three levels according to the proportion of family heads with university education. The estimated population was 1,680 male and female adults over 20 years of age. A total of 1,562 subjects were included; 85 were excluded since their total calorie intake was either below 500 kcal or over 4,000 kcal, as recommended by Willett[5] (1998).

There were reported 1,040 food items and preparations, grouped into 500 items by food type (e.g., orange and "pêra" orange), preparation and commercial brand. Food items were then regrouped according to nutrient category based on centesimal food composition tables making a total of 67 standard items.

There were made lists of food associated with energy intake in the diet of men, women and both: carbohydrate, protein, cholesterol, saturated, monounsaturated, polyunsaturated and trans fat, dietary fiber, insoluble and soluble fiber, vitamin E, folate, retinol, vitamin C, calcium, phosphorous, iron, zinc, sodium and beta-carotene. These lists were prepared through statistical analysis approach proposed by Block et al[1] (1985). Total nutrient intake was estimated by the weighed sum of nutrient content in all serving sizes of all food items reported. The percent contribution of each food item was estimated by dividing nutrient content of each food by total nutrient content provided by all food items, multiplied by 100. Hence, to identify the major sources of selected nutrients, all food items reported were classified according to their percent contribution to total daily intake of a given nutrient. The criterion for a food item inclusion in FFQ was the cutoff of 90% contribution to the nutrient's total content. Other nutrient sources for differentiating study subjects by intake levels were also included. The final FFQ list consisted of 60 food items for men, 59 for women and 60 for both men and women.

Serving sizes of each food item was divided into small (P25), medium (P50), large (P75) and extra large (P95) following the percentile weight distribution equivalent to household measurements usually used in 24HRs. Subject reports the number of times a food item was consumed and the unit of time (daily, weekly, monthly or yearly).

RESULTS

The main food items for total energy intake in men were rice (16.7%), beef (11.6%) and beans (9.3%) and in women were rice (16.0%), bread (9.3%) and beef (8.4%). When both men and women are analyzed together, the main sources of total energy intake were rice (16.4%), beef (10.2%) and bread (8.7%).

The Table shows the list of food items and their mean serving sizes in the FFQ developed for both men and women.[b]

DISCUSSION

In the present study, there were developed three FFQs, two gender-specific and one for both men and women, to be applied in epidemiological studies of adults based on a list of food items and serving sizes. It should be noted it is the first FFQ developed in Brazil with these features. Sichieri and Everhart[3] (1998) were the first authors to develop a 73-item FFQ based on data from the National Study on Family Expenses (ENDEF, 1974–1975). However, over its 30 years, ENDEF have reported changes in both food habits and availability and intake of food items. Also, the advent of globalization and new emerging markets have led to the development and access to new products, which has called for new evaluation instruments designed based on an updated database.

Other questionnaires have been developed in Brazil targeting specific population groups. The FFQs developed in the present study have been conceived to test epidemiological and nutritional hypotheses in studies primarily carried out in São Paulo. Since two of these ongoing studies are gender-specific, it was decided to develop gender-specific questionnaires aiming at increasing accuracy for estimating nutrient's content in habitual diet.

Besides calorie supply of food items, the present study investigated an additional 22 nutrients for pre-selection of food items to be included in the FFQ. Based on the original database, it was possible to assess 139 food compounds as well as to estimate for the first time the percent contribution of the food items studied to bioactive compounds and nutrients with evidenced role in the pathophysiology of chronic diseases such as carotenoids, flavonoids and tocopherols. This is at the same time a strength and a limitation of the present study. The fact that the program used in the calculation of diets was based on the American dietary data table (USDA) restricted the inclusion of Brazilian food items. The best approach would be a Brazilian table but the list of food items, as well as nutrients and bioactive compounds, included in currently available tables in Brazil is more incomplete.

The application of Block et al[1] (1985) formula resulted in a relatively low number of food items that comprised almost the total energy intake and all nutrients selected from the diet of subjects in São Paulo.

[a] Alves CGPA. ISA-Capital. Plano de amostragem. In: Universidade de São Paulo. Universidade Estadual Paulista. Universidade Estadual de Campinas. Secretaria de Estado da Saúde-SP. Secretaria Municipal de Saúde-SP. Inquéritos de Saúde. São Paulo; 2001. [Access at 13/09/07] Available at http://hygeia.fsp.usp.br/isa-sp/pdf/planoamostralisacapital.pdf.

[b] The tables for men or women are available under request to the first author.

Table. Average serving sizes (grams and household measurements) of Food Frequency Questionnaire food items.

