

Diet quality among adolescents: a population-based study in Campinas, Brazil

Qualidade da dieta de adolescentes: estudo de base populacional em Campinas, SP

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Abstract

We assessed the overall diet quality and adequacy of diet consumption of each component of the diet of adolescents according to demographic, socioeconomic and body mass index (BMI) data. A cross-sectional population-based study analyzed a representative sample of 409 adolescents, aged 12-19 years, using the Healthy Eating Index (HEI). We estimated the prevalence of diets classified in the first quartile of the HEI and the average scores of each component of the HEI. Linear and Poisson multiple regressions were used in the analysis. The mean score of HEI was 59.7. We observed a lower prevalence of inadequate diets in the segment with heads of household presenting higher schooling. The lower socioeconomic status segments, measured by income and schooling, showed a lower consumption of *vegetables, fruits, dairy products* and a less *diversified diet*, and a higher intake of *cereals* and *legumes*. Overweight/obese adolescents consume more *meat and eggs* and less *fruit* compared to low weight/normal weight adolescents. Girls had a higher intake of *total fat* and lower *sodium* intake. The results identified diet components that deserve more attention in the strategies to promote healthy eating, and the more vulnerable segments among adolescents.

Keywords: Adolescent. Feeding behavior. Eating. Nutrition survey. Diet. Nutrition.

Resumo

O objetivo deste estudo foi avaliar a qualidade global da dieta e a adequação do consumo de cada componente da dieta de adolescentes segundo fatores demográficos, socioeconômicos e índice de massa corporal (IMC). Trata-se de estudo transversal, de base populacional, que analisou amostra representativa de 409 adolescentes, de 12 a 19 anos, utilizando o Índice de Qualidade da Dieta (IQD). Foram estimadas as prevalências de dietas classificadas no 1º quartil do IQD e as médias de escores de cada componente do IQD. Regressões múltiplas linear e de Poisson foram utilizadas nas análises. O escore médio do IQD foi de 59,7. Observou-se menor prevalência de dietas inadequadas no segmento de melhor escolaridade do chefe da família. Os estratos de menor nível socioeconômico, avaliados por renda e escolaridade, mostram um consumo inferior de *verduras e legumes, frutas, leite e derivados* e menor *variedade da dieta* e uma ingestão superior de *cereais e derivados e leguminosas*. Adolescentes com sobrepeso/obesidade consomem mais *carnes e ovos* e menos *frutas* comparados aos que apresentam baixo peso/eutrofia. As meninas tiveram maior ingestão de *gordura total* e menor ingestão de *sódio*. Os resultados identificam os componentes que merecem atenção nas estratégias de promoção de alimentação saudável e os segmentos mais vulneráveis à má alimentação.

Palavras-chave: Adolescente. Comportamento alimentar. Ingestão de alimentos. Inquérito dietético. Dieta. Nutrição.

Introduction

Adolescence is a stage of life characterized by significant changes in biological, psychological and social dimensions, and is considered of fundamental importance to the formation of habits and attitudes, including dietary habits, which have an impact on the present and future health of the adolescent¹. Literature has shown evidence of the determinant role of a healthy diet in the prevention of different types of diseases, such as diabetes, cardiovascular disturbances, and various neoplasms².

In 2009, the National Survey of the Health of Schoolchildren (PeNSE)³, investigated the food consumption of adolescent students at public and private schools in Brazil. Food identified as healthy (beans, vegetables, fruits and milk) and unhealthy (soft drinks, sweet biscuits and cold meats) were used to evaluate diet. Results indicated the frequent consumption of unhealthy food, especially among girls. The intake of fruit and vegetables was extremely low for both genders, and was directly influenced by socio-economic level, which confirmed the findings of other studies in Brazil^{4,5}. These dietary inadequacies become even more relevant as a result of the high prevalence of overweight and obesity among adolescents⁶.

