Assessment of a Short Food Frequency Questionnaire as Predictor of Hypercholesterolemia in Adolescents

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Objective: To evaluate a short food frequency questionnaire (FFQ) as predictor of serum cholesterol obtained from a probabilistic sample of adolescents.

Methods: A probabilistic sample of 5th to12th grade students from state public schools in Niteroi, state of Rio de Janeiro, Brazil selected from 28 classes. Five hundred seventy-seven subjects had their blood collected, and 539 answered the short FFQ. The non response rate was 23.7%. The questionnaire internal consistence was evaluated through Cronbach's alpha, and agreement between cholesterol levels and food intake was assessed through weighted Kappa (K_w).

Results: Weighted Kappa value was very low (<- 0.05), despite the good internal consistence of the questionnaire (Cronbach's alpha > 0.66).

Conclusion: The results show that the short FFQ was not a predictor of cholesterol concentration.

Key words: hypercholesterolemia, adolescent, food consumption, reproducibility of results, Brazil.

According to the World Health Organization – (WHO)[1], 29% out of 50 million deaths in 1997 were due to cardiovascular system diseases. Among those, coronary artery disease (CAD) secondary to atherosclerosis is one of the main causes of morbidity and mortality in the world.

Inappropriate diet is one of the main risk factors for CAD. The intake of total fat, saturated fatty acids and cholesterol[2-5], as well as trans isomers[6], are positively associated with CAD.

Food intake at childhood and adolescents is associated with the development of chronic diseases in adulthood, such as cardiovascular diseases, cancer and osteoporosis[7]. Thus, the assessment of eating habits at this stage is relevant to evaluate risky habits.

One of the tools used to assess food consumption in adolescents is the food frequency questionnaire (FFQ), which is well accepted among youngsters[8], and presents a relatively low cost when it is self-completed[9]. As consequence many FFQ has been developed for adolescents[10-13]. Some studies have developed short questionnaires directed to evaluation of consumption of specific foods associated with the risk of chronic diseases[14,15], especially conditions related with fat consumption[12,16].

Chiara and Sichieri[17] developed a simplified questionnaire for self-evaluation of adolescents in terms of high saturated and trans fat intakes; this questionnaire originated from a semi-quantitative questionnaire with 80 items which had been validated[18]. The selection of nine items in the simplified questionnaire from out of the initial 80 items was due to the fact that these 9 items could explain 85% of the estimated variation of serum cholesterol level of the diet.

A similar method to develop a simplified questionnaire had already been used to characterize the quality of diet in the population from the United States (US)[19]. Block et al[15] elaborated a questionnaire with 15 items to assess fat intake in the US population; in that, 10 items were similar to those proposed by Chiara & Sichieri[17].

The purpose of this study was to evaluate this simplified questionnaire composed of 9 items as a predictor of serum cholesterol levels obtained in a probabilistic sample of adolescents.

Methods

A probabilistic sample of adolescents aged 12 to 19 years, of public schools in Niterói, state of Rio de Janeiro, Brazil, was evaluated in 2003. Adolescents with physical disabilities that prevented the anthropometric evaluation and also pregnant adolescents were excluded from the study.

The sampling calculation was based on a prevalence of 25% of hypercholesterolemia[20], with a confidence interval of 95% and a precision of 5%. Estimated size of sample was of 600 students[21]. By anticipating a non-response of 30%, according to a pilot study performed, the final sample was estimated as 780 adolescents, which was equivalent to 26 classes of 30 students between the 5th and 12th grades. Because classes were sampled instead of children a total of 28 classes were sanpled. In the classes drawn, all students who met the eligibility criteria were invited to participate in the study,

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totaling up 757 students. Anthropometric data were obtained in 610 youths. A total of 577, out of 610 students, had their blood collected the non-response rate was 23.7% and 539 answered the simplified FFQ (Chart 1).

Weight and height were measured; weight was measured using an electronic and portable precision able to weigh up to 150 kg and with a variation of 50g; the adolescents were barefoot, wore lightweight clothes and did not carry any heavy objects.

Height was measured with the use of a portable 200-cm anthropometer with a scale of 0.1 cm. Students were barefoot and had their heels next to each other and touching the anthropometer, and the head was maintained at the Frankfurt´s horizontal plane. Two measurements were performed and values were averaged. If variation between the two measures exceeded 0.05 cm, measures were repeated.

For biochemical evaluation 10 mL of blood was drown by a technician in the morning period, after a fasting of 12 hours. The blood samples were stored in a polystyrene container filled with dry ice, and taken immediately after collection to the clinical analysis laboratory. Serum cholesterol was evaluated by the automated enzymatic method.

The 9-item[17] simplified questionnaire was completed by the adolescents during the class period.

Duplicate data entry used the EPI-INFO[22] software, version 6.04[23], that allowed to automatic logic checks to prevent possible typing errors. In order to assess the internal consistency of the questionnaire the Cronbach´s alpha was used[24].