Food item	*ASS (g)	Household measurements
Avocado	106.75	2 full tablespoons (90 g)
Chocolate-flavored beverage mix (mixed with milk)	25.00	2 tablespoons (25 g)
Sugar/honey/jam	6.25	1/2 tablespoon (6 g)
Lettuce	30.00	3 medium-size leaves (30 g)
Whole grain/ polished rice	124.00	2 medium-size skimmers (120 g)
Banana	86.00	1 medium unit (86 g)
Boiled potato/mashed potato/boiled manioc/jicama (Mexican potato)/ taro	90.00	1 full skimmer (90 g)
Fried potato/chips	100.00	2 full tablespoons (100 g)
Ham and cheese sandwich/cheese and ham rolls/sfiha (meat with dough)/salty pastries	135.17	2 units or 2 medium slices (40 g)
Filled cookies/wafer	40.50	3 units (42 g)
Plain cookies/crackers	26.00	4 units (24 g)
Cake (plain/with filling)	60.00	1 medium slice (60 g)
Coffee or tea (with sugar)	102.34	2 cups of coffee (90 mL)
Coffee or tea (with no sugar)	96.09	2 cups of coffee (90 mL)
Persimmon	-	-
Beef (steak/cubes/ground/giblets/guts)	100.00	1 medium steak or 2 slices (100 g)
Pork (loin/chop)	100.00	1 medium slice (100 g)
Salt-cured meat	39.28	2 small slices (40 g)
Carrot	25.00	1 tablespoon (25 g)
Beer	703.01	2 cans (700 mL)
Chocolate/chocolate candy (brigadeiro)/bonbon	25.00	1 small bar or 2 tablespoons (25 g)
Cold cuts (ham/mortadella/salami/frankfurter)	30.00	2 medium slices (30 g) or 1 unit (40 g)
Manioc flour or corn/toasted cassava flour/couscous/oats/tapioca	40.00	3 tablespoons (40 g)
Beans (carioca/purple/black/green)	86.00	1 medium-size ladle (86 g)
Feijoada (Brazilian black beans stew)/ “feijão-tropeiro” (bean stew)	210.67	1 medium-size ladle (210 g)
Chicken (wings and other parts)/other birds	61.60	1 slice or 1 small fillet (60 g)
Guava	253.61	1 large unit (225 g)
Hamburger/nuggets/meat balls	62.50	1 medium unit (60 g)
Cruciferous vegetables (broccoli/cauliflower/cabbage)	30.25	1 stem or 2 tablespoons (30 g)
Yogurts	160.51	1 small unit (140 g)
Orange/acerola cherry/tangerine/lemon	180.00	1 medium unit
Milk (all sorts)	128.92	1/2 large glass (125 mL)
Lentil, dry peas, chick pea, soybean	40.00	1 tablespoon (45 g)
Sausage	60.00	1 medium segment (60 g)
Apple/pear/pineapple/other fruits	108.00	1 medium unit (110 g)
Pasta (with meat sauce/lasagna/gnocchi)	104.78	1 full skimmer or 1 small slice (110 g)
Pasta (with non-meat sauce)	200.00	1 flat bowl (200 g)
Mayonnaise/salad dressing/dip	16	1 flat tablespoon (17 g)
Babaco	155.00	1 slice or 1/2 medium unit (160 g)
Butter/margarine	13.50	3 knife tips (15 g)
Watermelon/melon	95.00	1/2 medium slice (100 g)
Soya sauce (shoyu)	4.31	2 teaspoons (4 g)
Other vegetables (spinach/chard/arugula/watercress/endive)	35.00	1 small bowl (38 g)
Other vegetables (eggplant/zucchini/chayote/beet/cucumber)	30.00	1 full tablespoon (30 g)
Egg (fried/boiled)	50.00	1 unit (50 g)
Bread (French roll/others)	50.00	1 unit or 2 slices (50 g)
Fish/parsley and anchovy appetizer/anchovies/sea food	100.00	1 small fillet or 1 small steak (100 g)

To be continued

Continuation of Table

Food item	*ASS (g)	Household measurements
Pizza/pancake	191.64	2 small slices or 2 units (180 g)
Polenta	81.75	1 slice small (100 g))
White cheese (Minas/cottage/"coalho")	30.00	1 medium slice (30 g)
Yellow cheese (mozzarella/"prato"/Parmesan/provolone/cheddar)	30.00	1 ½ thick slices (30 g)
Soft drink/sugarcane juice	251.58	1 large glass or 3/4 of a can (250 mL)
Salt for salad seasoning	0.35	1 thumb tip (0.35 g)
Mayonnaise salad with vegetables	89.68	3 tablespoons (90 g)
Appetizers (turnover dough/turnovers/chicken wings/cheese pastry/ tempura/patty)	82.09	1 large unit (80 g)
Sandwich (hot dog/hamburger)	218.91	2 plain units (220 g)
Desserts/cakes/sweet pies/pudding	61.72	1 slice or 1 medium slice (60 g)
Soups (vegetables/chicken/cream/etc.)	151.13	1 medium-size ladle (150 g)
Processed juice	240.00	1 large glass (240 mL with 10.8 g powder)
Natural juice	82.51	1/2 190-mL glass (80 mL)
Tomato/tomato sauce	40.95	3 medium slices (40 g)
Grape	-	-

*ASS - Average serving sizes

The FFQ design enables a more flexible food frequency choice and its analysis as a continuous variable, preventing subject misclassification by categories of intake.

The next step, the assessment of FFQ validity and reproducibility in target populations, is already being conducted. Validity is a property of an instrument applied to a given population and should be measured in every new study comprising different populations at different times. Since the early discussions in the literature on approaches for food intake assessment, it has been recommended studies in subsamples for standardization and quantification of the error of estimate measures of dietary intake in epidemiological studies in a large sample.[2] A computer program was designed for FFQ calculations and reports can be produced based on the database for individual nutritional advice, meeting research ethical criteria.

Since the FFQs here presented were developed based on a database of food intake of a representative sample comprising individuals of different income levels in the city of São Paulo, it is suggested its use in epidemiological studies in this population, either as gender-specific or general FFQ along with sub-studies for validation and/or calibration of dietary data.

ACKNOWLEDGMENTS

To the nutritionist Juliana Teixeira, graduate student of Faculdade de Saúde Pública of Universidade de São Paulo, for her help in the development and review of household food measurements of FFQ food items.

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Financed by the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq – Proc. N. 502948/2003-5).