

Development of a food frequency questionnaire for an adult population living in Santo Amaro, Bahia, Brazil

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Abstract

This study has aimed to describe the elaboration of a food frequency questionnaire (FFQ) for the adult population living in Santo Amaro, Bahia, Brazil. It was a cross-sectional study conducted with 50 adult subjects of both sexes in the city of Santo Amaro from August to September, 2013. The roll of items consisted of 91 food items distributed in 7 categories of consumption and in 15 food groups. The first FFQ was applied on the study population with the 24h recall (R24H). From the initial FFQ, 38 food products were excluded, representing 41.77% of the list. The foods mentioned by at least 15% of the study population were kept in the FFQ, highlighting the group of fruits, with a consumption percentage larger than or equal to 90%; of the groups of vegetables, sugars and sugary products, dairy products, bakery products, beverages, meats, grains, pasta and flour. The final FFQ list presented 53 food items. Noteworthy, with this instrument food consumption assessment is going to be more reliable, as it approximates to the local reality of the population studied, contributing with research that investigates the relationship between food consumption and health conditions. The conclusion is that the initial FFQ associated with the R24h were important instruments that outlined the construction of the proposed FFQ, which considered the food habit of the study population, expressing higher quality to the instrument, practicability and an optimized application time.

Key words: Food Consumption. Questionnaires. Eating Behavior. Epidemiology.

Introduction

Nutritional epidemiology has shown that the Brazilian population's dietary pattern has been reversing in the last two decades. It appears that the consumption of natural foods such as fruits, vegetables, legumes and roots has been replaced by food sources into sugars, saturated and trans fats, processed and/or highly processed foods.¹ This dietary pattern identified over time, associated with changes in lifestyle, characterizes the nutritional transition and has been identified in the scientific literature as a modifiable risk factor for the occurrence of chronic diseases in all life cycles.^{2,3}

For these patterns to be investigated, it is crucial to analyze the individuals' or population's food consumption by means of food consumption surveys. Among the most used in nutritional epidemiology, the Food Frequency Questionnaire (FFQ) stands out.^{2,4,5} This one is described in the scientific literature as an instrument to classify individuals according to their usual eating patterns and associate them with health conditions. It should be stressed that it is an easy to apply and low cost instrument, which enables its use in population studies.⁶

This dietary survey method is designed to obtain qualitative and quantitative information on the intake of specific foods or nutrients,⁷ being also used to investigate the usual food intake in short or long term periods.^{8,9}

Brazilian population's food consumption has regional differences and is influenced and conditioned by several factors, such as culture, socioeconomic conditions, food availability, food access, physiological conditions and inherent nutritional needs of each stage of human life.¹⁰ Therefore, according to Willet⁶ and Cade et al.,¹¹ to develop a tool to identify food consumption, one must consider all these factors, besides the research objectives, the study design, the resources available and the unique characteristics of the target population.

Given the above, the need to develop an instrument to assess food intake by region is evident, since each population has specific characteristics that should be considered in order to approach the food reality of the group studied. In this sense, the present study has aimed to describe the development of a food frequency questionnaire for the adult population of Santo Amaro, Bahia, Brazil.

Methodology

Study population

This is a cross-sectional study conducted with adults of both sexes, users at the Brazilian Unified Health System (SUS) of the municipality of Santo Amaro, Bahia, Brazil, in the period August-September 2013. Users registered in Brazilian Family Health Units (USF) were considered eligible for the study, with ages greater than or equal to 18, resident and domiciled in the city where the study was conducted. And as ineligible, adolescents and adults with health problems. It should be noted that there were no refusals.

The study consisted of a convenience sample, in which the minimum sample required for preparation and instrument validation for dietary assessment were adopted, as suggested by Burley¹² and Slater et al.⁹ Thus, the study presents 50 individuals, constituting the first stage of the study-matrix, which has aimed to identify the population's eating habits and thus develop a plausible tool for the local food reality.

