

Diet quality in a sample of adults from Cuiabá (MT), Brazil: Association with sociodemographic factors

Qualidade da dieta de uma amostra de adultos de Cuiabá (MT): associação com fatores sociodemográficos

Anarlete da Silva LOUREIRO¹
Regina Maria Veras Gonçalves da SILVA²
Paulo Rogério Melo RODRIGUES³
Rosângela Alves PEREIRA³
Loiva Lide WENDPAP²
Márcia Gonçalves FERREIRA²

ABSTRACT

Objective

To analyze the dietary quality of adults and to identify associated factors.

Methods

Cross-sectional study carried out in a sample of adults (n=195), aged 20-50 years, of both genders, from a population-based study in Cuiabá, Mato Grosso, Brazil. Food consumption data was collected by a food frequency questionnaire. Sociodemographic, lifestyle, anthropometric, and body composition data were also collected. Diet quality was analyzed by the Brazilian Healthy Eating Index-Revised. The associations were estimated by Poisson regression.

Results

The mean Brazilian Healthy Eating Index-Revised score was 75.2 points (CI95%=74.2-76.1), which differed significantly between the genders ($p=0.03$). Women had higher scores for whole fruit and sodium ($p<0.01$),

¹ Instituto Federal de Educação, Ciência e Tecnologia de Mato Grosso. Campus Cáceres, Av. dos Ramires, s/n., Distrito Industrial, 78200-000, Cáceres, MT, Brasil. *Correspondência para/Correspondence to:* AS LOUREIRO. *E-mail:* <anarlete.loureiro@cas.ifmt.edu.br>.

² Universidade Federal de Mato Grosso, Faculdade de Nutrição, Departamento de Alimentos e Nutrição. Cuiabá, MT, Brasil.

³ Universidade Federal do Rio de Janeiro, Instituto de Nutrição Josué de Castro, Departamento de Nutrição Social e Aplicada. Rio de Janeiro, RJ, Brasil.

Support: This study was sponsored by *Conselho Nacional de Desenvolvimento Científico e Tecnológico*, under protocol n° 473390/2008-6.

while men had higher scores for oils, nuts, and fish fat ($p=0.02$). Individuals aged ≥ 30 years had higher total Brazilian Healthy Eating Index-Revised score and higher scores for the groups whole fruit; saturated fat; and calories from solid fats, alcoholic beverages, and added sugar ($p<0.01$). The Poisson regression between high Brazilian Healthy Eating Index-Revised and the independent variables showed that high Brazilian Healthy Eating Index-Revised was associated with being female, being aged 30 years or more, and being from families whose household head had 8 or more years of formal education.

Conclusion

The factors associated with high Brazilian Healthy Eating Index-Revised were age, gender, and education level of the household head.

Indexing terms: Adult. Diet. Food consumption.

RESUMO

Objetivo

Analisar a qualidade da dieta e identificar fatores associados em adultos residentes na área urbana de Cuiabá, Mato Grosso, Brasil.

Métodos

Estudo transversal com amostra de 195 adultos de 20 a 50 anos, de ambos os sexos, extraída de estudo de base populacional. A ingestão alimentar foi avaliada por questionário de frequência de consumo alimentar. Foram coletados dados sociodemográficos, de estilo de vida, antropométricos e de composição corporal. A qualidade da dieta foi analisada pelo Índice de Qualidade da Dieta Revisado. As associações foram estimadas por meio da regressão de Poisson.

Resultados

A média do Índice de Qualidade da Dieta Revisado foi de 75,2 pontos (IC95%: 74,2-76,1), com diferença estatisticamente significativa entre os sexos ($p=0,03$). As mulheres obtiveram melhor pontuação para frutas inteiras e sódio ($p<0,01$), enquanto os homens obtiveram maiores escores para óleos, oleaginosas e gordura de peixe ($p=0,02$). Indivíduos com idade igual ou superior a 30 anos obtiveram maior pontuação para o Índice de Qualidade da Dieta Revisado total, fruta inteira, gordura saturada e calorias provenientes de gordura sólida, álcool e açúcar de adição ($p<0,01$). A regressão de Poisson entre o Índice de Qualidade da Dieta Revisado elevado e variáveis independentes mostrou associação para mulheres, para indivíduos com 30 anos ou mais e para aqueles cujo chefe da família apresentava maior escolaridade.

Conclusão

Os fatores que se mostraram associados ao Índice de Qualidade da Dieta Revisado elevado foram a idade, o sexo e a escolaridade do chefe da família.

Termos de indexação: Adulto. Dieta. Consumo alimentar.

INTRODUCTION

In the last decades in Brazil, changes in lifestyle, economic, social, and demographic conditions promoted changes in diet and level of physical activity that affected people's health negatively. These changes are associated with the growing prevalence of obesity and Chronic Non-Communicable Diseases (NCD)^{1,2}.

