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ORIGINAL ARTICLE / *ARTIGO ORIGINAL*

Design of a digital and self-reported food frequency questionnaire to estimate food consumption in adolescents and young adults: birth cohorts at Pelotas, Rio Grande do Sul, Brazil

Desenho de um questionário de frequência alimentar digital autoaplicado para avaliar o consumo alimentar de adolescentes e adultos jovens: coortes de nascimentos de Pelotas, Rio Grande do Sul

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ABSTRACT: ***Purpose:*** Methodological paper aiming to describe the development of a digital and self-reported food frequency questionnaire (FFQ), created to the 1982 and 1993 Pelotas Birth Cohorts. ***Methods:*** The instrument was created based on FFQs previously applied to subjects belonging to both cohorts in the 2004 and 2008 follow-ups. The FFQ was developed including 88 foods and/or meals where frequencies were clustered from a minimum of never or once/month to a maximum of greater than or equal to 5 times/day. The closed options related to portions were based on a 24-hour recall previously asked to a subsample from the 1993 cohort. Three options for portions were created: equal to, less than or greater than. Equal to portion was described based on the 50 percentile of each food consumed reported in a 24-hour recall. Photographs of portions related to the 50 percentile for each food were also included in the software. ***Results:*** This digital FFQ included food and meals based on the needs of current researches. The layout of the software was attractive to the staff members as well as to the cohort members. The responding time was 12 minutes and the software allowed several individuals to use it at the same time. Moreover, this instrument dismissed interviewers and double data entry. ***Conclusion:*** It is recommended the use of the same strategy in other studies, adapted to different contexts and situations.

Keywords: Questionnaires. Data collection. Database. Food consumption, Eating habits. Longitudinal studies.

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RESUMO: ***Objetivo:*** Artigo metodológico com o objetivo de descrever a construção de um questionário de frequência alimentar (QFA) digital autoaplicado, desenvolvido para as coortes de nascimentos de Pelotas de 1982 e 1993. ***Métodos:*** O instrumento foi criado com base em QFAs anteriormente utilizados nas duas coortes em acompanhamentos nos anos de 2004 e 2008. O QFA foi elaborado incluindo 88 alimentos e/ou preparações cujas frequências foram agrupadas em categorias desde o valor mínimo de consumo de nunca ou < 1 vez/mês até o máximo de ≥ 5 vezes/dia. As opções fechadas relativas à porção foram construídas considerando recordatórios de 24 horas (R24Hs) anteriormente aplicados à subamostra da coorte de 1993. Três alternativas de porção foram construídas: igual, menos ou mais. A porção igual foi descrita com base no percentil 50 do consumo de cada alimento, obtido a partir das distribuições das porções constantes nos R24H. Fotos das porções relativas ao percentil 50 de cada alimento foram também incluídas ao formato do programa. ***Resultados:*** Esse QFA digital incluiu alimentos e preparações que atendem aos objetivos das pesquisas atuais. A aparência do programa foi atrativa à equipe de trabalho e também aos participantes do estudo. O tempo médio de aplicação de 12 minutos e a facilidade de preenchimento possibilitaram que vários participantes respondessem às questões ao mesmo tempo. Além disso, o instrumento dispensou a necessidade de entrevistador e a dupla entrada de dados em programa específico. ***Conclusão:*** Recomenda-se o uso dessa mesma estratégia em outros estudos, adaptando-a aos diferentes contextos e situações.

Palavras-chave: Questionário. Coleta de dados. Base de dados. Consumo alimentar. Hábitos alimentares. Estudos longitudinais.

INTRODUCTION

The evaluation of food consumption has been increasingly referred to when estimating the association between dietary factors and the development of non-communicable diseases and health problems (CNDHP)[1]. A challenge for researchers in nutritional communicable diseases and health problems epidemiology is to accurately measure the food intake of the populations. Despite all the difficulty inherent in the dietary assessment, the methods for investigation of food intake are basic tools in epidemiological studies focused on the nutrition area. In this sense, attempts have been made to create instruments capable of positively responding to the difficulties imposed by the complexity of human feeding[1,2].

The instruments for dietary evaluation must consider the extensive variability of food intake by the human individuals and groups, considering that feeding may vary from day to day, from week to week, and tends to go through more profound changes over the years. Besides, although there is a consistent pattern underlying the individual diet, many cultural, economic and environmental facts contribute to the variation of food intake[2,3]. Different methods, such as dietary history, daily food log, 24-hour recall (24HR) and food frequency questionnaire (FFQ), are used in order to evaluate the dietary intake[3].