When considering the repercussions of diet on the general state of health and the incidence of disease, researchers have sought to develop indices to evaluate quality of diet in a global and synthetic form⁷. The Healthy Eating Index – (HEI), which represents such an index, was developed by the Department of Agriculture of the United States, with the aim of evaluating nutritional care needs and the recommendations of dietary guidelines⁸. The HEI was adapted for use in Brazil by Fisberg et al.⁹.

Taking into account the importance of establishing eating patterns during adolescence and the necessity of monitoring the diet of this segment of the population to evaluate and refocus interventions, the present study aimed to evaluate the overall diet

quality and adequacy of intake of each of the ten components of the HEI, according to demographic and socioeconomic variables and body mass index (BMI), of adolescents in the city of Campinas, SP.

Methods

Data used in the present study was gathered from a multicenter health survey, performed between 2001 and 2002, in four areas of the state of São Paulo, including the city of Campinas. Campinas has around one million inhabitants and is an important industrial and technological center in the state of São Paulo. In 2000, adolescents comprised 17.8% of the population of the city¹⁰.

The survey sample was determined by random sampling procedures, stratified and by conglomerate, and was divided in two stages: census sector and households. The census sectors of the city of Campinas were grouped into three strata according to percentage of head of household with university education, with ten sectors then randomly selected from each stratum.

After an inventory of households in the 30 randomly selected census sectors was performed, a random selection by gender and age was performed within the households.

In order to guarantee minimum sample numbers for determined population subgroups, eight fields of age and sex were defined, among them the segment of males aged 12 to 19 years and females aged 12 to 19 years. For each field of gender and age, a minimum sample size of 200 individuals was calculated, based on an estimated prevalence of 50% (which corresponds to maximum variability), with a confidence level of 95%, maximum error of 0.10 and a design effect (*deff*) of 2. For the present study data was analyzed from only two strata which would correspond to a minimum sample size of 400 individuals.

Information was collected in households by trained researchers, through the application of a questionnaire organized into 19

thematic blocks, with the majority of questions closed. The tool had been previously tested in a pilot study.

For the present study, data for adolescents aged 12 to 19 years was analyzed. The adolescents were of both genders, not institutionalized, resident in the urban area of the city of Campinas, and had their daily food intake evaluated by 24-hour dietary recall (R24h).

Study variables

The dependent variables were derived from the Healthy Eating Index adapted for the population of Brazil by Fisberg et al.⁹ in a study performed on a subsample of this same multicenter survey and later modified by Godoy et al.¹¹.

The index used was comprised of six components related to food groups (*cereals, bread, roots and tubers; vegetables; fruit; milk and dairy products; meat and eggs; pulses*), three components related to nutrients (*total fat, cholesterol and sodium*) and one which evaluated *variety of diet*. Each of the ten components of HEI was evaluated and scored from zero to ten, so that total HEI score could reach a maximum value of 100 points. Intermediate values of ingestion were calculated proportionally considering the interval between the minimum and maximum scoring criteria established for each component (Chart 1). The calculation for HEI was based on information obtained through the application of a 24h recall survey (R24h). The method recommended by Thompson and Byers¹² was used to apply the R24h survey. Before data was entered, quantification of the R24h was performed in order to identify errors and to change food quantities listed by household language into grams. Mixed meals, such as sandwiches and pizzas, were separated by ingredient and subsequently classified in their respective food groups. The nutritional value of food consumed was calculated, using the Virtual Nutri version 1.0 program (Universidade de São Paulo, São Paulo, Brazil), with a food database adapted to

include the different chemical composition of foods¹¹.

The dependent variables in the study were: a) prevalence of diets in the 1st quartile of distribution of HEI scores, which corresponded to diets with lower scores, being diets of poor quality; and b) the average score of each of the ten HEI components.

The independent variables were:

Demographic: gender, age, ethnic background, religion and number of people in household.

Socioeconomic: level of schooling of head of family, monthly family income *per capita* (measured in minimum salaries) and occupation of adolescent.

