FOOD AND NUTRITION IN COLLECTIVE HEALTH

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A food frequency questionnaire for schoolchildren from a capital city of midwestern Brazil according to the *NOVA* food classification

Desenvolvimento de um questionário de frequência alimentar para escolares de uma capital do centro-oeste brasileiro segundo a classificação de alimentos NOVA

Abstract

Objective: To describe the development of a quantitative food frequency questionnaire (FFQ) according to the *NOVA* food classification that evaluates the eating habits of 9 and 10-year-old schoolchildren. ***Methods***: This was a methodological study carried out with primary education students at a municipal school. The food list integrating the FFQ was compiled from the application of 24-hour dietary recalls in triplicate on every other day of the week. Foods providing 95% of the energy, carbohydrates, proteins, lipids, and fibers ingested by the respondents were included in the list. Once the food items were identified, they were grouped according to the *NOVA* food classification. ***Results***: A list of 81 food items was elaborated. Rice, beef, and chicken were the most represented of the fresh and minimally processed foods. Bread (French and various types of homemade bread) stood out among processed foods. Sugary drinks (soft drinks and powdered juices) were the most frequently mentioned ultra-processed foods. ***Conclusion***: The FFQ took into consideration the habits of the target population, as the list of food items reflected foods commonly eaten and responsible for 95% of the energy, macronutrients, and fiber consumption

Keywords: Children. Food consumption. Questionnaire.

Resumo

Objetivo: Descrever o processo de construção de um QFA quantitativo segundo a classificação de alimentos NOVA, para avaliação do consumo habitual de escolares de 9-10 anos de idade. ***Métodos***: Trata-se de estudo metodológico realizado com alunos de uma escola municipal de ensino básico. A lista de alimentos que integra o QFA foi construída a partir da aplicação do recordatório de 24 horas, em triplicata, em dias alternados da semana. Foram incluídos os alimentos que respondiam pelo fornecimento de 95% de energia, carboidratos, proteínas, lipídeos e fibras ingeridos pelos entrevistados. Após a definição dos itens alimentares, estes foram agrupados de acordo com a classificação de alimentos NOVA. ***Resultados:*** Elaborou-se lista com 81 itens alimentares, na qual arroz, carne bovina e de frango foram os alimentos mais representativos entre os alimentos *in natura* ou minimamente processados. Os pães (francês e caseiro de diversos tipos) se destacaram entre os alimentos processados. Já as bebidas açucaradas (refrigerante e sucos em pó) foram os mais referidos entre os alimentos ultraprocessados. ***Conclusão***: O QFA levou em consideração os hábitos

alimentares da população-alvo, uma vez que a lista de itens alimentares apresentada corresponde aos alimentos habitualmente ingeridos e responsáveis por 95% do consumo de energia, macronutrientes e fibras.

Palavras-chave: Criança. Consumo alimentar. Questionário.

INTRODUCTION

The adequate identification of nutritional risk factors in population groups requires instruments that enable the evaluation of habitual food consumption as accurately as possible.[1,2] The food consumption may be evaluated through a variety of instruments that enable easiness in its application, as well as precision and validation.[3] One of these instruments is the food frequency questionnaire (FFQ), which allows the identification of the habitual food consumption practiced for a long period.[2]

The FFQ shall be built or adapted according to the characteristics of the population under study,[4] which will contribute to a lower susceptibility of interpretation errors, contributing to more valid and accurate pieces of information.[5,6] One of the initial phases of the FFQ development is the construction of the list of foods that will integrate the questionnaire. This list shall follow the diet pattern of the investigated population, in addition to identifying the food portions that are habitually consumed. The methodology employed in the construction of the food list may have a direct impact on the quality of the FFQ developed.[7]

The FFQ list may group foods according to their main components, or the extension and purpose of the processing to which the food is submitted. Taking into account the different purposes of food processing, Monteiro et al.[8] proposed the classification of foods and food products into three groups. Subsequently, this classification was revised and updated, generating the NOVA food classification, which categorizes the foods and food products according to the extension and purpose of their processing into the following four groups: Group 1 contains *in natura* or minimally processed foods; Group 2 contains the culinary ingredients; Group 3 contains processed foods. Group 4 contains ultra-processed foods.[9] The extension, type, or purpose of the industrial processing of the foods may alter their quality and, consequently, the consumers' diet, with the possibility of contributing to the risk of the development of diseases. Therefore, such differences shall not be neglected.[9]

The construction of questionnaires aimed at schoolchildren becomes necessary because the identification of foods that compose the diet of this population group is important. The monitoring of dietary indicators of the youth is of individual and collective health interest, given that scientific pieces of evidence suggest that many diseases typical for the adult stage, such as osteoporosis, obesity, and cardiovascular diseases, are associated with eating habits of the early stages of life.[6,9,10]

From the need for proper instruments to assess eating habits and the importance of knowing the eating habits of the scholars, this study aimed to describe the construction of a quantitative FFQ according to the NOVA food classification, for the assessment of the habitual consumption of 9-to-10-year-old scholars.