Despite the diversity of available instruments, the FFQ has been considered the method of choice in epidemiological studies, especially when working with large samples[1,3]. The preference for the FFQ is based on its low cost and convenience in obtaining analyzing information. However, these advantages may be enlarged with the substitution of conventional method of use, such as questionnaires printed on paper, by the application of the digital instrument. Studies have shown that the researches with this kind of instrument have a series of advantages, once they allow continuous collection of data[3,4], in addition to being attractive especially to new generations.[5] Other advantages of this kind of use are speed and accuracy in the collection of data, considering that the answers of digital questionnaires be automatically stored in a database, eliminating the need for digitalization, reducing codification errors, and presenting reduced risk of data loss,[6] which decreases, consequently, the time and cost of data collection and the workload relating to the treatment of the data[7,8].

Considering the above, the digital self-administered FFQ was designed with the objective of estimating the dietary intake among the participants in birth cohorts, from 1982 and 1993, in Pelotas. This article describes the development of this questionnaire with the objective of allowing the replication of this process for the creation of other FFQs, in sync with the specific needs of each study.

METHODS

The city of Pelotas, located in the far south of the State of Rio Grande do Sul, Brazil, has 3 birth cohorts that were initiated at intervals of 11 years, the first one being the birth cohort performed in 1982. The FFQ presented here was developed in order to be used in the collection of data of the two first cohorts, at 30 (born in 1982—follow-up in 2012) and 18 years of age (born in 1993 — follow-up in 2011), respectively. The methodology of these two studies is briefly described below.

All hospital births occurred in 1982 and 1993 in the city of Pelotas were monitored, 5,914 and 5,249 live births included in a cohort study in the years of 1982 and 1993, respectively[9,10]. Both cohorts were monitored at different times[9]. In the years of 2004 and 2005 (cohort from 1982, participants aged 22 years) and 2008 (cohort from 1993, participants aged 15 years), all participants located were visited in their households and an FFQ, among other instruments, was applied by the interviewer. Additional information on the methods applied in such cohort studies may be found in other publications[9,11-13]. Between 2011 and 2013, all the participants from both cohorts were contacted and invited to attend to the Health Researches Center Amilcar Gigante (*Centro de Pesquisas em Saúde Amilcar Gigante*) for a new evaluation, in which 3,646 and 4,072 participants of the cohorts from 1982 and 1993, respectively, filled out a semiquantitative, digital and self-administered FFQ, whose creating process will be described herein.

ETHICAL ASPECTS

All the monitoring of birth cohorts in Pelotas was approved by the Ethics Committee of the School of Medicine of the Federal University of Pelotas. Since this article contemplates only the creation of the FFQ used in these follow-ups, it was not submitted to this committee.

RESULTS

EVOLUTION OF THE USE OF THE FFQ IN THE COHORTS OF PELOTAS

An FFQ was applied for the first time, in the birth cohorts of Pelotas, in 2004 and 2005, during the follow-up of the members of the cohort of 1982, when they were 22 years of age. This questionnaire was based on the list of foods included in the instrument proposed by Sichieri[14], adding the frequency of consumption of other foods of regional habits.

The FFQ used had a quantitative component (consisting of 70 foods) and a qualitative one (consisting of 15 food items) (Table 1). The recall period of this questionnaire comprised the 12 months previous to the interview, in order to capture the seasonal variation of the available foods. For each food item in the quantitative component, the participants were asked about the frequency of consumption and the amount consumed, considering that the frequency of consumption was collected openly. Thus, if the individuals would report consuming a given food, two questions would be asked in the sequence: "How many times?" (possible answers vary from zero to ten) and "How often?" (possible answers: day, week, month, or year). Regarding the quantities consumed, they were collected in household measures through the following question: "How many (...) do you eat/a time?". The (...) was replaced by the household measure u corresponding to each food (example: "how many spoons full of Rice do you eat/a time?") (Table 2).

In 2008, during the follow-up of the 15 years of age of the cohort of 1993, a FFQ was once again applied (Table 3). This questionnaire was based on the one previously applied to the participants of the cohort from 1982 at age 22. However, the FFQ became qualitative (without the size of the portion consumed) and consisted of 81 foods (Table 1). Differences in relation to the one applied in the cohort from 1982 in 2004 and 2005 were as follows:

- Does not include foods such as stew steak, fried chicken, bacon, corn, peppers, cream cheese, butter or margarine, Orange juice, and lemonade
- Includes chips, milk (whole and low-fat/skimmed), meat on the bone, soft drinks (regular and light), and artificial juices

In 2008, in the cohort of 1993, at 15 years of age, the frequency of consumption was also collected openly and was not requested for any information on the amount consumed. Thus, if the individual reported consuming a given food, they would be asked in the sequence:

Table 1. Food items that made up the food frequency questionnaire in the different follow-ups in the birth cohorts of 1982 and 1993 in Pelotas (RS).