Nutritional status assessed by BMI was calculated from the weight and height supplied. The nutritional status of adolescents was classified as underweight, healthy weight, overweight and obese, according to the cutoffs recommended by the World Health Organization (WHO, 2007)¹³, with percentages used referring to the midpoint of age.

The interview data was entered into a database created using the Epi Info 6.04b program (Center for Disease Control and Prevention, Atlanta, USA). The prevalence of diets in the 1st quartile of the HEI according

to the independent variables was calculated, with the association verified by χ^2 test and with a 5% significance level. Prevalence ratios and confidence intervals of 95% were calculated using Poisson simple regression analysis. For the multiple regression model, constructed using Poisson multiple regression analysis, the variables with p value < 0.20 in bivariate analysis were introduced, with variables with a value of p < 0.05 remaining in the model.

The mean scores for each of the ten components of the HEI were also calculated and the association between these components and independent variables was calculated. A multiple linear regression model was developed for each component of the HEI with variables with a value of p < 0.20 in bivariate analysis being introduced, with variables with a value of p < 0.05 remaining in the model. All the models included adjustment for total energy of diet.

Statistical analysis was performed with the Stata 10 program (Stata Corporation, College Station, USA) which allowed the following characteristics of sample design to be considered: strata, weighting and conglomerates.

The present study was approved by the

Chart 1 - Criteria for the minimum and maximum score of each Healthy Eating Index component.

Quadro 1 - Critérios para a pontuação máxima e mínima de cada componente do Índice de Qualidade da Dieta.

Components	Criteria for minimum score (0 point)	Criteria for maximum score (10 points)
1. Cereals, breads and roots group	Not consumed	5 to 9 portions
2. Vegetables group	Not consumed	4 to 5 portions
3. Fruits group	Not consumed	3 to 5 portions
4. Milk and derivatives group	Not consumed	3 portions
5. Meat and eggs group	Not consumed	1 to 2 portions
6. Pulses group	Not consumed	1 portion
7. Total fat group	45% or more of VET*	≤30% and >20% of VET*
8. Cholesterol	450mg or more	300mg or more
9. Sodium	4800mg or more	2400mg or more
10. Variety of diet	3 or more different types of food per day	8 or more different types of food per day

Fonte: Godoy et al.¹² / Source: Godoy et al.¹²

*VET: Valor Energético Total / *VET: Total energy requirement.

Ethics Research Committee of the Faculdade de Ciências Médicas of UNICAMP, through an addendum to process 369/2000.

Results

Among 433 adolescents identified in residences selected to participate in the study, 12 refused to participate, so that the study comprised interviews with 421 individuals.

Of the 421 adolescents in the study, 12 were excluded as a result of having an energy consumption of less than 1% (< 641,934 Kcal) or greater than 99% (> 6546,23 Kcal) of observed distribution, taking into account the recommendation of Nielsen et al.¹⁴. As such, the information of 409 adolescents was analyzed, with an average age of 15.5 years (standard deviation = 2.33).

The sample comprised similar proportions of boys and girls, with a slightly larger participation of adolescents aged between 12 and 15 years. The strata of lower income and level of schooling of head of family represented more than 50% of individuals studied. Adolescents of caucasian ethnic background represented 71% of the sample, those of catholic faith comprised 61%, those with an occupational activity 21%, those that resided in households with 4 to 5 people represented 58%, and those that were classified as eutrophic corresponded to 77.7%.

The average HEI score was 59.7 (IC95%: 58.6-60.7), being 58.9 (IC95%: 57.3-60.4) for girls and 60.5 (IC95%: 58.8-62.1) for boys.

In relation to socioeconomic variables, a gradient of improved food quality could be clearly observed to correspond to an increased number of years of schooling of the head of the family. Adolescents with a head of family with 12 or more years of schooling had a 46% lower risk of having a HEI score in the 1st quartile and those with *per capita* income equal to or greater than three minimum salaries had a 29% lower risk than families with income lower than one minimum salary (Table 1).

