



Applied nutritional investigation

Calibration of the food list and portion sizes of a food frequency questionnaire applied to free-living elderly people

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ABSTRACT

Objective: To calibrate the food list and relative portion sizes of a food frequency questionnaire (FFQ) for application to a free-living, healthy, elderly population.

Methods: Cross-sectional study. One hundred free-living, healthy participants, aged from 60 to 75 y, randomly selected from among individuals in the area served by the Family Health Program, School of Medicine of Ribeirao Preto, University of São Paulo. A Food Frequency Questionnaire (FFQ) and a Diet History Questionnaire (DH) were applied by trained dietitians. Each food item of the FFQ had its portion size recalculated according to the percentiles referenced by the volunteers in the DH (25th = small, 50th = medium, and 75th = large). The list of foods and portion sizes of the original FFQ and those obtained by the application of the DH were compared. The percent contribution of energy, protein, fat, carbohydrate, folic acid, vitamin C, calcium, and fiber of each food item mentioned in the FFQ was determined from the data obtained by the application of the DH.

Results: FFQ, as compared with the DH, provided good estimation of the intake of protein, calcium, folic acid, and fiber (paired *t* test $P < 0.05$). Portion sizes of the FFQ differed from those obtained by the application of the DH (–23% to 300%).

Conclusions: Adjustments to the FFQ in particular, new portion sizes and a reduction of the food list were found to be appropriate for application to healthy, urban, free-living elderly people in Ribeirao Preto, Brazil.

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Introduction

The Brazilian population is aging fast. The number of Brazilians aged 60 y or more is 20 million, or 10.5% of the total population, of which 82% live in urban areas [1]. As a consequence, the pattern of diseases is also changing, with the prevalence of chronic disabling diseases increasing sharply and the prevalence of infectious diseases decreasing. As diet patterns are clearly

involved in the pathogenesis of age-associated chronic diseases [2], the development and validation of accurate methods for the assessment of food intake is important for a reliable evaluation of local dietary patterns. Moreover, studies on the impact of diet on the health status of older populations have shown that a better evaluation of the methods used for the assessment of food intake is clearly needed [3].

The Food Frequency Questionnaire (FFQ) is considered a useful tool for the evaluation of the intake of food and nutrients. Epidemiology studies show important associations between diet, as assessed by this method, and chronic diseases. However, FFQs are frequently applied to different populations without

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adequate adaptation. Adjustments to the FFQ improves the accuracy of nutrition research studies [4,5].

The determination of the food list is one of the main components of the adjustment of the FFQ for a given population. When the list is well defined, the length of the interview and the participant burden are reduced, as a long interview may be tiresome for some interviewees. Also, a food list that does not include items usually consumed by the studied population may lead to underestimation of food intake.

Another important component is the portion size, defined as the weight and unitary size that best represent the usual intake [6]. Portion sizes that are not adequate for a given population lead to significant inaccuracy in the estimation of food intake. Also, the use of pictures showing the different portion sizes of a food item during the application of the questionnaire may improve the accuracy of the quantification of intake, especially when the participants are older [7].

This research was aimed to calibrate and evaluate the adequacy of the food list and portion sizes of a FFQ, originally designed for use in an adult Brazilian population, when applied to an elderly population.

Materials and methods

Patients and study design

One hundred persons aged from 60 y to 75 y, living in the area served by the Family Health Program of the School of Medicine of Ribeirão Preto, São Paulo, Brazil, participated in this research. The area is medium-to-low income, with about 2,000 inhabitants aged 60 y or more. The selection of participants covered all the census areas of the neighborhood (2000 census). Houses were randomized, and persons living in the selected houses were invited to participate. Inclusion criteria were being free-living, independent, and ages 60 y to 75 y. Exclusion criteria were being bed-ridden or dependent, having severe health impairment due to cerebrovascular and other chronic diseases, having uncontrolled chronic diseases, undergoing weight gain or loss, and being under prescribed diet restrictions. The study was approved by the local Human Research Ethics Committee, and all participants signed an informed consent before participating.

Anthropometric assessment

Volunteers had their weight measured on a Filizola ID 1500 scale with precision of 0.1 kg (Filizola, Brazil) and their height measured to the nearest centimeter by a stadiometer at head level with the subject standing barefoot, with feet together. Body mass index (BMI) was calculated as weight (kg) divided by height squared (m^2).

Assessment of food intake

The food intake of each volunteer was assessed by the application of a DH and a FFQ by trained dietitians during a single interview session. For the application of the DH, volunteers were asked to refer to a usual day within the last year. They were asked to list the foods they usually consumed (more than four times a week) from the first meal of the day until the last.