Cohort Follow-up	Quantitative FFQ	Qualitative FFQ
1982 (2004-2005)	rice, beans, pasta, manioc flour, bread, homemade bread, bread made with whole wheat flour or rye, sweet or stuffed cookies, crackers, cake, polenta, French fries, baked potato, cassava, popcorn, lentils/ peas/garbanzo beans, lettuce, kale, cabbage, orange or bergamot, banana, papaya, apple, watermelon or melon, pineapple, avocado, mango, strawberry, grape, peach, guava, pear, tomato, chayote, pumpkin, natural cucumber, green beans, carrots, beets, cauliflower, eggs, milk, yogurt, queijo, steak, pork, chicken, fresh fish, shrimp, bauru or cheeseburger, stewed steak, hot dog sausage or sausage, hot dog, pizza, mayonnaise, finger food (kibe, pastel, empada), ice cream, sugar, candies, chocolate powder or Nescau, chocolate bar or goody, pudding or sweets, soft drinks, coffee, orange juice, lemonade, fruit juice, beer, wine, cachaça/ whiskey/ vodka	corn, peppers, cream cheese, butter or margarine, offal (kidney, liver, heart, gizzard, mondongo), fried chicken, canned fish (sardines or tuna), bacon, garlic, onion, salt-preserved meats (beef jerky, cod), canned food (peas, olives, palm), cold cuts (cakegna, salami, ham), barbecue, mate/chimarrão
1993 (2008)		rice, beans, pasta, manioc flour, bread branco, homemade bread, whole wheat bread, sweet or stuffed cookies, crackers, cake, polenta, chips/finger food, French fries or chips, baked potato, cassava, popcorn, lentils/peas/garbanzo beans, lettuce, kale, cabbage, orange or bergamot, banana, papaya, apple, watermelon or melon, pineapple, avocado, mango, strawberry, grape, peach, guava, pear, tomato, chuchu, pumpkin, natural cucumber, green beans, carrots, beets, cauliflower, eggs, milk, low fat milk, yogurt, cheese, boneless meat (steak, roast beef, stew, etc), meat on the bone (ribs, palette, etc), pork, chicken, fresh fish, shrimp, bauru or cheeseburger, hot dog sausage or sausage, hot dog, pizza, mayonnaise, finger food (kibe, pastel, empada), ice cream, sugar, candies, chocolate powder or Nescau, chocolate bar or goody, pudding or sweets, regular soft drinks, light soft drinks, coffee, fruit juice, artificial juices, beer, wine, other alcoholic drinks, garlic, onion, offal (kidney, liver, heart, gizzard, mondongo), canned fish (sardines or tuna), salt preserved meats (beef jerky, cod), canned food (peas, olives, palm), barbecue, mate/chimarrão

Continua...

Tabela 1. Continuação.

Cohort Follow-up	Quantitative FFQ	Qualitative FFQ
1982–1993 (2011–2012)	Cereals and tubers (rice, whole wheat or black bread, White bread, homemade bread, pasta, manioc flour, sweet or stuffed cookies, crackers, cake without stuffing, baked potato, French fries, fried polenta, fried cassava and corn); Milk and dairy (milk, yogurt, cheese, cream cheese); Fruit and vegetable (orange or bergamot, banana, papaya, apple, watermelon or melon, pineapple, avocado, mango, strawberry, grape, peach, guava, pear, lettuce, tomato, onion, garlic, kale, cabbage, chuchu, pumpkin, natural cucumber, green beans, carrots, beets, cauliflower and peppers); Vegetables (beans, lentils, peas or garbanzo beans); Meats and eggs (meat on the bone such as ribs, palette, read meat such as steak or stew, pork, roast chicken, fried chicken, fish, shrimp, canned fish such as sardines and tuna, offal such as kidney, liver, heart or gizzard, hot dog sausage or sausage, cakegna, ham or salami, bacon, salt preserved meats such as beef jerky, cod, eggs); Sugar and sweets (sugar, ice cream and popsicle, candies, pudding or sweets, chocolate powder or Nescau, chocolate bar or goody); Beverages (regular soft drinks, light, diet or zero sugar soft drinks, box or powder juice, natural fruit juice, coffee or teas, mate/chimarrão, beer, wine, cachaça, whiskey and vodka); Others (nut, walnut, hazelnut or almond, bauru or cheeseburger, hamburger or stewed steak, hot dog, pizza, finger food such as kibe, pastel or empada, canned food, popcorn, chips and fingerfood)	

FFQ: food frequency questionnaire.