The need of understanding the association between diet and NCD led to the development

and continuous improvement of dietary indices. In Brazil, Previdelli *et al.*³, used the Brazilian Food Guide⁴ to propose the Brazilian Healthy Eating Index-Revised (BHEI-R), which resulted in the adaptation of the North American Healthy Eating Index (HEI) to the Brazilian Population⁵.

Like the Healthy Eating Index⁵ revised in 2005, the BHEI-R includes the foods and nutrients that are most likely to promote health and prevent disease. The BHEI-R also approaches dietary factors that are considered unhealthy, allowing

their association with socioeconomic, demographic, anthropometric, and lifestyle components; and health-related outcomes.

The Brazilian Healthy Eating Index-Revised³ estimates dietary adequacy and detects changes in dietary patterns; it considers the recommendations for a healthy diet taking into account the Brazilian dietary characteristics and allows the dietary assessment and monitoring of individuals and populations. This index classifies individuals into dietary categories by grouping them into similar segments. The purpose is to investigate possible associations with other factors and to identify population groups that are at risk of consuming a diet inadequate in a given nutrient or food group.

The objective of this study was to analyze the dietary quality of adults living in the urban region of *Cuiabá* (MT), Brazil and identify possible associated factors using the BHEI-R adapted for the Brazilian population.

METHODS

Study design and population

This cross-sectional study included 195 adults of both genders aged 20 to 50 years from the urban area of *Cuiabá* (MT)⁶. A secondary analysis was done of their food intake data, collected by a Food Frequency Questionnaire (FFQ). The sample size was calculated as recommended by Willett *et al.*⁷.

The study participants were selected from a sample of participants of a population-based study that investigated the prevalence of hypertension in the city of *Cuiabá* (MT), in 2003-2004⁸. The present study used cluster sampling in three phases. Stratification was proportional to the density of each urban region of *Cuiabá* (MT). More details about the sampling method can be found elsewhere⁸.

Data were collected from July to September 2007 through personal interviews and

anthropometric assessments done at the participants' homes.

Measurement procedures

The participants' race/skin color was self-reported and classified as recommended by the Instituto Brasileiro de Geografia e Estatística⁹ (IBGE, Brazilian Institute of Geography and Statistics). Age was recorded in years. The individual's and household head's education levels were also classified as recommended by IBGE¹⁰. The socioeconomic level was categorized as recommended by the Associação Brasileira de Empresas de Pesquisa¹¹ (ABEP, Brazilian Association of Survey Companies).

The participants were also classified as active or inactive depending on how much leisure physical activity they had practiced weekly in the month that preceded the interview; other classifications included smoking status (smokers, nonsmokers, or ex-smokers); and consumption of alcoholic beverages based on their consumption in the two weeks that preceded the interview (consumers, non-consumers). More details on their lifestyle-related variables are available elsewhere¹².

Anthropometric and body composition assessments

Weight; height; and waist, and hip circumferences were measured as recommended by the literature^{13,14}. Weight was determined by a body composition analyzer of the brand Tanita, model UM 080, with 150.0kg capacity and 0.1kg accuracy. This same analyzer was used for determining percentage of body fat. Except for weight, anthropometric measurements were taken twice and the final measurement was given by calculating the means. Nutritional status was classified according to Body Mass Index (BMI), given by dividing the weight by the square of the height. BMI, waist circumference, and Waist-to-

Hip Ratio (WHR) were categorized according to the cut-off points recommended by the World Health Organization¹⁵. Percentage of body fat was categorized according to the cut-off points proposed by Gibson¹⁶.

Food consumption

Habitual food intake data were collected by a semiquantitative FFQ. The said FFQ contained 81 food items divided into food groups. Three standard serving sizes and eight intake frequency options, from three times per day to rarely or never, were available for each item. This study investigated 75 food items, leaving out those whose main components had already been reflected by other items.

The intake frequencies reported in the FFQ were converted into daily frequencies and a value of 1.0 was attributed to a once-daily consumption. Proportional values were used for the other frequency options. The mean daily intake of each food item was calculated by multiplying the daily frequency by the amount consumed.

The energy and nutrient contents of the diet were determined by the software Nutwin¹⁷, which uses the United States Department of Agriculture (USDA) food composition table. The food groups were grouped according to the groups in the Brazilian Food Guide⁴. The preparations that contained more than one food group, such as sandwiches, pizzas, stuffed pasta, and other mixtures, were divided into their individual components, which were then classified in the corresponding groups. The nutrients and dietary information of foods that were not found in the program's database were collected from the Nutrition Data System for Research (NDSR)¹⁸ and from the *Tabela Brasileira de Composição de Alimentos* (TACO, Brazilian Food Composition Table)¹⁹.