In the initial approach to the study, the research purposes were presented, and those who agreed to participate completed a questionnaire with socioeconomic and demographic information. An initial FFQ was applied, together with a 24h aide-mémoire (R24h). The participants in the research signed an Informed Consent Form (TCLE), as recommended by Brazilian National Health Council Resolution no. 466/2012¹³ and they were free to choose not to participate in the study if they believed that their physical and moral integrity was impacted. The matrix project, which includes the study sub-sample, was approved by the Ethics Committee of Brazilian Universidade Federal do Recôncavo da Bahia in March 2013 (CAAE: 04022312.0.0000.0056 and legal opinion: 219566).

Data collection was carried out from August to September 2013 in the city of Santo Amaro, Recôncavo of Bahia, Brazil.

Constructing the initial FFQ

The FFQ used was constructed based on the data obtained by the IBGE [Instituto Brasileiro de Geografia e Estatística (Brazilian Institute of Geography and Statistics)],¹⁴ Census 2006, which contains the municipal agricultural production in the city of Santo Amaro, BA, and in the 2008/2009 Brazilian Family Budgets Research (POF).¹⁴ The aim was to obtain more reliable data on the products produced by the region and the family budget and consumption habits, based on the literature on the northeastern Brazil population's typical regional foods.¹⁵

The list consisted of 91 food items distributed into seven consumption categories (never, less than once a month, one to three times per month, once a week, two to four times a week, once daily, and two or more times daily) and distributed into 15 food groups. The similarity of the food nutritional characteristics and the cultural and regional aspects were considered, based on the Brazilian food pyramid.

The pilot project and restructuring the FFQ

A minimum sample was selected for the pilot experiment of the larger study, entitled “Risk assessment in the consumption of food potentially contaminated with heavy metals in Santo Amaro, BA.” In such pilot study, were tested the research general questionnaire, the initial FFQ constructed based on the food mentioned in the 2003/2009 POF,¹⁶ as well as the regional food. Then the R24h was applied, a food survey necessary to determine the most consumed food by the adult population residing in the municipality. This instrument provided support to include the food that was usual in the FFQ list to be developed. It should be highlighted that the R24h acts as a benchmark to compare the data investigated by the FFQ in validation and calibration studies.⁹

Therefore, the participants answered to the initial FFQ and the R24h in 40 minutes. For the purposes of the FFQ, the researcher presented the participants a list of foods and drinks and asked the frequency of consumption, if daily, weekly, monthly or never (never, less than once a month, one to three times per month, once a week, two to four times a week, once daily, and two or more times daily). As for the R24h, the respondent was asked to inform the consumption of all foods and drinks consumed in a 24-hour period. Recall techniques were also employed, such as rapid listing, detailed description and review. This technique contributes to the respondent’s memory.

The interviews were conducted by students of Nutrition and Biological Sciences courses, previously trained by the project research team. After implementing and revising the instruments, a comparison was carried out between the food referenced in the R24h and the food listed in the initial FFQ. In order for the food mentioned in the R24h to be part of the FFQ list, the frequency of consumption of at least once a week was adopted as a criterion, thus characterizing it as food usually consumed,⁶ besides presenting at least 15% of mentions, either as a food item consumed alone or as an ingredient for preparations.¹⁷

The FFQ foods that had less than 15% of mentions and/or consumption were excluded from the final list. In addition, during the FFQ restructuring process, for items that had large varieties the name “others” was established to identify names for regional food. Also included in the FFQ list were food sources of iron and calcium obtained from the Brazilian Food Composition Table (TBCA-USP), because they are considered as intervening in lead metabolism, which is an object of study in the matrix research.

After including and excluding items in the FFQ final list, foods were regrouped considering the nutritional similarity and the evaluation was carried out by judges. Two nutrition professors in the Dietetic and Food Technique area, with experience in botanical and nutritional classification of foods as well as development and implementation of food frequency questionnaires were considered judges.

The researchers assessed the FFQ separately regarding the food groups composition and the general structure. This is a qualitative-type instrument. Therefore, it has the option of food consumption by food groups, without adding serving size.

Collection and processing of data

Data collection was obtained from applying the initial FFQ and R24h, according to the methodology proposed by Slater,⁹ in order to identify foods that were likely to be of regular consumption.