"How many times?" (possible answers vary from zero to ten) and "How often?" (possible answers: day, week, month, or year).

From these two questionnaires, a new FFQ was built to be used in the monitoring of the 18 years of the birth cohort of 1993 (carried out in 2011) and the 30 years of the cohort of 1982 (carried out in 2012). The process of putting together this semiquantitative, digital, and self-administered FFQ is described next.

DEVELOPMENT OF THE SELF-ADMINISTERED DIGITAL FFQ

The new FFQ was developed with the help of the I9 company (http://www.i9naweb.com.br/), which was responsible for the creation of the digital format of the instrument. The whole application was processed by a server and the data were collected by the browser of any computer connected to this server's network. The data were immediately saved in

Table 2. Food Frequency Questionnaire (quantitative component) applied to the participants of the birth cohort from 1982 during the follow-up of the 23 years of age. Pelotas (RS), 2004 and 2005.

Do you eat...?	A. How many times?	B. Per?	C. How many... do you eat/a time?
13. Rice	N 1 2 3 4 5 6 7 8 9 10	D S M A	full soup spoon
14. Beans	N 1 2 3 4 5 6 7 8 9 10	D S M A	Scoop
15. Pasta	N 1 2 3 4 5 6 7 8 9 10	D S M A	Gripper
16. Manioc flour	N 1 2 3 4 5 6 7 8 9 10	D S M A	Spoon
17. Bread	N 1 2 3 4 5 6 7 8 9 10	D S M A	French or 2 slices
18. Homemade Bread	N 1 2 3 4 5 6 7 8 9 10	D S M A	Slice
19. Whole wheat or rye Bread	N 1 2 3 4 5 6 7 8 9 10	D S M A	Slice
20. Bocookies or stuffed cookies	N 1 2 3 4 5 6 7 8 9 10	D S M A	Unit
21. Crackers	N 1 2 3 4 5 6 7 8 9 10	D S M A	Unit
22. Cake	N 1 2 3 4 5 6 7 8 9 10	D S M A	Slice
23. Polenta	N 1 2 3 4 5 6 7 8 9 10	D S M A	Piece
24. Frech fries	N 1 2 3 4 5 6 7 8 9 10	D S M A	Porção
25. Backed potato	N 1 2 3 4 5 6 7 8 9 10	D S M A	Unit
26. Cassava	N 1 2 3 4 5 6 7 8 9 10	D S M A	Piece
27. Popcorn	N 1 2 3 4 5 6 7 8 9 10	D S M A	Bag
28. Lentils, peas, garbanzo beans	N 1 2 3 4 5 6 7 8 9 10	D S M A	Spoon

the database installed in the server and, later on, the information was exported by the software itself, in *Excel* spreadsheets, which allows its conversion into the formats required for the analysis in different statistical packages, such as the Stata, SPSS, and SAS. The FFQ may be used online, with direct transference of data into the server, or off-line, with the storage of the data in the computer it is installed in.

This FFQ included all foods which made up the questionnaire previously used by both cohorts and a question about the consumption of nuts, walnuts, almonds and hazelnuts was introduced (Table 1). Thus, such instrument consisted of 88 food items distributed into 9 food groups: cereals and tubers; milk and dairy; fruit and vegetables; legumes; meat and eggs; fats;

Table 3. Food Frequency Questionnaire (qualitative) applied to the participants of the birth cohort of 1993 during the follow-up of the 15 years of age. Pelotas (RS), 2008.