Diet quality assessment

The Brazilian Healthy Eating Index-Revised³ was used for assessing diet quality. Originally, this

index consisted of points given to twelve components that characterize different dietary aspects: nine components are food groups; two are nutrients (sodium and saturated fat); and one is the energy percentage of the diet coming from Solid Fats, Alcoholic beverages, and Added Sugar (SoFAAS). The score attributed to the food group components included the number of servings recommended by the Brazilian Food Guide⁴ for a 2,000kcal diet.

The item "*Whole Grains*" in the BHEI-R was not used in the present study because the study FFQ does not distinguish between grain types. Therefore, 10 points were attributed to three 1,000kcal grain servings as a criterion for the maximum score in the item "*Total Grains*". Hence, the BHEI-R in this study consists of points stemming from eleven components.

The total Brazilian Healthy Eating Index-Revised score is 100 points. High scores indicate that the diet is close to ideal, while low scores indicate that the diet is far from ideal.

Statistical analysis

The total and component Brazilian Healthy Eating Index-Revised scores were analyzed as continuous variables. Additionally, the total scores were categorized into quartiles. The continuous variables were expressed as means, standard deviation, and 95% Confidence Interval (95%CI) and the categorical variables as proportion (%) and respective 95%CI. The Kolmogorov-Smirnov test was used for determining the distribution symmetry of the continuous variables. The nonparametric variable means were compared by the Mann-Whitney test ($p < 0.05$).

The bivariate analysis used the prevalence ratio and the 95%CI to investigate possible associations between the independent variables (gender, age, participant's education level, household head education level, social class, marital status, skin color, leisure physical activity status, smoking status, alcohol intake status, BMI, percentage of body fat, waist-to-hip ratio, and

waist circumference) and the response variable (high BHEI-R). The variables with p value ≤ 0.20 in the bivariate analysis were included in the Poisson regression. The significance level was set at 5% ($p \leq 0.05$).

Brazilian Healthy Eating Index-Revised scores above the third quartile were considered high. The independent variables were included simultaneously in the Poisson regression model.

Ethical aspects

The research project was approved by the Research Ethics Committee of the University Hospital Júlio Muller under protocol number n° 234/CEP-HUJM/05, on December 3, 2008. All participants signed a Free and Informed Consent form before they entered the study, as recommended by Resolution 196/96²⁰ of the National Health Council.

RESULTS

A total of 195 adults were assessed; of these, 51% were females, 58% were aged 30 years or more, 80% were not Caucasians, 55% were from the social classes A and B, 54% were single, 74% were from household whose head had more than 8 years of formal education, and 52% were overweight or obese (Table 1).

The mean Brazilian Healthy Eating Index-Revised score was 75.2 points (95%CI=74.2-76.1), and the mean scores of women and men differed significantly (76.1 and 74.2; $p=0.03$). Table 2 shows that men obtained higher scores for the food groups oils, nuts, and fish oil (9.4 and 8.9; $p=0.02$), while women obtained higher scores for whole fruits (4.7 and 4.2; $p<0.01$) and sodium (2.9 and 1.9; $p<0.01$).

Table 2 shows that the participants aged 30 or older had higher total BHEI-R scores (76.4 and 73.6; $p<0.01$), and they had higher scores for the components whole fruit (4.7 and 4.2; $p<0.01$), saturated fat (9.0 and 8.5; $p<0.01$); and

Table 1. Characterization of the sociodemographic, lifestyle, weight, and body composition data of a sample of adults from Cuiabá (MT), Brazil, 2007.

Variable	n	%	95%CI
<i>Gender</i>			
Male	95	48.7	41.5- 56.0
Female	100	51.3	44.0- 58.5
<i>Age (years)</i>			
20 to 29	82	42.1	35.0- 49.3
30 to 39	53	27.2	21.7- 34.0
40 to 50	60	30.8	24.4- 37.8
<i>Marital status</i>			
Single	93	47.7	40.5- 54.9
Married	89	45.6	38.5- 52.9
Widowed	2	1.0	0.1- 3.7
Separated	11	5.6	2.8- 9.9
<i>Social class</i>			
A	21	10.8	6.8- 16.0
B	87	44.6	37.5- 51.9
C	74	37.9	31.1- 45.2
D	13	6.7	3.6- 11.1
<i>Skin color</i>			
White	39	20.0	14.6- 26.3
Brown	103	52.8	45.6- 60.0
Black	49	25.1	19.2- 31.8
Asian	4	2.1	0.6- 5.2
<i>Participant's education level</i>			
≥8 years of formal education	172	88.2	82.8- 92.4
<8 years of formal education	23	11.8	7.6- 17.2
<i>Household head education level</i>			
≥8 years of formal education	145	74.4	67.6- 80.3
<8 years of formal education	50	25.6	19.7- 32.4
<i>Leisure physical activity</i>			
Yes	74	37.9	31.1- 45.2
No	121	62.1	54.8- 68.9
<i>Smoking status</i>			
Smoker	25	12.8	8.5- 18.3
Ex-smoker	29	14.9	10.2- 20.7
Non smoker	141	72.3	65.5- 78.5
<i>Alcoholic beverage intake</i>			
Yes	75	38.5	31.6- 45.7
No	120	61.5	54.3- 68.4
<i>Waist-to-hip ratio</i>			
Normal	179	91.8	87.0- 95.2
High	16	8.2	4.8- 13.0
<i>Percentage of body fat</i>			
Normal	102	21.5	17.1- 26.5
High	93	78.5	72.2- 84.8
<i>Body mass index</i>			
Underweight	6	3.1	1.1- 6.6
Normal weight	87	44.6	37.5- 51.9
Overweight	64	32.8	26.3- 39.9
Obese	38	19.5	14.2- 25.8