The cutoff points used to define cholesterolemia in youngsters were those established by the National Cholesterol Education Program Expert Panel on Blood Cholesterol levels in children and adolescents – NCEP[25].

The simplified food questionnaire (SFQ) was evaluated according to the scores proposed by the authors[17] in terms of cardiovascular risk, classifying the consumption as appropriate (100 points), high (between 101 and 119 points) and excessive (≥ 120 points). The sum of the consumption frequency of 9 SFQ items was also analyzed without taking into account the proposed scores.

The evaluation of agreement between the classification of consumption obtained with the questionnaire and the classification of total cholesterol serum concentrations proposed by the NCEP[25] was carried out by using the weighted Kappa. The interpretation of Kappa results followed Shrout´s instructions [26].

The statistical analyses were performed using the SAS System program for Windows, version 8.2 [27].

The study protocol was approved by the Research Ethics Committee of the *Hospital Universitário Clementino Fraga Filho* of the *Universidade Federal do Rio de Janeiro*.

The results of anthropometric and biochemical assessments were handed to the students and those who presented risky abnormalities were given orientation.

Results

The characteristics of the population studied, according to gender, are described in Table 1.

Foods	Consumption frequency							
	Per day			Per week				
	Once	Twice	3 or + times	Once or twice	3 or 4 times	5 or 6 times	Never / almost never	Subtotal (*)
French Fries or Potato Chips (100g)	48	96	144	10	24	38	0	
Beef or roasted meat (1 average unit)	50	100	150	11	25	39	0	
Cookies (50g)	21	42	63	4.5	10.5	16.5	0	
Cakes or pies (1 slice)	16	32	48	3.5	8	12.5	0	
Whole-fat milk (1 glass)	24	48	72	5	12	19	0	
Hamburger (1 unit)	25	50	75	5	12.5	20	0	
Cheese (1 slice)	10	20	30	2	5	8	0	
Butter or margarine (1 dessert spoon)	2	4	6	0.5	1	1.5	0	
Sausage (1 unit)	4	8	12	1	2	3	0	

(*) The subtotal column corresponds to the sum of values mentioned in the consumption frequency column for each food.

Chart 1 - Simplified questionnaire for self-evaluation of food consumption associated with the risk of coronary diseases in adolescents

	Males	Females
Age (years)	16.5 (0.3)	16.1 (0.3)
Body mass index (kg/m2)	21.1 (0.3)	21.1 (0.2)
Serum cholesterol (mg/dL)	150.5 (4.1)	160.4 (3.50)1

"1 p< 0.0001 (Student´s t test)".

Table 1 - Means and standard-errors of the variables studied, by sex, in a probabilistic sample of adolescents in public schools of Niteroi, RJ, 2003

The weighted Kappa value for males was – 0.05 (-0.14 to 0.05) and for females, -0.06 (-0.14 to 0.02) (Table 2).

The mean serum cholesterol was higher (p<0.0001) for girls (160.4 mg/dL) than for boys (150.5 mg/dL). These means, according to food consumption classification, were 150 mg/dL, 159 mg/dL and 146 mg/dL for boys and 162 mg/dL, 161 mg/dL and 158 mg/dL for girls, when the food consumption was normal, high and excessive, respectively. There was no statistically significant difference between the groups according to the consumption classification (p= 0.29 in boys and p= 0.54 in girls).

The questionnaire's internal consistency, analyzed with Cronbach´s alpha was 0.70 in males and 0.66 in females.

Discussion

There was no agreement between the serum cholesterol levels and food consumption in the youths studied, although the SFQ showed a good internal consistency. Rabelo et al[28] also did not detect any association between changes in lipid levels and consumption of fat in adolescents despite the high number of individuals who eat excessive amounts of total fat and cholesterol. A similar result was observed by Fisberg et al[29] evaluating food consumption in 118 university students in the State of Sao Paulo (Brazil), with a mean age of 20.3 years. Few epidemiological studies carried out in a single population reported a direct association between the eating habits and serum lipid concentrations[30]. This association is found in studies comparing different populations, such as the Seven Countries Study[31].

Willett[7] emphasizes that the expected correlation between dietary cholesterol and serum cholesterol in populations should be low even using a perfect method to measure food consumption. This is because several factors, including genetic ones, influence serum cholesterol levels. Additionally, within the same population there are major inter-individual differences in the ability to suppress the synthesis of cholesterol with increased dietary cholesterol[32].

Genetic participation in determining the variability of lipid profile is approximately 60%; it can have a monogenic (when it is influenced by one gene or one pair of genes) or polygenic determination. Polygenic disorders result from the expression of several genes in interaction with environmental factors, such as inappropriate diet and sedentary lifestyle[25].