METHODS

This study is part of the research entitled "Construction, validation, and reproducibility of a food frequency questionnaire for 9 to 10-year-old schoolchildren from Cuiabá-MT". This study is a methodological study carried out with students from a municipal school of primary education in Cuiabá, State of Mato Grosso, from May to August 2017, aimed at the construction of a list of foods that integrate the FFQ. The researchers chose the school where the food list was compiled for convenience, inviting all the students enrolled in the fourth and fifth years of the morning or afternoon periods to join the research. The location of the school's unit is one of the main avenues of Cuiabá, which allows the attendance of students from different regions and socioeconomic profiles.

Concerning the sample size, the proposal from Cade et al.[11] was adopted, which recommends a sample of 50 to 100 people per demographic group for FFQ validation studies. Seventy-three students, both male

and female, aged 9 to 10, accepted to participate in the trial study. The enrollment excluded from the study those scholars who presented any type of neurological or cognitive alteration that could hinder the response of the answers.

The pieces of information were collected after signing of Term of Free and Clarified Consent (TFCC) by the legal accountable for the child, and agreement term (AT) by the child.

Students of the Nutrition Course applied the 24-hour Dietary Recalls after undergoing training for the proper collection of information. Albums of a photographic register of foods[12,13] and culinary utensils were used to assist the research participants in the provision of information. After the application of the questionnaires, they were revised by a nutritionist experienced in food consumption data collection.

The researchers inputted the obtained information into the Virtual Nutri Plus® software to determine the nutritional content of the foods mentioned. Pieces of information on those foods that were mentioned but not included in the program were searched consulting the Table of Nutritional Composition of Foods Consumed in Brazil - Research of Household Budgets (RHB),[14] and also in the table of food consumption evaluation in homemade measurements,[15] for the input of their nutritional information. When the information related to the food product was also not available in the tables, their nutrition information was looked up in the food labels and at the websites of their respective manufacturers.

The research project was approved by the Ethics Committee of the University Hospital Júlio Müller of the Federal University of Mato Grosso - UFMT, under file No 1.878.777.

Development of the list of foods for the quantitative food frequency questionnaire

The list of foods that compose the FFQ was built through information collected from the application of three 24-hour Dietary Recalls (R24h/3D) applied every other weekday, including the day after the weekend, to capture the most considerable variability of foods consumed by the scholars. The interviews were conducted with an interval of 30 days between the first and second applications, and 45 days between the second and third applications, due to the school break, according to the methodology applied by Hining et al.[16]

First, a list of every food ingested by the scholars was developed. Each food on the list received its unique identification code. The quantity and nutritional composition (macro and micronutrients and fibers) of each food item were defined.

The foods quoted on the R24h were listed in descending order according to the percentage of contribution of the total energy value, carbohydrates, proteins, and lipids, according to the methodological proposal established by Block et al.[17] and with the assistance of the software *Microsoft Excel*® 2013. The "dietary fiber" was included as a selection criterion for food items after the conclusion that this addition would result in the inclusion of foods that were not detected by their macronutrients and energy. From the inclusion of this nutrient, foods such as "lettuce, rocket, green cabbage, carrot, and beet, among others" were included in the FFQ.

The construction of the FFQ considered the foods responsible for up to 95% of calories consumption, of other chosen macronutrients, and fibers. The inclusion of food into the list required its meeting of at least one inclusion criterium. It meant that it was among the foods that had contributed with 95% of the calories, or carbohydrates, or lipids, or proteins or fibers. Next, the chosen foods were organized according to the Nova foods classification, proposed by Monteiro et al.[8] and adopted by the Ministry of Health at the *Dietary*

Guide for the Brazilian Population. This new classification proposes that foods are organized according to the extension and purpose of industrial processing. The FFQ addresses the effective food consumption. As considering the difficulty to break down the recipes and identify all ingredients used to prepare them, a choice was made to organize the groups that compose the FFQ. The foods were grouped as follows: Group 1: *in natura* or minimally processed foods and culinary preparations based on these foods; Group 2: processed foods and culinary preparations based on these foods; and Group 3: ultra-processed foods and culinary preparations based on these foods.

The food consumption frequency was divided into eight categories: daily (once a day; twice or more times a day); weekly (once a week, two to four times a week, five to six times a week); and monthly (once a month, two to three times a month), in addition to the option 'did not eat/did not drink in the past month' or 'does not remember,' according to the proposals adapted from Colucci et al.[6] and Hining et al.[16]

The definition of the portion sizes of the food items employed in the questionnaire used a percentual distribution, in grams, of the weight of the consumed foods. Three food portion sizes were defined based on the percentiles 25 (P25), 50 (P50), and 75 (P75), which stand for the small, medium, and large portions, respectively. When percentile values coincide in a food item, the simple rule of three was used as a calculation method, taking into account that the weight distribution of the consumed food is uniform throughout the entire distribution. Thus, it is possible to obtain a more accurate measurement of the content of the nutrients in food frequency questionnaires.[15] Subsequently, the grams defined for the portions were converted into homemade measurements, with the assistance of the table for the evaluation of food consumption in homemade measurements, 11 according to the methodology employed by Hining et al.[16]

As to its temporality, the questionnaire assessed the habitual consumption of the previous month that preceded its application. This questionnaire shall be applied in the services routine, during a consultation with the nutritionist or in epidemiological studies on the food consumption of children, by properly trained interviewers.