Foods	A. Since <last year's month>, have you eaten it?		B. How many times and how often?													
61. Rice	(0) No	(1) Yes	1	2	3	4	5	6	7	8	9	10	D	S	M	A
62. Beans	(0) No	(1) Yes	1	2	3	4	5	6	7	8	9	10	D	S	M	A
63. Pasta	(0) No	(1) Yes	1	2	3	4	5	6	7	8	9	10	D	S	M	A
64. Manioc flour	(0) No	(1) Yes	1	2	3	4	5	6	7	8	9	10	D	S	M	A
65. Bread branco	(0) No	(1) Yes	1	2	3	4	5	6	7	8	9	10	D	S	M	A
66. Homemade Bread	(0) No	(1) Yes	1	2	3	4	5	6	7	8	9	10	D	S	M	A
67. Bread integral	(0) No	(1) Yes	1	2	3	4	5	6	7	8	9	10	D	S	M	A
68. Bocookies or stuffed cookies	(0) No	(1) Yes	1	2	3	4	5	6	7	8	9	10	D	S	M	A
69. Crackers	(0) No	(1) Yes	1	2	3	4	5	6	7	8	9	10	D	S	M	A
70. Cake	(0) No	(1) Yes	1	2	3	4	5	6	7	8	9	10	D	S	M	A
71. Polenta	(0) No	(1) Yes	1	2	3	4	5	6	7	8	9	10	D	S	M	A
72. Chips, salgadinho	(0) No	(1) Yes	1	2	3	4	5	6	7	8	9	10	D	S	M	A
73. Frech fries ou batata chips	(0) No	(1) Yes	1	2	3	4	5	6	7	8	9	10	D	S	M	A
74. Backed potato	(0) No	(1) Yes	1	2	3	4	5	6	7	8	9	10	D	S	M	A
75. Cassava	(0) No	(1) Yes	1	2	3	4	5	6	7	8	9	10	D	S	M	A
76. Popcorn	(0) No	(1) Yes	1	2	3	4	5	6	7	8	9	10	D	S	M	A
77. Lentils, peas, garbanzo beans	(0) No	(1) Yes	1	2	3	4	5	6	7	8	9	10	D	S	M	A
78. Lettuce	(0) No	(1) Yes	1	2	3	4	5	6	7	8	9	10	D	S	M	A

sugar and candies; drinks; others. For each food item, the participants were asked about their frequency of consumption and the quantities consumed. Eight options of answers for the frequency of consumption were used: never or < 1 time/month; 1 – 3 times/month; 1 time/week; 2 – 4 times/week; 5 – 6 times/week; 1 time/day; 2 – 4 times/day; ≥ 5 times/day. In order to obtain the data regarding the quantities consumed, a mean serving for each food was defined, considering that the respondent should inform whether having consumed each time an equal, larger, or smaller amount in relation to the mean serving. In order to define the mean serving, the data from three 24HR was applied in a substudy conducted in 2006[15] with 185 adolescents in the cohort of 1993, aged 13 years at the time. Some foods were grouped by type and nutritional composition (e.g., crystal sugar and refined sugar were classified as sugar). For each food, we calculated the mean quantity (in grams or milliliters) consumed a day, obtained from the three 24HR. Thereafter, for each food item, the mean serving was defined as equivalent to the 50th percentile (median) of the distribution. In order to determine the household measure regarding the mean portion, the Table for Food Consumption Evaluation in Household Measures (*Tabela para Avaliação de Consumo Alimentar em Medidas Caseiras*) was used[16]. Foods that were not in the 24HR, such as mate (*chimarrão*), beer, wine, *cachaça*/whiskey/vodka and nuts, had their mean servings decided in a consensus by the authors themselves, based on usual household measures and regional habits. In order to facilitate the understanding and the decision making of the respondents, the mean servings equivalent to each food were photographed in the Gastronomy Laboratory of the Federal University of Pelotas, the food being prepared according to the habits of the region, being subsequently inserted in the electronic FFQ.

LAYOUT OF THE FOOD FREQUENCY QUESTIONNAIRE

The new FFQ presents two parts: an initial page and the questionnaire itself. The initial page of the digital FFQ contains instructions on how to fill out the questionnaire, in addition to a field for registration number of identification of the interviewee, which could be done manually or by means of a codebar reader (Figure 1A).

After the identification of the user, through the FFQ itself, there is a screening for each kind of food. Besides, there are three different columns for each food. The first column refers to the frequency of consumption (Figure 1B); the second one asks about the time of consumption (only for those foods that have a defined production season — watermelon or melon, pineapple, avocado, mango, strawberry, grape, peach, guava, pear, ice cream, and shrimp) (Figure 1C), while the third one refers to the size of the serving consumed (equal, smaller, and larger) (Figure 1D). In order to analyze the macro- and micronutrients, the "equal" portion must correspond to the mean serving, the "smaller" portion corresponds to half of the mean serving, and the "larger" portion to one and a half times the mean serving. These values were defined by the researchers.

After its filling out, routines for consistency analysis and for the calculation of caloric intake and macro- and micronutrients intake were developed. For this purpose, files were created especially to be used in the statistical package Stata 12. These files in *.do* format are able to

detect the presence of incoherent answers that, for some reason, went unnoticed in the application process. Other files in the same format convert the measures of portions referring to the household measures presented in the questionnaire by the mean servings or by the options of larger (1.5 times the mean serving) or smaller (half the mean serving) serving for grams of food. After this process, command routines of the statistical package Stata convert the quantity of each food into grams and milligrams of macro- and micronutrients, according to the Brazilian Table of Food Composition (*Tabela Brasileira de Composição de Alimentos*)[17] or to the United States Department of Agriculture table[18], for food not present in the first one[18].