Note: 95%CI: 95% Confidence Interval.

calories from solid fats, alcoholic beverages and added sugar (17.0 and 15.1; $p < 0.01$).

Table 3 analyzes the association between explanatory variables and the response variable (high BHEI-R) given by the crude Prevalence Ratio (PR) and its respective 95% CI. Women were more likely to have higher BHEI-R scores than men (PR=2.15; 95%CI=1.17-3.95). Likewise, higher scores of BHEI-R were seen in older individuals (PR=2.23; 95%CI=1.18-4.21), married individuals (PR=2.70; 95%CI=1.47-4.96), individuals whose household head had at least 8 years of formal education (PR=2.06; 95%CI=0.99-4.61), and Caucasians (PR=1.61; 95%CI=0.95-2.83).

Poisson regression between high BHEI-R and the independent variables showed that only

the sociodemographic variables were associated with high BHEI-R scores. Women were twice as likely to have a high BHEI-R (Odds Ratio-OR=2.00; 95%CI=1.08-3.69). Other factors associated with high BHEI-R were age ≥ 30 years (OR=2.07; 95%CI=1.09-3.93) and belonging to a household whose head had 8 years or more of formal education (OR=2.21; 95%CI=1.07-4.92), regardless of other factors (Table 4).

DISCUSSION

In the sample of adults evaluated in *Cuiabá* (MT) the participants with better diets were women, individuals aged 30 years or more, and individuals whose household heads had at least

Table 2. Mean and 95% confidence interval of the Brazilian Healthy Eating Index - Revised (BHEI-R) and its components according to gender and age in a sample of adults from *Cuiabá* (MT), Brazil, 2007.

Components BHEI-R	Maximum score	Total BHEI-R scores	Gender		Age	
			Male	Female	Under 30 years	30 years or more
Total BHEI-R	100	75.16 (74.18-76.14)	74.22 (72.80-75.64)	76.05 (74.71-77.4)*	73.57 (72.06-75.14)	76.44 (75.24-77.64)*
Total Fruit	5	4.55 (4.41-4.70)	4.38 (4.12-4.64)	4.71 (4.57-4.81)	4.4 (4.23-4.71)	4.62 (4.44-4.80)
Whole Fruit	5	4.45 (4.27-4.62)	4.18 (3.88-4.49)	4.68 (4.52-4.85)*	4.18 (3.88-4.48)	4.66 (4.47-4.85)*
Total vegetables	5	4.61 (4.49-4.73)	4.67 (4.51-4.83)	4.54 (4.36-4.71)	4.51 (4.31-4.71)	4.69 (4.54-4.83)
Dark green and orange vegetables	5	4.15 (3.95-4.36)	4.29 (4.01-4.57)	4.02 (3.71-4.32)	4.06 (3.73-4.40)	4.23 (3.96-4.50)
Total grains	10	6.43 (6.18-6.68)	6.41 (6.08-6.75)	6.44 (6.07-6.82)	6.44 (6.07-6.80)	6.43 (6.09-6.77)
Meats, eggs, legumes	10	9.94 (9.86-10.00)	9.94 (9.84-10.00)	9.92 (9.82-10.00)	10.00 (10.00-10.00)	9.88 (9.75-10.00)
Milk	10	4.49 (4.11-4.87)	4.23 (3.65-4.81)	4.73 (4.23-5.22)	4.66 (4.09-5.22)	4.36 (3.84-4.87)
Oils	10	9.13 (8.90-9.37)	9.37 (9.05-9.62)*	8.9 (8.55-9.26)	9.2 (8.84-9.60)	9.06 (8.75-9.38)
Saturated fat	10	8.81 (8.63-9.00)	8.81 (8.52-9.10)	8.81 (8.55-9.06)	8.54 (8.23-8.85)	9.03 (8.81-9.26)*
Sodium	10	2.43 (2.08-2.79)	1.87 (1.41-2.33)	2.96 (2.43-3.48)*	2.35 (1.83-2.86)	2.50 (2.00-2.99)
SoFAAS	20	16.16 (15.47-16.85)	16.00 (15.03-16.97)	16.30 (15.30-17.3)	15.14 (14.03-16.25)	16.98 (16.12-17.83)*

Note: * $p < 0.05$ associated according to the Mann-Whitney test.