RESULTS

The final sample was composed of 73 children, out of which 60.3% (n=44) were female. The predominant age was nine years old (50.7%), with an average age of 9.9 (sd ± 0.6 years). Among the scholars who participated in the research, 65 answered to three R24h (89.0%), and eight answered to two R24h (11.0%), in a total of 211 dietary recalls.

Based on the R24h applied, 359 foods and preparations were identified and listed. After the identification of the percentual contribution of the food items that accounted for 95% of the food consumption, taking into account the total consumption of energy, carbohydrates, proteins, lipids, and fibers, 96 foods and preparations were identified, which were grouped and formed 68 food items that composed the list of foods of the FFQ. Next, they were divided into three groups, according to its extension and purpose of the industrial processing, and defined as: Group 1: *in natura* or minimally processed foods and culinary preparations based on these foods; Group 2: processed foods and culinary preparations based on these foods; and Group 3: ultra-processed foods and culinary preparations based on these foods.

As the extension and purpose of the food processing, the scholars reported consuming, in higher frequency, white and brown rice, bovine and chicken meat, cooked beans ("Carioca" and black), whole milk (Group 1: *in natura* or minimally processed foods and culinary preparations based on these foods), bread (French and homemade of several types) and mozzarella cheese (Group 2: processed foods and culinary

preparations based on these foods) and sugar beverages (sodas, powder juice), powder chocolate, cakes and industrialized snacks (Group 3: ultra-processed foods and culinary preparations based on these foods), as shown in table 1.

As to the contribution of the foods according to the provision of energy, macronutrients, and fibers, the food items that contributed the most to the total energy consumption were the white and brown rice, cooked bean ("Carioca" and black), sodas, powder juice, and chocolate. Concerning the proteins, the food items that contributed the most were the beef and poultry meat, cooked beans ("Carioca" and black), milk, white and brown rice, french bread. The food items that contributed the most with the provision of lipids were beef and poultry meat, cow milk, soybean oil, olive oil, and sausages (pork or chicken). About fibers, the foods that participated the most in its supply were cooked beans ("Carioca" and black), French bread, white and brown rice, banana (manzano, yellow cavendish, plantain, burro), red apple, papaya, mango, and powder chocolate, as shown in table 1.

Table 1. Food items according to the percentual contribution for the total of energy and macronutrients of the diet of the scholars, according to the NOVA foods classification. Cuiabá-MT, Brazil, 2017.

FOOD ITEMS	Percentual contribution (%)				
	Energy	CHO	PTN	LIP	FIB
Group 1: *in natura* or minimally processed foods and culinary preparations based on these foods					
White rice; brown rice	9.35	14.62	3.93	2.85	4.89
Beans ("Carioca" and black)	3.93	4.30	5.05	2.84	38.06
Pasta	1.37	2.11	1.09	0.03	1.92
Lasagna, several flavors (homemade)	0.62	0.41	0.92	0.79	0.60
Homemade simple cake	1.02	1.73	0.63	0.1	0.95
Salty popcorn (homemade)	0.38	0.33	0.15	0.61	1.12
Beef meat	12.76	0.08	33.54	20.8	0.2
Chicken / poultry	4.92	0.36	15.58	5.96	0.58
Pork meat	0.96	0.02	2.3	1.68	0.06
Fresh or frozen fish	0.44	0.01	1.95	0.26	0.04
Entrails (bovine liver; cow heart)	0.17	0.05	0.99	0.39	0.01
Eggs or omelet	1.38	0.06	2.27	2.92	-
Cow milk	3.1	1.92	3.99	4.59	-
Cassava	1.06	1.67	0.16	0.63	1.44
Cassava flour	0.43	0.82	0.05	0.02	0.51
Potato	0.74	1.06	0.29	0.55	1.43
Banana (manzano, yellow cavendish, burro)	0.63	1.27	0.17	0.09	1.90
Apple	0.43	0.87	0.03	0.07	1.95
Mango	0.03	0.07	0.01	-	0.12
Guava	0.16	0.29	0.06	0.05	1.14
Orange; tangerine; mandarin	0.62	1.17	0.30	0.06	1.07
Plantain banana	0.13	0.23	0.03	0.09	0.34
Watermelon	0.25	0.45	0.11	0.09	0.25
Pineapple	0.11	0.23	0.01	0.02	0.30
Tomato; cherry tomato; salad tomato	0.18	0.29	0.29	0.06	1.85
Green cabbage	0.06	0.10	0.08	0.02	0.71
Carrot	0.07	0.13	0.04	0.01	0.53
Lettuce (butterhead, leaf)	0.06	0.09	0.18	0.03	0.58
Onion	0.12	0.22	0.11	0.01	0.6