The data on food consumption were entered and analyzed using the statistical software SPSS® version 17.0. To do so, the frequency of consumption of each food was converted on daily frequency, as recommended by Coelho et al.,⁴ whose value 1 is once a day consumption. And if the food was consumed more than once a day, it would be multiplied by the daily frequency range reported. For the options involving time intervals, the average interval of frequencies divided by the period was used, if weekly (7) and monthly (30), as described in Chart 1.⁴ Thus, all frequencies mentioned were converted into daily frequency in order to use only one time unit to carry out the subsequent analyses with validation purposes.

Chart 1. Frequency conversion of the Daily Food Frequency Questionnaire. Santo Amaro, BA. August to September, 2013.

Frequency	Amount assigned
Never	0
Less than once a month	0.03
1 to 3 times a month	0.07
Once a month	0.14
2 to 4 times a week	0.43
Once a day	1
Twice or more a day	2

Results

Of the 50 individuals analyzed, 82% were females, with a mean age of 39 years (SD: 15).

Considering the exclusion criteria clarified in the methodology, 38 food items were excluded from the initial FFQ, representing 41.77% of the list of foods (Table 2). Despite the exclusion of these foods, there was no exclusion of any of the previously selected food groups.

Chart 2. Food excluded from the final FFQ list. Santo Amaro, BA. August to September, 2013.

Food group	Food excluded
Fruits	Cocoa, cashew, sugarcane, coconut, soursop, watermelon, jocote, tangerine
Horticulture	Sweet potato, beets, breadfruit, yam, cucumber, arugula, celery, green beans
Oilseeds	Peanuts, nuts
Sugars and sugary products	Honey, desserts, ice cream
Dairy products	<i>Requeijão</i> (milk-derived product, produced in Portugal and Brazil)
Bakery products	Baked snacks, fried snacks, sandwiches
Beverages	Teas, artificial juice
Meats	Goat, quail, game, sheep
Grains	Black beans, green beans, black-eyed beans, pigeon peas
Pasta	Instant noodles
Eggs	Quail egg
Flours	<i>Tapioca</i> (starch extracted from cassava root)

The final FFQ list presented 53 food items, organized by groups of foods with similar nutritional and botanical characteristics (Chart 3).

Chart 3. Food making up the final FFQ list, classified by food group. Santo Amaro, BA. August to September, 2013.

Food groups	Food
Fruits	Pineapple, <i>acerola</i> (also Barbados cherry, West Indian cherry and wild crepe myrtle), banana, guava, orange, lemon, mango, passion fruit.
Horticulture	Pumpkin, cassava, lettuce, potato, green onion, carrots, chayote, cilantro, small and thick mint, pepper, bell pepper, okra, tomato
Oilseeds	Palm oil
Sugars and sugary products	Cake, sugar
Regional food preparations	<i>Abará</i> , <i>acarajé</i> [a dish made from peeled beans formed into a ball and then deep-fried in <i>dendê</i> (palm oil)]
Dairy products	Cheeses, fresh milk
Bakery products	Bread
Food preparation	Soup
Beverages	Water, coffee, natural juice
Meats	Beef, chicken, pork, meat preserved in salt [dried meat, <i>carne-de-sol</i> (Portuguese for “sun-dried meat,” literally “meat of sun,” also called <i>jabá</i>), jerky]
Fish	Freshwater fish, saltwater fish, oysters, mussels, <i>chumbinho</i> , <i>callinectes</i> , crab, <i>lambreta</i> , <i>mapé</i> shellfish, sardines
Grains	Rice, pinto beans
Pasta	Pasta (lasagna, macaroni)
Eggs	Chicken eggs
Flours	Flour, maize flour

The foods mentioned by at least 15% of the study population are shown in Table 1, highlighting some food items of the fruit group, which exhibited percentage consumption higher than or equal to 90% [*acerola* (also Barbados cherry, West Indian cherry and wild crepe myrtle), banana, guava, orange and mango)], potherb (pumpkin, carrots, cilantro, bell pepper, okra and tomato), sugars and sugary products (cake, sugar), dairy (milk), bakery products (bread), drinks (water, fresh juice), meat (beef, chicken), grains (rice, pinto beans), pasta and flours. Foods less consumed by the population with a percentage of consumption lower than 60% were pork, fish and regional preparations *abará* and pepper.