SoFAAS: Calories from solid Fats, Alcoholic beverages, and Added Sugar.

Table 3. Prevalence of high Brazilian Healthy Eating Index-Revised (BHEI-R) score (%), Prevalence Ratio (PR), and 95% Confidence Interval (95%CI), according to the characteristics of a sample of adults from Cuiabá (MT), Brazil, 2007.

Variable	%	PR (95%CI)	p value
<i>Gender</i>			
Female	34.0 (34/100)	2.15 (1.17 - 3.95)	0.01
Male	15.8 (15/95)	1.00	
<i>Age</i>			
>30 years	33.3 (36/108)	2.23 (1.18 - 4.21)	0.01
≤30 years	14.9 (13/87)	1.00	
<i>Participant's education level</i>			
≥8 years	26.2 (45/172)	1.50 (0.54 - 4.18)	0.43
<8 years	17.4 (4/23)	1.00	
<i>Household head education level</i>			
≥8 years	29.0 (42/145)	2.06 (0.99 - 4.61)	0.08
<8 years	14.0 (7/50)	1.00	
<i>Social class*</i>			
A and B	26.9 (29/108)	1.17 (0.66 - 2.06)	0.59
C and D	23.0 (20/87)	1.00	
<i>Marital status</i>			
Married	38.2 (34/89)	2.70 (1.47 - 4.96)	0.001
Not married	14.2 (15/106)	1.00	
<i>Skin color</i>			
White	33.9 (21/62)	1.61 (0.91 - 2.83)	0.05
Non-white	21.1 (28/133)	1.00	
<i>Leisure physical activity</i>			
Yes	25.7 (19/74)	1.04 (0.58 - 1.84)	0.91
No	24.8 (30/121)	1.00	
<i>Smoking status</i>			
No	26.8 (45/168)	1.74 (0.63 - 4.84)	0.29
Yes	15.4 (4/26)	1.00	
<i>Alcoholic beverage intake</i>			
No	27.0 (17/63)	1.13 (0.63 - 1.99)	0.69
Yes	24.0 (18/75)	1.00	
<i>BMI (kg/m²)¹</i>			
Excess weight	27.5 (28/102)	1.22 (0.69 - 2.14)	0.50
No excess weight	22.6 (21/93)	1.00	
<i>Waist-to-hip ratio¹</i>			
At risk	37.5 (6/16)	1.56 (0.66 - 3.67)	0.31
No risk	24.0 (43/179)	1.00	
<i>Percentage of body fat²</i>			
At risk	30.1 (28/93)	1.46 (0.83 - 2.57)	0.19
No risk	20.6 (21/102)	1.00	
<i>Waist circumference¹</i>			
At risk	29.3 (24/82)	1.37 (0.78 - 2.41)	0.28
No risk	21.4 (24/112)	1.00	

Note: *Economic classification according to the Brazilian Association of Survey Companies (ABEP)¹¹; ¹World Health Organization cut-off points¹⁵; ²Gibson cut-off points¹⁶. BMI: Body Mass Index.

Table 4. Crude (PR_b) and adjusted (PR_{ad}) Prevalence Ratios and 95% Confidence Interval (95%CI) between the Brazilian Healthy Eating Index-Revised (BHEI-R) and associated factors. *Cuiabá* (MT), Brazil, 2007.

Variables	PR _b	95%CI	PR _{ad}	95%CI
<i>Gender</i>				
Female/Male	2.15	1.17 - 3.95	2.00	1.08 - 3.69
<i>Age</i>				
≥30 years/<30 years	2.23	1.18 - 4.21	2.07	1.09 - 3.93
<i>Household head education level (in years)</i>				
≥8/<8	2.06	0.99 - 4.61	2.21	1.07 - 4.92

8 years of formal education. Analysis of the BHEI-R components shows that the consumption of fruits and non-starchy vegetables was close to the recommended intakes, but the consumption of sodium was high, and the consumption of milk and dairy products was low.

There are no other Brazilian studies that use the BHEI-R in adults. However, comparison of studies that use the HEI-2005 and BHEI-R is possible because the two indices are similar.