Table 1. Food items according to the percentual contribution for the total of energy and macronutrients of the diet of the scholars, according to the NOVA foods classification. Cuiabá-MT, Brazil, 2017. (Continues)

FOOD ITEMS	Percentual contribution (%)				
	Energy	CHO	PTN	LIP	FIB
Group 1: *in natura* or minimally processed foods and culinary preparations based on these foods					
Apple	0.43	0.87	0.03	0.07	1.95
Mango	0.03	0.07	0.01	-	0.12
Guava	0.16	0.29	0.06	0.05	1.14
Orange; tangerine; mandarin	0.62	1.17	0.30	0.06	1.07
Plantain banana	0.13	0.23	0.03	0.09	0.34
Watermelon	0.25	0.45	0.11	0.09	0.25
Pineapple	0.11	0.23	0.01	0.02	0.30
Tomato; cherry tomato; salad tomato	0.18	0.29	0.29	0.06	1.85
Green cabbage	0.06	0.10	0.08	0.02	0.71
Carrot	0.07	0.13	0.04	0.01	0.53
Lettuce (butterhead, leaf)	0.06	0.09	0.18	0.03	0.58
Onion	0.12	0.22	0.11	0.01	0.6
Group 2 - Processed foods and culinary preparations based on these foods					
French bread;	4.42	6.96	3.41	1.11	5.95
Homemade bread	2.06	2.90	1.20	1.15	2.23
Mozzarella cheese	0.65	0.04	1.04	1.42	-
Whole Grape Juice	0.32	0.63	0.04	0.00	-
Beef jerky; sun dried meat	0.13	0.00	0.28	0.24	-
Group 3 - Ultra-processed foods and culinary preparations based on these foods					
Sweetened yogurt, several flavors	0.34	0.46	0.24	0.21	0.08
Petit Suisse cheese	1.05	0.42	0.41	0.25	-
Sodas, several flavors	3.54	7.25	-	-	-
Diluted powdered juice, several flavors	2.92	5.79	-	-	-
Ready-to-drink juices (nectar);	0.63	1.23	0.07	-	0.2
Powdered chocolate	2.8	4.92	0.77	0.58	3.38
Condensed milk/condensed milk pudding	0.95	1.28	0.51	0.69	-
Guava paste	0.31	0.48	0.12	0.11	0.2
Ice cream, several flavors	0.8	0.85	0.3	1.01	-
Bubble gum; various candies	0.52	0.87	0.11	0.20	-
Chocolates, truffle, bonbon	0.35	0.34	0.08	0.52	0.07
Simple cake (industrialized dough)	2.39	2.72	0.86	2.82	1.09
Stuffed cake; cake with frosting	0.37	0.46	0.14	0.38	0.09
Granola	0.20	0.18	0.25	0.32	0.59
Sweet cookies (cornstarch, marie, etc.)	1.26	1.88	0.60	1.16	1.11
Salty biscuit (water crackers; cream cracker)	1.42	1.71	0.71	1.40	1.33
Sandwich biscuits	3.37	3.52	1.01	4.31	0.61
Snack package	2.25	2.64	0.78	2.45	0.17
Sliced bread	1.09	1.54	0.76	0.58	1.86
Hamburger bun, bread roll	0.73	1.08	0.54	0.06	0.47
Cheese bread	0.75	0.79	0.55	0.85	0.1
Hot dog, sandwiches	1.07	0.57	0.69	2.11	0.69
Various pastries	0.84	1.07	0.62	0.58	1.07

Table 1. Food items according to the percentual contribution for the total of energy and macronutrients of the diet of the scholars, according to the NOVA foods classification. Cuiabá-MT, Brazil, 2017. (Continues)

FOOD ITEMS	Percentual contribution (%)				
	Energy	CHO	PTN	LIP	FIB
G3 - Ultra-processed foods and culinary preparations based on these foods					
Pizza, several flavors	0.74	0.75	0.61	0.83	0.98
Industrialized lasagna, several flavors	0.62	0.41	0.92	0.79	0.6
Microwave popcorn; industrialized sweet popcorn	0.37	0.67	0.15	0.14	0.17
Instant noodles	1.01	1.14	0.47	1.13	1.78
Salty or non-salty creamy margarine	1.86	0	0	5.81	0
Sausage	1.61	0.02	1.95	3.59	0
Mortadella; salami	0.81	0.03	0.81	2.1	0
Bacon	0.26	-	0.09	0.82	-
Ham; ham paste; turkey breast	0.20	0.02	0.52	0.29	-
Hamburger	0.37	0.09	0.63	0.69	-
Mayonnaise; ketchup	0.15	0.02	0.02	0.44	0.01

Legend: CHO – carbohydrates PTN – proteins LIP – lipids FIB - fib

Table 2 presents a percentile distribution of the portion sizes in grams of the food items contained in the list of FFQ foods. In addition, part of the FFQ is shown in the chart, where the consumption frequencies are shown, as well as the homemade measurements employed in this questionnaire.

Table 2. Food items of the Food Frequency Questionnaire according to portion sizes in percentiles (grams) and food groups. Cuiabá-MT, 2017.