Table 1. Percentage of food consumed by the study population according to the evaluation by the FFQ method. Santo Amaro, BA. August to September, 2013.

FOOD ITEMS	N	%
Pineapple	34	68
<i>Acerola</i> (also Barbados cherry, West Indian cherry and wild crepe myrtle)	47	94
Banana	45	90
Guava	47	94
Orange	48	96
Lemon	42	84
Mango	46	92
Passion fruit	41	82
Pumpkin	46	92
Cassava	42	84
Lettuce	42	84
Potato	41	82
Green onion	34	68
Carrot	45	90
Chayote	33	66
Cilantro	48	96
Small and thick mint	42	84
Pepper	26	52

to be continued

FOOD ITEMS	N	%
Okra	47	94
Bell pepper	45	90
Tomato	47	94
Palm oil	41	82
Cake	47	94
Sugar	47	94
Abará	30	60
<i>Acarajé</i> [a dish made from peeled beans formed into a ball and then deep-fried in <i>dendê</i> (palm oil)]	34	68
Cheeses	38	76
Fresh milk	48	96
Bread	49	98
Soup	41	82
Beef	48	96
Chicken	49	98
Pork	23	46
Meats preserved in salt	44	88
Fish	28	55
Rice	49	98
Pinto beans	48	98
Pasta (lasagna, macaroni)	47	94
Chicken eggs	42	84
Cassava flour	47	94
Maize flour	39	78
Water	50	100
Coffee	42	84
Fresh juice	46	92

With the aid of the R24h, two foods (*mapé* shellfish and sardines) which initially had not been considered in the initial FFQ list were identified. However, considering the criterion “consumption frequency at least once a week” and to present at least 15% of mentions, these two items were included, aiming to cover the population’s eating habits.

Food sources of calcium and iron were also inserted, such as meat and dairy products, to meet the study goal of identifying food sources of calcium and iron consumed by the population in order to assess their interference on lead absorption by the body.

Discussion

This study has allowed us to describe the development of an FFQ with 53 specific food items for the Northeastern Brazil population. It is noteworthy that with the tool developed and validated in the study population, the assessment of food consumption is going to have greater reliability by approaching the local reality and eating habits, contributing to research investigating the relationship between food consumption and health conditions.

It is noted that the measurement of the usual food intake is considered one of the most challenging tasks of nutritional epidemiology.¹⁸ However, many different solutions have been used over time to facilitate and approach the population’s actual feed consumption. Among these, there is the development and validation of tools to investigate the population’s food consumption.

According to Machado et al.,¹⁹ the FFQ is an important tool to assess the food consumption of a given population in a more practical and reduced fashion. To develop the FFQ it is necessary to determine which foods are going to be included in the list, the type of FFQ classification, if qualitative, semi or quantitative, and then decide which consumption frequency categories are going to be employed.²⁰

Regarding the list construction, Willett²¹ describes a methodological approach to be followed by identifying the foods that are important sources of nutrients, using information from food composition tables or data collected by food record or R24h. Thus, the study has followed the methodological procedures suitable to construct the FFQ food list and identify food sources of iron and calcium to associate them with lead metabolism, which is the matrix research object. The advantage of using this approach is that the number of items in the food list is lower, making the FFQ faster, less expensive in practice and unlikely to fatigue.

The application of the FFQ by trained interviewers decreases the frequency of errors in completing the tool, even with participants having an average or higher education level.²² Carvalho et al.²³ reinforce the idea that conducting a pilot study allows the collection team's improvement as well as instructions reformulation. Thus it reduces possible biases that might interfere with data reliability, contributing to the collection tool standardization.