Results similar to those of the present study were found by other studies done in Brazil and elsewhere, that is, different HEI scores between genders, age groups, and education level of the household head^{21,22}. Gender, age group, and education level are determinants of food habits since they influence an individual's decision to adopt protective or risk behaviors concordant with the cultural standards of his group. People become more health aware as they age, which may have a positive influence on diet quality, contributing to better food choices. Regarding education level, the observed association may be explained by the relationship between low education level and low income, and by lower access to nutrition information^{23,24}.

The use of a Food Frequency Questionnaire for collecting dietary data may have affected the scores of some BHEI-R components because the main limitations of this method are its predefined food list and its dependence on the participants' understanding and memory²⁵. However, the FFQ reflects the usual intake, which minimizes

intraindividual variability, contrary to the 24-hour Recall (R24h) or the food record.

The mean Brazilian Healthy Eating Index-Revised scores found by the present study, 74.2 for men and 76.1 for women, was greater than those found for North American adults, which varied from 52.6 to 65.4 points^{26,27}. In a study conducted by Pires²⁸ with 204 individuals from both genders and aged 18 to 79 years participating in a population-based study in the municipality of *São Paulo*, the mean BHEI-R was 64.0 points for men and 65.4 points for women. The mean BHEI-R scores found by the present study may have been overestimated because of the method used for collecting dietary data. According to the literature, the mean HEI score tends to be overestimated when the FFQ is used, contrary to the R 24h²⁹.

In the present study, the mean score of the group meats, eggs, and legumes was close to 10 points for both genders. Similar results were seen in adults from *São Paulo* (SP)²⁸. The consumption of meats in Brazil has been increasing according to the food acquisition per household data published by the *Pesquisa de Orçamento Familiar* (POF, Family Budget Surveys)³⁰ that show that between 2002/2003 and 2008/2009, the percentage of household expenditure on meats, including organ meats and fish, increased from 18.3% to 21.9% of the total food expenditures. The trend of high meat, eggs and legumes consumption has also been observed abroad²⁶. Another factor that may justify the high scores for this group is the fact that HEI-2005

and BHEI-R add legumes to the groups of meats and eggs, resulting in an overestimation of protein intake.

The intake of whole fruits, total fruits, total vegetables, dark green and orange vegetables and legumes was high, contrary to literature data²⁶⁻²⁸. It is possible that the use of a FFQ to collect dietary data contributed to the overestimated consumption of these items. Data from POF 2008/2009³⁰ show that less than 10.0% of the Brazilian population reaches the recommended intakes for fruits and non-starchy vegetables. Data from Vigitel³¹ show that the frequency of regular consumption of fruit and non-starchy vegetables was 29.9% of the adult population, being lower in men (24.7%) than in women (34.4). The study also shows that the consumption of fruits and non-starchy vegetables of both genders increase with age and education level.

The estimated scores for the group milk and dairy products in this study (4.49) were comparable to the results obtained by a study in another country³². In Brazil, Morimoto *et al.*²¹ found a score of 2.9 for the group milk and dairy products. The Inquérito Nacional de Alimentação (INA, National Food Survey) done in 2008/2009³⁰ evidenced that the consumption of milk and dairy among Brazilian adults is much lower than ideal, which means a high prevalence of inadequate vitamin and calcium intakes.

Determining sodium intake is challenging because it is hard to measure the amount of sodium added to foods, so the reported intake is inaccurate. Sodium intake was high in this study; both genders had a low score, especially males. These scores are lower than the mean scores found by other studies done in Brazil and abroad^{26,28,33}. According to the POF 2008-2009³⁰ data, 88.7% of men and 69.7% of women aged 19 to 59 years consumed too much sodium daily (>2300mg/day), and most of the sodium came from processed foods.

Many studies associate high sodium intake with the development of chronic diseases and indicate that if individuals aged 25 to 55 years

reduced their daily sodium intake by 1300mg, their systolic blood pressure would drop by 5mmHg and the prevalence of high blood pressure would drop by 20.0%. Low sodium intake could also reduce stroke (14.0%) and coronary artery (9.0%) mortalities worldwide³⁴. The population-based sample that gave rise to this study sample had a high prevalence of high blood pressure (28.3%), and the prevalence was higher in males (33.5%) than in females (23.5%)⁸.

One of the limitations of the present study is its cross-sectional design because it is not possible to infer relationships of causality. However, it is possible to explore the factors associated with diet quality. Another limitation is the possible low FFQ accuracy, not only because its number of food items is limited, but also because it usually overestimates food intake, which is also influenced by recall bias.

On the other hand, a positive aspect of the study was the way the sample was selected, since the selection was based on a population-based study, which contributed to its internal validity. This study is original in this region, and its results show that the diet quality of the participants is not ideal, especially with respect to sodium intake. Therefore, monitoring and surveillance are necessary, given the high prevalence of high blood pressure in the study municipality.