FOOD ITEMS	P25	P50	P75
Group 1 – *in natura* or minimally processed foods and culinary preparations based on these foods			
White rice; brown rice	67.5	85.0	106.3
Beans ("Carioca" and black)	48.8	65.0	140
Pasta	51.5	88.0	110.0
Lasagna, several flavors (homemade)	53.0	240.0	600.0
Homemade simple cake (cornmeal, wheat, corn, etc)	60.0	120.0	180.0
Salty popcorn (homemade)	15.0	20.0	40.0
Bovine meat	40.0	80.0	135.0
Chicken / poultry	30.0	40.0	70.0
Pork meat	20.0	25.0	40.0
Fish	150.0	200.0	400.0
Entrails (bovine liver; cow heart)	75.0	93.7	260.0
Eggs	12.0	50.0	62.5
Cow milk	82.5	165.0	206.2
Cassava	84.0	100.0	250.0
Cassava flour	10.0	22.0	32.0
Potato	23.0	50.0	65.0
Banana (manzano, yellow cavendish, burro)	52.5	70.0	132.5
Plantain banana	7.0	14.5	56.3

Table 2. Food items of the Food Frequency Questionnaire according to portion sizes in percentiles (grams) and food groups. Cuiabá-MT, 2017.(Continues.)

FOOD ITEMS	P25	P50	P75
Group 1 – *in natura* or minimally processed foods and culinary preparations based on these foods			
Apple	112.5	150.0	187.5
Mango	165.0	220.0	275.0
Papaya	80.7	200.0	370.0
Orange; tangerine; mandarin	150.0	180.0	270.0
Strawberry	12.0	24.0	36.0
Pineapple	26.0	68.0	109.0
Guava	86.1	114.8	143.5
Watermelon	200.0	285.0	370.0
Tomato; cherry tomato; salad tomato	6.0	15.0	30.0
Lettuce (butterhead, leaf)	15.0	20.0	27.5
Green cabbage	15.0	20.0	24.5
Carrot	10.0	13.0	25.0
Onion	3.0	4.0	7.0
Whole grape juice without added sugar	123.7	165.0	285.0
Group 2 - Processed foods and culinary preparations based on these foods			
French bread;	37,5	50,0	62,5
Homemade bread	25,0	37,5	81,2
Mozzarella cheese	15,0	20,0	40,0
Beef jerky; sun dried meat	25,3	32,5	39,0
Group 3 - Ultra-processed foods and culinary preparations based on these foods			
Sweetened yogurt, several flavors	90.0	120.0	195.0
Petit Suisse cheese	80.0	120.0	200.0
Sodas, several flavors	165.0	240.0	330.0
Diluted powdered juice, several flavors	165.0	240.0	300.0
Ready-to-drink juices (nectar);	123.7	165.0	240.0
Powdered chocolate	11.3	22.0	32.0
Condensed milk/condensed milk pudding	24.0	32.0	40.0
Guava paste	20.0	35.0	52.5
Ice cream, several flavors	80.0	100.0	220.0
Bubble gum; various candies	3.0	5.9	11.7
Chocolates, truffle, bonbon	16.1	21.5	40.5
Simple cake (industrialized dough)	60.0	120.0	180.0
Stuffed cake; cake with frosting	75.0	100.0	187.5
Granola	15.8	21.0	30.3
Sweet cookies (cornstarch, marie, etc.)	15.0	25.0	45.0
Salty biscuit (water crackers; cream cracker)	20.0	30.0	100.0
Sandwich biscuits	39.0	70.0	130.0
Snack package	59.0	92.0	164.0
Sliced bread	25.0	50.0	62.5
Hamburger bun, bread roll	52.5	70.0	87.5
Cheese bread	20.0	50.0	65.0
Hot dog, sandwiches	40.0	125.0	156.3
Various pastries	30.0	40.0	50.0

Table 2. Food items of the Food Frequency Questionnaire according to portion sizes in percentiles (grams) and food groups. Cuiabá-MT, 2017.(Continues.)

FOOD ITEMS	P25	P50	P75
Group 3 - Ultra-processed foods and culinary preparations based on these foods			
Pizza, several flavors	77.0	90.0	122.5
Industrialized lasagna, several flavors	53.0	240.0	600.0
Microwave popcorn; industrialized sweet popcorn	22.5	25.0	40.0
Instant noodles	78.7	90.0	112.5
Salty or non-salty creamy margarine	4.0	5.0	12.0
Sausage	31.5	55.0	67.5
Mortadella; salami	22.5	30.0	22.5
Bacon	13.1	20.0	23.0
Ham; ham paste; turkey breast	11.3	15.0	18.8
Hamburger	42.0	56.0	70.0
Mayonnaise; ketchup	5.2	6.5	18.2

Legend: P25- percentile 25 (smart portion) P50 percentile 50 (medium portion) P75 percentile 75 (large portion)

Chart 1. Demonstration of part of the quantitative food frequency questionnaire for 9 to 10-year-old children, employing the NOVA classification of foods. Cuiabá-MT, 2017.