These routines and the scripts used may be requested to the authors of this study.

TESTING OF THE FOOD FREQUENCY QUESTIONNAIRE

The test of the new instrument was developed with adolescents and adults who do not belong to the two birth cohorts. The participants received an initial orientation on how to access and fill out the questionnaire.

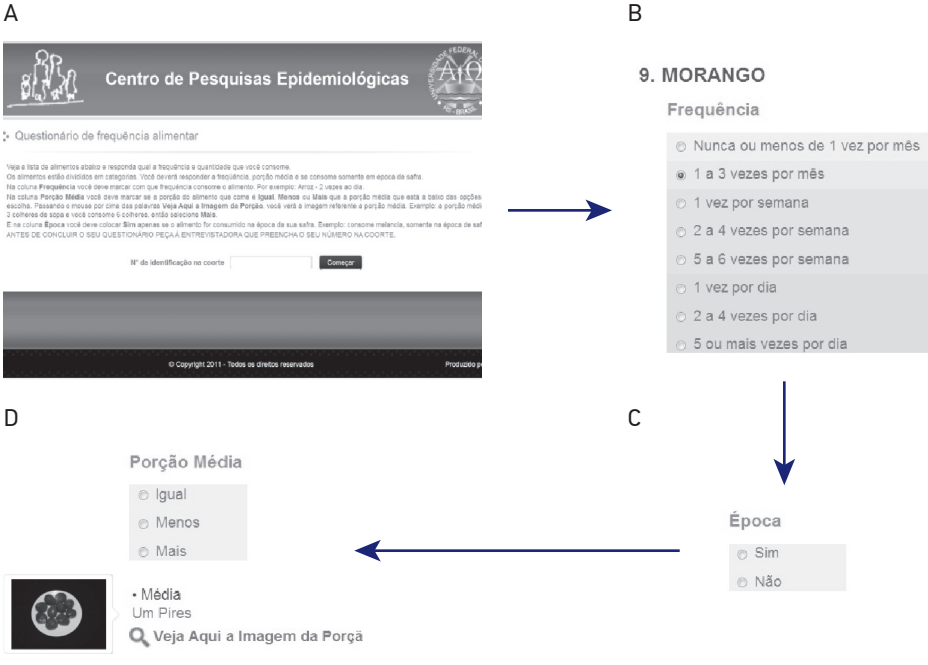

Figure 1. Layout of the self-administered digital food frequency questionnaire; (A) initial page of the questionnaire with information about its filling out; (B) frequency of consumption; (C) time of consumption (only for a few foods); and (D) size of the serving.

DISCUSSION

The present study aimed at reporting the creation of a semiquantitative, self-administered, and digital FFQ. The questionnaire was developed considering advances in researches in the field of nutritional epidemiology regarding the new foods incorporated, such as nuts, walnuts, and hazelnuts, and also regarding the grouping of the questions on frequency and servings[1,19].

The tests with the instrument had fully favorable results. Initially, the tests were performed in paper; later on, after the initial adjustments of the instructions, tests were made with the digital version. The mean time to fill out the FFQ in the digital versions was 12 minutes and there was no difficulty in understanding the way it should be filled out. Some analysis was performed, with the objective of verifying whether some answers of the FFQ were systematically different from others. For example, it was attempted to verify whether there was repetition of the same frequency of consumption for the foods listed in the questionnaire, which could happen by fatigue of the interviewed. However, no problems of this nature were observed.

The possible sources of mistake in FFQ may result from the inadequate list of foods or the estimates of portions and usual frequencies[1,3]. The items included in the instrument at matter were chosen based on the 24HR and the consumption frequencies from the FFQ previously applied to the cohorts of Pelotas, and, this way reflect the foods and preparations usually consumed by this population. As for the usual frequencies chosen, other studies, such as the European Prospective Investigation into Cancer and Nutrition (EPIC)[20], also use grouped frequencies, which facilitate self-admnitration[1]. The FFQ proposed for the cohorts in Pelotas from 1982 and 1993 took into consideration the proposal of categorization of the frequencies pointed out by Willett[1], with some modifications, such as the insertion of the category of consumption of five or more times a day, in order to facilitate the evaluation of adequacy of the daily intake of fruit and vegetable.