Means values of cholesterol for both sexes found in the current study are in accordance with the literature. Gerber and Zienlinsky[20], in a sample of 1501 students aged 6-16 years and residing in the State of Rio Grande do Sul, found a mean of 167 mg/dL. Rabelo et al[28] evaluated 17-19-year-old students in a private University in Sao Paulo and obtained a similar mean cholesterol level (178 mg/dL). Moura et al[33], in Campinas, studied a sample of 1600 students (ages ranging between 7-14 years) and detected a mean total cholesterol level of 160 mg/dL.

Compared with international studies, a systematic review of the 1975-1996 period, based on 18 studies in 26 countries, involving individuals aged 2 to 19 years, detected mean serum cholesterol levels of 160 mg/dL in students in the USA, 187 mg/dL in Finland, 183 mg/dL in Greece and Germany, and 180 mg/dL in Switzerland. The overall mean was 165mg/dL, which is slightly higher than the value observed in the current study[34].

Excessive fat and cholesterol intake is associated with increased levels of serum cholesterol[30,35]. The current study evaluated the fat intake but total energy intake was not evaluated, as well as other nutrients that may reduce serum cholesterol levels such as fibers, since a simplified food frequency questionnaire was used. Such factors, as well as the lack of evaluation of physical activity, may represent a limitation in this study. Regular physical activity can bring direct and indirect benefits the lipid profile[36].

Thus, the results found do not allow us to conclude that the simplified questionnaire applied in this study can be used as a predictor of hypercholesterolemia in adolescents.

Informed Consent Form

(In compliance with Resolution 196/96 of the National Health Council / Ministry of Health)

Consumption*	Total serum cholesterol (mg/dL)**					
	Males (n= 190)			Females (n= 318)		
	Normal	Borderline	Increased	Normal	Borderline	Increased
Normal	68	22	10	86	52	20
Increased	15	5	3	26	8	4
Excessive	50	13	4	76	33	13

** Consumption according to the simplified questionnaire 17. ** Total serum cholesterol: normal up to 170 mg/dL; borderline ranging from 170 to 199 mg/dL and increased equal to or greater than 200 mg/dL 25.*

Table 2 - Agreement between serum cholesterol classifications according to cholesterol consumption, by sex, in a probabilistic sample of adolescents in public schools of Niteroi, RJ, 2003

Purpose of this study: I was informed that a research will be carried out at the school attended by my son/daughter , in order to check the values of body mass index (BMI –weight (Kg) / height in m^2), waist circumference (WC) and waist to hip ratio (WHR) that may be associated with changes in the blood lipid profile (cholesterol and triglycerides), high values of plasma glucose and blood pressure in adolescents. This study shall include measurements of weight, height, waist and hip circumferences and body fat using an electronic scale, stadiometer, tape measure and bioimpedance instrument, respectively; the adolescents will wear their Physical Education class uniform. Bioimpedance technique to evaluate body fat percentage consists of passing a low, unnoticeable and painless electric current, lasting 30 seconds, through electrodes placed on the hands and feet. A self-evaluation of the sex maturity shall be carried out, in which the adolescent will check, in a specific form, the stage of pubertal development he/she fits in, after looking at illustrations about the development of secondary sexual characteristics. This evaluation shall take place in a secluded environment and without the presence of any research participant. A blood sample will also be drawn with disposable material by a trained person with the purpose of evaluating blood cholesterol, triglycerides, glucose and insulin; blood pressure will also be measured. The tests will be performed in the morning as per previously scheduled appointments and only after a detailed explanation of the procedures to the adolescent and the reception of consent given by the adolescent and by his/her guardian. The adolescent shall observe a fasting period of 12 hours; a snack will be offered after blood collection. The adolescents shall answer a questionnaire about diet and physical activity.

Risks: the participation in the study does not imply any risks to the adolescent's health, although a certain discomfort may be present at blood collection.

Benefits: the information obtained with this study may be scientifically helpful and may help other individuals.The adolescent shall also have access to the diagnosis of his/her nutritional status and results of blood chemistry tests and blood pressure levels, and may be referred to nutritional guidance, if necessary.

Privacy: any information obtained in this investigation shall be confidential and will only be disclosed after permission from the adolescent and his/her guardian. Individual data obtained in this study will be revealed only to the study participant. The resulting scientific data can be presented in medical congresses and scientific journals without identifying the participants. The adolescent's participation in this study shall be totally voluntary and he/she can drop out from the study at any time and for any reason. The person in charge of this study may be contacted anytime for more detailed information about the study and any clarifications about the study at the telephone numbers 2562-6595 or 96114080.

Based on the information above, I authorize my son (daughter) (space) (name of adolescent) to participate, if he/she wishes to do so, in the study "Body mass index, waist circumference and waist to hip ratio as predictors of risk factors for cardiovascular diseases in adolescents," conducted by the researchers at the UFRJ.

I Authorized my son (daughter)

Name of adolescent ----------

_____

Signature of the person in charge of the adolescent (guardian)

Date: _____/_____/_____

Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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