How many times have you consumed this food item within the last month?												
Food	Day		Week			Month				Choose your portion		
	≥2	1	5-6	2-4	1	2-3	1	N*	NS**			
White rice; brown rice										( ) 1,5 CS	( ) 2 CS	( ) 3 CS
"Carioca" beans; black beans										( ) ½ CoM	( ) 1CoM	( ) 2 CoM
Pasta										( ) 1 FM	( ) 1,5 CS	( ) 2CS
Homemade simple cake										( ) 1 FM	( ) 2FM	( ) 3FM

Legend:
N* – didn't eat/ didn't drink within the last month
NS** – doesn't remember
CS – Serving spoon
OM – medium scoop
FM – medium slice

The FFQ presents instructions on how to fill it and the identification of the interviewee on its first page.

DISCUSSION

The understanding of the relation between the diet of children and teenagers, and the potential pathologies that may occur during their adult life, motivates the execution of studies aimed at the evaluation of food consumption, with particular attention to the eating practices adopted by the individuals [6]

This work describes, in detail, the methodology applied for the construction of an FFQ directed to 9 to 10-year-old children, according to the methodology proposed by Block et. al.,[17] and Hinig.[18] The FFQ developed contains 68 food items, organized into three food groups, according to the NOVA foods classification,[9] to estimate the habitual consumption of foods according to the extension and purpose of their processing.

Several authors have investigated the food consumption of children and proposed instruments for its evaluation. Among those, one may mention the questionnaires elaborated and validated by Hammon et al.[19]

with British children; the one proposed by Kobayashi et al.,[20] with Japanese children; the one from Medina et al.,[21] with scholars from Mexico City; Lera et al.,[22] with students from public schools in Chile; and Söderberg et al.,[23] with Swedish children.

Several studies assesssed the consumption of foods by Brazilian children: Colucci et al.,[6] for children from 2-5 years of age, in the city of São Paulo-SP; Scagliusi et al.,[24] with scholars from 6-9 years of age from Acrelândia-AC; Hinnig et al.[16] developed a questionnaire for children 7-10 years of age in São Paulo-SP.

Another methodological strategy for obtaining an FFQ is the adaptation of questionnaires of other age ranges. Simona et al.,[25] adapted an FFQ for adults to assess the intake of macronutrients and calcium in Italian children and teenagers. Fumagalli et al.[26] verified the validity of an FFQ of adults in order to evaluate the dietary intake of children 5-11 years of age. Del Pino[27] has adapted e validated a semiquantitative questionnaire of food frequency for 5 to 11-year-old children in the city of Porto Alegre-RS.

There are no records in the literature of FFQ developed or adapted to children who live in the Midwestern cities of Brazil. The lack of such studies justifies the development of this instrument, with a list of foods elaborated from pieces of information collected with this age group, for a better representativity of its food consumption.

The children's ability of self-reporting the consumption of food increases quickly after they reach the age of 8.[28] The quality of the information collected may be enhanced with the proper training of the interviewers, the use of albums of photographic records, of copies, a package of foods and utensils to estimate the quantity and quality of the food ingested.[16]

The food list is a crucial step in the development of an FFQ. The food list must agree with the characteristics of the habitual diet of the studied population, and consider the estimates for the food portions, allowing their classification according to the consumption of ingested nutrients.[29]

Several studies,[6,16,19] applied the method of Block et al.[17] Its application allows the inclusion in the foods list of foods that do not contain significative amounts of the nutrient of interest, but the interviewed persons frequently quote them. The list of foods that integrate this FFQ reflects the foods that are habitually consumed by the children of the age range under study, organized into seven categories of food consumption frequency.

In the development process of the food list, some foods were not included, according to Block et al.,[17] because this study takes into consideration only the macronutrients and the energy of the foods. It was chosen to include "fiber" in the analysis of the foods that would compose the list. The list of foods included those foods accounting for 95% of the fiber consumption mentioned by the interviewees. Foods such as lettuce, green cabbage, onion, tomato, and carrot were included in the list of food items of the FFQ.

The definition of the food portion sizes to be employed in the FFQ followed the methodology proposed by Block et al.[17] Closed questions were chosen for the registration of the food consumption frequency, given that those are the most recommended type because they reduce codification time and typing errors.[11] The consumption frequency was defined in eight categories, based on the distributions employed by Colucci et al.[6] e Hinnig et al.,[16] with the options organized from the highest to the lowest consumption frequency.

It is understood that the number of categories is enough to categorize the consumption of the individuals evaluated, given it offers a variety of consumption frequency options, then portraying the consumption, easing the comprehension of the interviewee and avoiding the overlap of the defined categories[6]. According to Willet,[10] an FFQ with 5 to 10 food consumption categories is adequate because the use of a lower number of consumption options could lead to the underestimation of food consumption.

In the investigation on food consumption, the conversion of foods into nutrients is an important step, in which computer programs and food composition tables are employed. The programs of food consumption evaluation are handy tools, once they make the food composition analysis process more agile. However, they depend on the tables of food composition, because there are some moments in which it is necessary to input information from these tables in the programs.[16]

Nevertheless, the tables available that aim to evaluate the food consumption present limitations, such as the outdating of food options.[16] The food industry has been launching several products, mainly ultra-processed ones, and the literature destined to this theme has not been following this evolution. In this case, it is necessary to let go of information available in the labels of these products, but this strategy presents restrictions, given that the information provided may not be accurate.