The importance of the pilot study to reduce the food list is highlighted, which is usually performed in the same population group under study.²⁴ Despite the simplification of the food list that makes up the FFQ, this one can not lose its essence, which is to evaluate the closest as possible the actual food consumption by the population. For this it is necessary to follow the recommendations by authors such as Fisberg et al.²⁵ and Colucci.²⁰ These show that lists with less than 50 food items do not measure exactly the food intake and lists with more than 100 items can cause fatigue and boredom during their completion, causing biases. In this sense, it is observed that the FFQ developed in this study follows the recommendations described in the scientific literature.

In a study on the development of the FFQ food list carried out by Furlan-Viebig & Pastor Valero,²⁶ information collected by the R24h was used, in which individuals reported in detail the food and drink consumed in the 24 hours preceding the interview. These foods served to make up the study FFQ list.

Reducing the extent of the FFQ food list is important as a way to simplify, facilitate understanding and application of the questionnaire in the field, avoiding refusals. However, this procedure should be methodologically and carefully adopted in order to keep in the final list the main food representing the regular intake by individuals and/or populations.²³

In general, studies aimed at reducing food lists in frequency questionnaires are developed to assess the intake of specific nutrients or food group.

Considering the importance of the food list for a better result on the study of eating habits, the initial FFQ of this study was an essential tool for the preparation of the final FFQ (in a reduced model). It is summed up in 53 foods grouped into 15 food groups, representing the use of 58.24% of the food items present in the initial FFQ. Such percentage is close to that obtained by Chiara et al.,²⁷ which was 50% of use of the initial FFQ for the final FFQ in a study with adolescents. This reinforces the need to reduce the items on the food list with various audiences.

In this perspective, it is observed that the food list that makes up the FFQ is representative of the population under study by taking into consideration, at the time of preparation, important determinants of food intake assessment, such as access, income, culture, regionalism and nutritional composition of the food, and these considerations were described by the *Guia Alimentar Brasileiro* (Brazilian Food Guide).¹⁰

The FFQ list in this study was compared to the information contained in the POF,¹⁶ with the aim of detecting foods which had not been reported in the R24h, but which could be important components for the study population's usual intake. However, it was observed that food purchased by Santo Amaro families had been included in the final FFQ list, revealing precision in gathering this information, as they approached the usual diet.

According to Matarazzo,²⁸ the quality of information on diet is going to be determined by the recording tool accuracy and validity, which should be specifically evaluated for each study population.

It should be noticed that both FFQ and R24h have limitations inherent to the method itself, such as the recall bias, i.e., the individual may have difficulty remembering all food consumed. However, procedures that minimize these errors described in the literature were employed and they contribute to the interviewee reminding it, such as memory techniques (rapid lists, detailed description and review).²⁵ Then, every care to minimize errors was considered in the preparation of the instrument, so that, once applied, it can more trustingly represent the study population's food intake.

A limitation of the study proposed is the small sample size. However, it has been observed in the scientific literature that other studies working on FFQ development and validation use the same sample number and this number is referenced by Slater et al.⁹ as borderline for implementation.

As for the research positive aspects, it should be highlighted that it was developed with a population in Northeastern Brazil lacking in studies involving the area of food consumption. In addition, to prepare the FFQ, all the conditions necessary for analysis were taken into account. It is noteworthy, however, that only one FFQ and one R24h were used and for more accuracy in future analyses more than one application of R24h is recommended, aiming to make more precise the investigation of the population's food consumption.

Conclusion

Based on the data observed, it is concluded that the initial FFQ and R24h were important instruments that methodologically outlined the construction of the FFQ proposed, especially regarding the food list reduction, expressing the instrument higher quality, practicality and optimization of the application time.

It is possible that the list of 53 foods of this FFQ represents the "habitual" diet of the population in Santo Amaro, BA, Northeastern Brazil. When proven the instrument validity (study in progress), it can be used in future epidemiological studies seeking to investigate the relationship between diet and health.

Studies like this are important to describe methodologically the construction of a specific food consumption research tool for the population, approaching the intrinsic relationship between actual food consumption and observed food consumption and contributing to other studies that have the same goal. In addition, the food consumption evaluation results investigated for these instruments can be associated with the population's health conditions in order to identify protective food groups and risky food groups for particular health problems, contributing to public health policies.

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