In relation to the estimates of portions, the consensus is that there is a challenge inherent to this choice for different types of foods and preparations[1,3]. In the first FFQ applied to the individuals in the cohort of 1982, the number of servings previously established in household measures for each type of food or preparation was questioned. However, in the digital version, in order to facilitate self-reporting and considering the mean populational consumption of these foods, the individuals were questioned about their intake in relation to the mean serving of each item. This information was obtained from the 24HR applied previously to the ones born in 1993, when they were 13 years old. It is believed that this estimate of consumption, even though obtained in previous age, is adequate, once that individuals may point out to a larger or smaller portion than the one referred to as mean serving. Also, the concern about reducing the error regarding the choice of the portions culminated with the use of images of the mean serving of each food in the FFQ, considering the participant can choose between an equal portion to the one shown in the image, a larger one or a smaller one.

The strategy of use of images is not new, considering that, in the last two decades, studies point out to the benefits of the use of photographs to help individuals and estimate the size of the portion they consume[21-23]. A study published over 2 decades ago[22] showed that more than 50% of the evaluations of the size of servings were under- or overestimated when photographs of the mean serving were not used, while another study found that the use of photographs improved agreement between the quantitative FFQ and the food records with weighing[23].

The digital version of the FFQ has some challenges, characteristics, and limitations similar to the FFQs developed on paper. Among which we may mention the dependence on the memory of the interviewed for the reporting of their diet and the low sensitivity for the evaluation of consumption of specific nutrients[24,25]. Despite that, the FFQs are good instruments for the evaluation of eating habits and also to estimate the intake of nutrients that have high variability in daily intake[1,3].

The FFQ developed for the birth cohorts of Pelotas was created with the objective of meeting the needs of these current follow-up studies. The use of this version of the instrument facilitated the reading and understanding of the questions, a fact that possibly reduced an important common bias in dietary surveys, related to the overestimate consumption of foods considered healthier[26], once that, when asked by someone else, the respondents tend to report what they are expected to eat, rather than what they actually eat.

Another advantage of the digital version regards the fast input of the data, which facilitates the execution of analysis of consistency and eliminates the need for double entry of the data[4,27]. Moreover, the mean execution time of 12 minutes suggests that the digital instrument may shorten the time needed for the collection of dietary data. Besides, this survey may be easily used in household interviews, as long as the interviewer has a laptop computer.

This instrument was developed so that the experience of answering an extensive and monotonous questionnaire, such as the FFQ, is faster, more pleasurable, and also facilitates data input. In the future, it is also intended to provide the information of dietary intake to the respondent immediately after the questionnaire.

CONCLUSIONS

This article, for being purely methodological, did not aim at providing information about the validation of the FFQ created. This is justified by the fact that the FFQ should be created according to the regional habits, so that they collect reliable data on the diet of the individuals. From its creation, validation studies should be conducted in order to verify their reliability and validity.

Our objective was to describe the methodology of creation of this instrument, so that other scholars in the field may have this information, since those aspects are not usually approached in the articles addressing the theme.

Our evaluation of the process we described is that the use of this technological resource and the images of the mean servings, with the option to inform whether the serving consumed was an equal, larger, or smaller portion, was attractive both to the participants and to the work teams, making the instrument pleasant and facilitating its use, by allowing it to be self-administered, answered to in a short period and immediately available for data analysis. Considering the positive experience, the use of this same strategy for other research groups is recommended in Brazil, adapting it to different contexts and situations.