During the execution of this study, at certain times, it was necessary to use the information provided on food labels, especially for ultra-processed foods consumed by the interviews, which causes limitations in the exact identification of the percentual contribution of energy, macronutrients, and fibers. However, the methodological strategy proposed by Block et al.,[17] employed in this study, minimizes this estimation error, once it allows that 95% of the representative food items in the food consumption are identified.

To ease the answer from the children, the authors chose to avoid including too many foods in the same category, even when the foods displayed similar nutritional characteristics. This decision generated a list of 68 food items.

According to Fisberg et al.,[2] an FFQ with a reduced food list, with less than 50 items, may compromise the evaluation of the food consumption, once it restricts the food options. On the other hand, long lists with more than 100 foods may induce the interviewees to answer inappropriately, given that it may lead to fatigue or boredom.

This instrument shall be applied by trained professors and interviewers, with the use of albums of photographic records of food portions and domestic utensils, to assist the children to provide the answers. A pilot study displayed that children of the studied age range are capable of answering without the assistance of their parents or caretakers.

It is noteworthy that the interviewed scholars did not mention regional food that are characterized by seasonality.

The instrument developed needs to be tested about its reproducibility and validity concerning its capacity to portray the habitual diet of the 9 to10-year-old scholars. It must be emphasized that, even after this process, the FFQ shall be reviewed periodically, since changes may occur in the food consumption pattern of the children, due to the constant offer of new food products targeted to this audience, in addition to the possibility of non-characteristic food of the region begin to be part of the habitual diet of the scholars, among other factors.

CONCLUSION

The development of this FFQ took into account the food habits of the target population, once the list of food items presented corresponds to the commonly ingested foods and accountable for 95% of the consumption of energy, macronutrients, and fibers of the 910-year-old scholars. The food items were grouped according to the NOVA classification of foods because it allows the understanding of the essential characteristics of the diet of children that will be evaluated through this instrument.

This instrument will still be submitted to the psychometric study, in which the steps of verification of its reliability and validity will be performed, given that these steps are essential to ensure the highest quality of the information related to the food consumption of the population under investigation.

REFERENCES

1. Lopes ACS, Caiaffa WT, Mingoti SA, Lima-Costa MFF De. Ingestão alimentar em estudos epidemiológicos. Rev Bras Epidemiol. 2003; 6:209-19. https://doi.org/10.1590/s1415-790x2003000300004
2. Fisberg RM, Marchioni DML, Slater B. Inquéritos alimentares: métodos e bases científicos. São Paulo: Barueri; 2005. 334 p.
3. Pereira R, Sichieri R. Métodos de avaliação do consumo de alimentos. In: Kac G, Sichieri R, Gigante DP, editors. Epidemiologia Nutricional. Rio de Janeiro: Fiocruz; Atheneu; 2007. p. 181-200.
4. Pereira RA, Koifman S. Uso do questionário de frequência na avaliação do consumo alimentar pregresso. Rev Saúde Pública. 1999; 33(6):610-21. https://doi.org/10.1590/s0034-89101999000600013
5. De Sales RL, Silva MMS, Costa NMB, Euclydes MP, Eckhardt VF, Rodrigues CMA, et al. Desenvolvimento de um inquérito para avaliação da ingestão alimentar de grupos populacionais. Rev Nutr. 2006; 19(5):539-52. https://doi.org/10.1590/s1415-52732006000500002
6. Colucci ACA, Philippi ST, Slater B. Desenvolvimento de um questionário de freqüência alimentar para avaliação do consumo alimentar de crianças de 2 a 5 anos de idade. Rev Bras Epidemiol. 2004; 7(4):393-401. https://doi.org/10.1590/s1415-790x2004000400003
7. Cardoso MA. Desenvolvimento, validação e aplicações de questionários de frequência alimentar em estudos epidemiológicos. In: Epidemiologia Nutricional. 2007. p. 580.
8. Monteiro C, Levy R, Claro R, De Castro I, Cannon G. A new classification of foods based on the extent and purpose of their processing. Cad Saude Publica. 2010; 26(11):2039-49. https://doi.org/10.1590/s0102-311x2010001100005
9. Monteiro CA, Cannon G, Levy R, Moubarac J-C, Jaime P, Martins AP, et al. NOVA. A estrela brilha (Classificação dos alimentos. Saúde Pública). World Nutr. 2016; 7(1-3):28-40.
10. Willett W. Nutritional Epidemiology. 2nd ed. Press;, editor. New York; 1998.
11. Cade J, Thompson R, Burley V, Warm D. Development, validation and utilisation of food-frequency questionnaires - a review. Public Heal Nutr. 2002; 5(4):567-587. https://doi.org/10.1079/phn2001318
12. Ferreira MG, Pereira RA, Silva RMVG da, Sichieri R. Álbum fotográfico para uso em inquéritos alimentares: ênfase para a dieta da população mato-grossense. Cuiabá: índice Gestão Editorial; 2011. 66 p.
13. Zabotto CB, Viana RP de T, Gil M de F. Registro fotográfico para inquéritos dietéticos: utensílios e porções. 1st ed. Goiânia: UNICAMP; UFG; 1996. 74 p.
14. Brasil. Instituto Brasileiro de Geografia e Estatística - IBGE. Pesquisa de Orçamentos Familiares 2008-2009. Tabelas de Composição Nutricional dos Alimentos Consumidos no Brasil. 1st ed. Vol. 39, Rio de Janeiro; 2011. p. 1-351.
15. Pinheiro ABV, Lacerda EM de A, Benzecry EH, Gomes MC da S, Costa VM. Tabela para avaliação de consumo alimentar em medidas caseiras. 5th ed. Atheneu. Rio de Janeiro: Atheneu; 2005. 141 p.
16. Hinnig PF, Mariath AB, Freaza SRM, Gambardella AMD, Bergamaschi DP. Construção de questionário de frequência alimentar para crianças de 7 a 10 anos. Rev Bras Epidemiol. 2014; 479-94. DOI: 10.1590/1809-4503201400020015.
17. Block G, Dresser Cm, Hartman Am CM. Nutrient sources in the American diet: quantitative data from the NHANES II survey. I. Vitamins and minerals. Am J Epidemiol. 1985; 122(1):13-26. https://doi.org/10.1093/oxfordjournals.aje.a114072
18. Hinnig PF. Construção de um questionário de frequência alimentar quantitativo para crianças de 7 a 10 anos [dissertação]. São Paulo: Universidade de São Paulo, Faculdade de Saúde Pública; 2010. doi:10.11606/D.6.2010.tde-13102010-084115.
19. Hammond J, Nelson M, Chinn S RR. Validation of a food frequency questionnaire for assessing dietary intake in a study of coronary heart disease risk factors in children. Eur J Clin Nutr. 1993; 47(4):242-50.