CONCLUSION

The mean Brazilian Healthy Eating Index-Revised scores found by the present study were higher than those found by other Brazilian and foreign studies. Sodium presented the most inappropriate intake pattern. Better diet quality was directly associated with higher age, being female, and belonging to a household whose head had a higher education level. Possible result errors can be minimized by future studies by using methods other than the FFQ for collecting food intake data, especially methods that do not rely on the memory of the participants.

CONTRIBUTORS

AS LOUREIRO performed the study, statistical analysis, and data interpretation; and wrote the manuscript. RMVG SILVA analyzed and interpreted the results. PRM RODRIGUES analyzed and interpreted the results. RA PEREIRA analyzed and interpreted the results; and wrote the manuscript. LL WENDPAP analyzed and interpreted the results. MG FERREIRA designed and supervised the study, performed the statistical analysis, interpreted the data, and wrote the manuscript.

REFERENCES

- Batista Filho M, Rissin A. A transição nutricional no Brasil: tendências regionais e temporais. *Cad Saúde Pública*. 2003; 19(1):S181-S91. doi: 10.1590/S0102-311X2003000700019.
- Kac G, Velásquez-Meléndez G. A transição nutricional e a epidemiologia da obesidade na América Latina. *Cad Saúde Pública*. 2003; 19(1):S4-S5. doi: 10.1590/S0102-311X2003000700001.
- Previdelli NA, Andrade SC, Pires MM, Ferreira SRG, Fisberg RM, Marchioni DM. Índice de Qualidade da Dieta Revisado para população brasileira. *Rev Saúde Pública*. 2011; 45(4):794-8. doi: 10.1590/S0034-89102011005000035.
- Brasil. Ministério da Saúde. Secretaria de Atenção a Saúde. Guia alimentar para a população brasileira: promovendo a alimentação saudável. Brasília: MS; 2006.
- Guenther PA, Reedy J, Krebs-Smith SM. Development of the Healthy Eating Index - 2005. *J Am Diet Assoc*. 2008; 108:1896-901. doi: 10.1016/j.jada.2008.08.016.
- Ferreira MG, Silva NF, Schmidt FD, Silva RMVG, Sichieri R, Guimarães LV, *et al.* Development of a Food Frequency Questionnaire for adults in a population-based sample in Cuiabá, Mid-Western Region of Brazil. *Rev Bras Epidemiol*. 2010; 13(3):1-11. doi: 10.1590/S1415-790X2010000300005.
- Willett W. *Nutritional epidemiology*. 2th ed. Oxford: Oxford University Press; 1998.
- Barbosa LS, Scala LCN, Ferreira MG. Associação entre marcadores antropométricos de adiposidade corporal e hipertensão arterial na população adulta de Cuiabá, Mato Grosso. *Rev Bras Epidemiol*. 2009; 12(2):237-47. doi: 10.1590/S1415-790X2009000200013.
- Instituto Brasileiro de Geografia e Estatística. Síntese de indicadores sociais. Brasília: IBGE; 2004 [acesso 2011 maio 13]. Disponível em: <http://www.sepm.gov.br/nucleo/dados/pnad_cor_2004>.
- Instituto Brasileiro de Geografia e Estatística. Censo demográfico do Brasil. Brasília: IBGE; 2000 [acesso 2011 maio 11]. Disponível em: <<http://www.ibge.gov.br>>.
- Associação Brasileira de Empresas de Pesquisa. Critério de classificação econômica Brasil. São Paulo: ABEP; 2008 [acesso 2011 maio 11]. Disponível em <<http://www.abep.org/novo/content.aspx?contentID=302>>.
- Ferreira MG, Valente JG, Gonçalves-Silva RMV, Sichieri R. Alcohol consumption and abdominal fat in blood donors. *Rev Saúde Pública*. 2008; 42(6):1-6. doi: 10.1590/S0034-89102008000600013.
- Gordon CC, Chumlea WC, Roche AF. Stature, recumbent length, weight. In: TG Lohman, AF Roche, R Martorell (Eds.). *Anthropometric standardizing reference manual*. Champaign, Illinois: Human Kinetics Books; 1988.
- Callaway CW, Chumlea WC, Bouchard C, Himes JH, Lohman TG, Martin AD, *et al.* Circumferences. In: TG Lohman, AF Roche, R Martorell. *Anthropometric standardization reference manual*. Champaign, Illinois: Human Kinetics Books; 1988.
- World Health Organization. Obesity: Preventing and managing the global epidemic. Geneva: WHO; 1998. WHO Technical Report Series, 894.
- Gibson RS. *Principles of nutritional assessment*. 2th ed. New York: Oxford University Press; 2005.
- Universidade Federal de São Paulo. Programa de apoio à nutrição: NutWin. São Paulo: Unifesp; 2005.
- Programa Nutrition Data System for Research. Version 2008. Minnesota: University of Minnesota; 2008.
- Núcleo de Estudos e Pesquisas em Alimentação. Tabela Brasileira de Composição de Alimentos - TACO. 2^a ed. Campinas: Unicamp; 2006.
- Brasil. Conselho Nacional de Saúde. Resolução CNS nº 196, de 10 de outubro de 1996. Dispõe sobre as diretrizes e normas regulamentadoras de pesquisas envolvendo seres humanos. Brasília: CNS; 2010.
- Morimoto JM, Latorre MRDO, César CLG, Carandina L, Barros MBA, Goldbaum M, *et al.* Fatores associados à qualidade da dieta de adultos residentes na Região Metropolitana de São Paulo, Brasil, 2002. *Cad Saúde Pública*. 2008; 24(1):169-78. doi: 10.1590/S0102-311X2008000100017.
- Raffensperger S, Kuczmarski MF, Hotchkiss L, Cotugna N, Evans MK, Zonderman AB. Effect of race and predictors of socioeconomic status on diet