REFERENCES

1. Willett WC. Nutritional epidemiology issues in chronic disease at the turn of the century. Epidemiol Rev 2000; 22(1): 82-6.
2. Willett W. Foreword. The validity of dietary assessment methods for use in epidemiologic studies. Br J Nutr 2009; 102 Suppl 1: S1-2.
3. Thompson FE, Byers T. Dietary assessment resource manual. J Nutr 1994; 124(11 Suppl): 2245S-317S.
4. Winter J, Boushey CJ. Workshop 1: Use of technology in dietary assessment. Eur J Clin Nutr 2009: 63 Suppl 1: S75-7.
5. Long JD, Littlefield LA, Estep G, Martin H, Rogers TJ, Boswell C, et al. Evidence review of technology and dietary assessment. Worldviews Evid Based Nurs 2010; 7(4): 191-204.
6. Falomir Z, Arregui M, Madueno F, Corella D, Coltell O. Automation of Food Questionnaires in Medical Studies: A state-of-the-art review and future prospects. Comput Biol Med 2012; 42(10): 964-74.
7. Ngo J, Engelen A, Molag M, Roesle J, Garcia-Segovia P, Serra-Majem L. A review of the use of information and communication technologies for dietary assessment. Br J Nutr 2009;101 Suppl 2:S102-12.
8. Illner AK, Freisling H, Boeing H, Huybrechts I, Crispim SP, Slimani N. Review and evaluation of innovative technologies for measuring diet in nutritional epidemiology. Int J Epidemiol 2012; 41(4): 1187-203.
9. Barros FC, Victora CG, Horta BL, Gigante DP. Methodology of the Pelotas birth cohort study from 1982 to 2004-5, Southern Brazil. Rev Saúde Pública 2008; 42 Suppl 2: 7-15.
10. Victora CG, Araujo CL, Menezes AM, Hallal PC, Vieira Mde F, Neutzling MB, et al. Methodological aspects of the 1993 Pelotas (Brazil) Birth Cohort Study. Rev Saúde Pública 2006; 40(1): 39-46.
11. Victora CG, Barros FC. Cohort profile: the 1982 Pelotas (Brazil) birth cohort study. Int J Epidemiol 2006; 35(2): 237-42.
12. Victora CG, Hallal PC, Araujo CL, Menezes AM, Wells JC, Barros FC. Cohort profile: the 1993 Pelotas (Brazil) birth cohort study. Int J Epidemiol 2008; 37(4): 704-9.
13. Araujo CL, Menezes AM, Vieira Mde F, Neutzling MB, Goncalves H, Anselmi L, et al. The 11-year follow-up of the 1993 Pelotas (Brazil) birth cohort study: methods. Cad Saúde Pública 2010; 26(10): 1875-86.
14. Sichieri R, Everhart JE. Validity of a Brazilian food frequency questionnaire against dietary recalls and estimated energy intake. Nutr Res 1998; 18: 1649-59.
15. Gigante DP, Reichert FF, Hallal PC, Souza RV, Neutzling MB, Vieira Mde F, et al. Dietary assessment in the 1993 Pelotas (Brazil) birth cohort study: comparing energy intake with energy expenditure. Cad Saude Publica 2010; 26(11): 2080-9.
16. Pinheiro ABV. Tabela para avaliação do consumo alimentar em medidas caseiras. 5ª ed. Rio de Janeiro: Atheneu; 2004.
17. Universidade Estadual de Campinas (UNICAMP). Tabela Brasileira de Composição de Alimentos - TACO. Versão 2. 2ª ed. Campinas: UNICAMP; 2006.
18. United States Department of Agriculture - USDA. Nutrient Database for Standard Reference - SR14. Washington DC: United States Department of Agriculture; 2011. Disponível em: < http://ndb.nal.usda.gov/ndb/foods>. (Acessado em 08 de janeiro de 2016).
19. Li TY, Brennan AM, Wedick NM, Mantzoros C, Rifai N, Hu FB. Regular consumption of nuts is associated with a lower risk of cardiovascular disease in women with type 2 diabetes. J Nutr 2009; 139(7): 1333-8.
20. Kroke A, Klipstein-Grobusch K, Voss S, Moseneder J, Thielecke F, Noack R, et al. Validation of a self-administered food-frequency questionnaire administered in the European Prospective Investigation into Cancer and Nutrition (EPIC) Study: comparison of energy, protein, and macronutrient intakes estimated with the doubly labeled water, urinary nitrogen, and repeated 24-h dietary recall methods. Am J Clin Nutr 1999; 70(4): 439-47.

21. Faggiano F, Vineis P, Cravanzola D, Pisani P, Xompero G, Riboli E, et al. Validation of a method for the estimation of food portion size. Epidemiology (Cambridge, Mass) 1992; 3(4): 379-82.
22. Guthrie HA. Selection and quantification of typical food portions by young adults. J Am Diet Assoc 1984; 84(12): 1440-4.
23. Pietinen P, Hartman AM, Haapa E, Rasanen L, Haapakoski J, Palmgren J, et al. Reproducibility and validity of dietary assessment instruments. I. A self-administered food use questionnaire with a portion size picture booklet. Am J Epidemiol 1988; 128(3): 655-66.
24. Cade J, Thompson R, Burley V, Warm D. Development, validation and utilisation of food-frequency questionnaires - a review. Public Health Nutr 2002; 5(4): 567-87.
25. Cade JE, Burley VJ, Warm DL, Thompson RL, Margetts BM. Food-frequency questionnaires: a review of their design, validation and utilisation. Nutr Res Rev 2004; 17(1): 5-22.
26. Kipnis V, Midthune D, Freedman LS, Bingham S, Schatzkin A, Subar A, et al. Empirical evidence of correlated biases in dietary assessment instruments and its implications. Am J Epidemiol 2001; 153(4): 394-403.
27. Garcia-Segovia P, Gonzalez-Carrascosa R, Martinez-Monzo J, Ngo J, Serra-Majem L. New technologies applied to food frequency questionnaires: a current perspective. Nutr Hosp 2011; 26(4): 803-6.

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