20. Kobayashi T, Tanaka S, Toji C, Shinohara H, Kamimura M, Okamoto N, et al. Development of a food frequency questionnaire to estimate habitual dietary intake in Japanese children. Nutr J. 2010; 9(17):1-7. doi:10.1186/1475-2891-9-17

21. Medina C, Villanueva-Borbolla M, Barquera S. Desarrollo de un cuestionario didáctico para conocer la ingestión de verduras y frutas de niños en el receso escolar. Estudio piloto. Salud Publica Mex. 2012; 54(5):479-86. https://doi.org/10.1590/s0036-36342012000500004

22. Lera L, Fretes G, González CG, Salinas J, Vio F. Validación de un instrumento para evaluar consumo, hábitos y prácticas alimentarias en escolares de 8 a 11 años. Nutr Hosp. 2015; 31(5):1977-88. doi: 10.3305/nh.2015.31.5.8607

23. Söderberg L, Lind T, Karlsland Åkeson P, Sandström A-K, Hernell O, Öhlund I. A Validation Study of an Interviewer-Administered Short Food Frequency Questionnaire in Assessing Dietary Vitamin D and Calcium Intake in Swedish Children. Nutrients [Internet]. 2017; 9(7):682-91. Available from: http://www.mdpi.com/2072-6643/9/7 https://doi.org/10.3390/nu9070682

24. Scagliusi FB, Garcia MT, Indiani ALC, Cardoso MA. Relative validity of a food-frequency questionnaire developed to assess food intake of schoolchildren living in the Brazilian Western Amazon. Cad Saude Publica. 2011; 27(11):2197-206. https://doi.org/10.1590/s0102-311x2011001100013

25. Simona B, Maria Letizia P, Emanuela P, Stefano M, Giovana. W, Giuseppe C, et al. Validation of food frequency questionnaire for assessing dietary macronutrients and calcium intake in Italian children and adolescents. J Pediatr Gastroenterol Nutr. 2005; 40(5):555-60. https://doi.org/10.1097/01.mpg.0000153004.53610.0e

26. Fumagalli F, Pontes Monteiro J, Sartorelli D, Vieira MNCM, Bianchi MP. Validation of a food frequency questionnaire for assessing dietary nutrients in Brazilian children 5 to 10 years of age. Nutrition. 2008; 24(5):427-32. https://doi.org/10.1016/j.nut.2008.01.008

27. Del Pino DL. Adaptação e validação de um questionário de frequência alimentar para crianças De 6 a 10 anos. Universidade Federal do Rio Grande do Sul; 2009.

28. Livingstone MB, Robson PJ. Measurement of dietary intake in children. Proc Nutr Soc. 2000; 59(2):279-93. https://doi.org/10.1017/s0029665100000318.

29. Ribeiro AB, Cardoso MA. Construção de um questionário de frequência, alimentar como subsídio para programas de prevenção de doenças crônicas não transmissíveis. Rev Nutr. 2002; 15(2):239-45. https://doi.org/10.1590/s1415-52732002000200012

Contributors

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