- quality in the HANDLS study sample. *J Am Diet Assoc.* 2010; 102(10):923-30.
23. Monteiro CA, Conde WL, Castro IRR. A tendência cambiante da relação entre escolaridade e risco de obesidade no Brasil (1975-1997). *Cad Saúde Publica.* 2003; 19(1):67-75. doi: 10.1590/S0102-311X2003000700008.
 24. Vieira ACR, Sichieri R. Associação do status socioeconômico com obesidade. *Physis Rev Saúde Coletiva.* 2008; 18(3):415-26. doi: 10.1590/S0103-73312008000300003.
 25. Pereira RA, Sichieri R. Métodos de avaliação do consumo de alimentos. In: Kac G, Sichieri R, Gigante DP, organizadores. *Epidemiologia nutricional.* Rio de Janeiro: Fiocruz; 2007.
 26. Guenther PM, Juan WY, Reedy J, Britten P, Lino M, Carlson A, *et al.* Diet quality of Americans in 1994-96 and 2001-02 as measured by the healthy eating Index - 2005. Washington (DC): USDA; 2007.
 27. Hamidi M, Tarasuk V, Corey P, Cheung AM. Association between the Healthy Eating Index and bone turnover markers in US postmenopausal women aged ≥ 45 y. *Am J Clin Nutr.* 2011; 94(1): 199-208. doi: 10.3945/ajcn.110.009605.
 28. Pires MM. Análise da relação da qualidade da dieta com nível de atividade física e destes com perfil lipídico e estado inflamatório em indivíduos de risco cardiometabólico [dissertação]. São Paulo: USP; 2011.
 29. Huybrechts I, Vereecken C, Bacquer DD, Vandevijvere S, Oyen HV, Maes L, *et al.* Reproducibility and validity of a diet quality index for children assessed using a FFQ. *Br J Nutr.* 2010; 104(1):135-44. doi: 10.1017/S0007114510000231.
 30. Instituto Brasileiro de Geografia e Estatística. Sala de Imprensa: pesquisa de orçamentos familiares - POF 2008-2009. Análise do consumo alimentar pessoal no Brasil. IBGE; 2011 [acesso 2011 ago 17]. Disponível em: <http://www.ibge.gov.br/home/estatistica/populacao/condicaodevida/pof/2008_2009_analise_consumo/pofanalise_2008_2009.pdf>.
 31. Brasil. Ministério da Saúde. Secretaria de Vigilância em Saúde. Secretaria de Gestão Estratégica e Participativa. *Vigitel Brasil 2010: vigilância de fatores de risco e proteção para doenças crônicas por inquérito telefônico.* Brasília: MS; 2011.
 32. Grimstvedt ME, Woolf K, Milliron BJ, Manore MM. Lower healthy eating index-2005 dietary quality scores in older women with rheumatoid arthritis vs. healthy controls. *Public Health Nutr.* 2010; 13(8):1170-7. doi: 10.1017/S136898001000008X.
 33. Breslow RA, Guenther PM, Juan W, Graubard BI. Alcoholic beverage consumption, nutrient intakes, and diet quality in the us adult population, 1999-2006. *J Am Diet Assoc.* 2010; 110:551-62. doi: 10.1016/j.jada.2009.12.026.
 34. World Health Organization. Report of a WHO forum and technical meeting, 2006; Paris, France: Reducing salt intake in populations. Geneva: WHO; 2007.

Received on: 5/7/2012
 Final version on: 12/11/2012
 Approved on: 25/4/2013