The FFQ applied in the present study was originally developed and validated for Japanese-Brazilian adults [8,9]. The Japanese foods were excluded from the original food list, as they were not usually consumed by the population involved in this study [10]. The FFQ included the specification of the habitual intake frequency of each food item (daily, weekly, or monthly), and the usual portion sizes, classified as small, medium, and large. The FFQ included 120 food items, but the interviewer was allowed to add foods that the interviewee consumed at least once a month but were not mentioned in the original FFQ. The questionnaire also included questions about the intake of supplements.

During the application of the FFQ, a book with pictures showing the different portion sizes was used to avoid bias and facilitate the classification of the portion sizes [11]. Before data collection, the dietitians were trained in order to standardize the application of the FFQ and the DH.

A complete recheck of codes was performed before the registration of data and double keying was used for data entry. Food intake, when assessed by the application of the FFQ, was analyzed with the DietSys 4.02 software (1999; HHHQ DietSys Analysis Software, National Cancer Institute, Bethesda, MD, USA) and, when assessed by the application of the DH, with the Dietpro

Table 1
Characteristics of the volunteers

Gender	Number	Age (y)		Weight (kg)		BMI (kg/m^2)	
Female	59	66.2	3.7	66.9	10.7	28.2	4.7
Male	41	66.5	4.4	74.6	12.7	26.7	3.8
Total	100	66.3	3.9	70.0	12.1	27.6	4.4

Data are presented as mean and standard deviation

4.0 software (São Paulo, Brazil, 2004). Data were always typed in by the same dietitian. The Food Composition Tables from the United States Department of Agriculture [12] and from the official Brazilian Food Composition Data [13] were used for analysis.

The intakes of energy and nutrients (protein, fat, carbohydrate, calcium, fiber, vitamin C, and folic acid) obtained by the application of the FFQ and DH were compared.

The percent contribution of energy, protein, fat, carbohydrate, folic acid, vitamin C, calcium, and fiber [14,15] of each food item mentioned in the FFQ was determined by comparison with the data obtained by the application of the DH. To identify the contribution of each nutrient of the different food items, the method proposed by Block et al. [16] was used, according to the following equation:

% contribution of nutrient k by food item i = amount of nutrient k supplied by food i \times 100/amount of nutrient k supplied by all food intake

Portion sizes were determined according to the weights obtained by the application of the DH. Small, medium, and large sizes were defined, respectively, as the 25th, 50th, and 75th weight percentiles. If the person ate more than one food item of the same group, the portion size was determined by the food item most frequently consumed.

The adequacy of the food list of the FFQ was evaluated by comparison with the food items referred during the application of the DH.

Statistical analysis

Mean and standard deviation (SD) were calculated for the total nutrient intake obtained by the FFQ and DH. The Shapiro-Wilk test was used to verify normality. Because the distribution of most nutrients was skewed towards higher values, all variables were log (natural) transformed before statistical analysis. The Student's *t* test for paired samples was used to compare the results of the application of the FFQ and DH.

All statistical analyses were performed using the SPSS software version 16.0. *P* values ≤ 0.05 were considered significant.

Results

Fifty-nine volunteers were women, mean age was 66.3 y, and BMI was 27.6 kg/m^2 (Table 1). There were no significant differences between genders, so the results shown represent the whole population.

The mean consumption of energy and nutrients (excluding supplements) estimated by the FFQ and the DH is shown in Table 2. There were significant differences in the estimated consumption of almost all nutrients, except for protein, calcium, fiber, and folic acid.

Table 3 shows the distribution, in percentiles, of the weight of the portion sizes of all foods listed in the FFQ, according to the sizes obtained by the application of the DH.

Table 2

Mean intake of energy and nutrients as estimated by the Food Frequency Questionnaire (FFQ) and the Diet History (DH) in elderly volunteers (n = 100)

Nutrients	FFQ		DH		P value
	Mean	SD	Mean	SD	
Energy (kJ)	7824.0	3090.7	6711.5	2956.4	<0.005
Protein (g)	71.3	29.3	69.5	35.3	0.082
Fat (g)	60.6	25.4	50.5	31.8	<0.005
Carbohydrate (g)	253.9	112	215.0	94.4	<0.005
Calcium (mg)	607.4	315.2	607.0	321.0	0.981
Fiber (g)	17.3	9.3	16.4	11.7	0.055
Vitamin C (mg)	215.1	147.4	153.1	170.7	<0.005
Folic acid (mg)	226.5	121.8	259.6	163.0	0.132

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