The results of Poisson multiple regression analysis (data not included in tables) revealed that the prevalence of adolescents

with diets in the 1st quartile of the HEI was significantly lower (RP=0.54; IC95%: 0.32-0.92) in households with a head of family with a greater level of schooling. When the scores of each component of the HEI (Table 2) were evaluated, low scores (< 5) were found for the components *vegetables*, *fruits*, and *milk and dairy products*, and only the component *meat and eggs* had a high score (> 8), with the remaining components having intermediate scores (5 to 8). The averages of boys were significantly superior to those of girls for four components (*cereals and derivatives*, *vegetables*, *milk and dairy products* and *variety of diet*), while girls had a higher average than boys only for the component *sodium*. There were higher scores for the components *vegetables*, *fruits*, *milk and dairy products* and *variety of diet*, and lower scores for the components *pulses* and *cholesterol* among the group of adolescents whose head of family had 12 or more years of schooling compared to those with up to seven years of schooling. Overweight or obese adolescents had higher average intakes in the *cholesterol* and *sodium* groups and lower average scores for *fruits*, *milk and dairy products*, and *variety of diet*. In segments with higher *per capita* income, there was greater consumption of the components *vegetables*, *fruits*, *milk and dairy products*, *meat and eggs* and *variety of diet* and lower consumption of *pulses* (Table 2).

Table 3 shows the results of the multiple regression analysis carried out for each HEI component, with the models being adjusted for total energy of diet. In relation to gender, girls had a higher consumption than boys for the component *total fat*, while the opposite was true for *sodium*. Compared to the reference category, the segment with greater family income had lower ingestion of *cereals* and *pulses* and, together with the segment with income between one and two minimum salaries, higher consumption of *fruits* and a greater *variety of diet*. In strata with higher levels of education, higher average scores were found for the group *milk and dairy products*, while for the *vegetables* group this relationship was found only in

Table 1 - Prevalence and prevalence ratio (PR) of diets in the first quartile of HEI, according to demographic, socioeconomic and BMI variables in 12 to 19 year-old adolescents. Campinas, São Paulo State, Brazil, 2002.

Tabela 1 - Prevalência e razão de prevalência (RP) de dietas no 1º quartil do IQD, segundo variáveis demográficas, socioeconômicas e IMC em adolescentes de 12 a 19 anos. Campinas, SP, 2002.

Variables	N	%	Prevalence 1º Quartile (IC 95%)	RP (IC95%)
Gender			0,1695*	
Male	205	49.4	21.4 (15.9-28.2)	1.00
Female	204	50.5	28.0 (21.9-35.1)	1.31 (0.88-1.95)
Total	409	100	24.7 (20.7-29.3)	
Age Group (years)			0.0886*	
12-15	211	51.4	21.7 (17.1-27.1)	1.00
16-19	198	48.5	28.0 (22.2-34.7)	1.29 (0.96-1.74)
Ethnic Background			0.8542*	
Caucasian	293	71.0	24.5 (19.9-29.7)	1.00
Non-Caucasian	116	29.0	25.4 (17.7-35.0)	1.04 (0.70-1.54)
Religion			0.9683*	
Catholic	254	61.0	24.8 (19.8-30.7)	1.00
Protestant	96	25.0	25.4 (15.9-37.9)	1.02 (0.60-1.74)
Others	58	14.0	23.7 (14.3-36.5)	0.95 (0.57-1.58)
Number of people living in household			0.7925*	
1-3	66	16.0	21.8 (13.6-33.1)	1.00
4-5	236	58.0	25.3 (19.3-32.3)	1.16 (0.67-2.01)
6 or +	107	26.0	25.3 (18.0-34.3)	1.16 (0.76-1.76)
Level of schooling of head of family (years)			0.0751*	
0-7	175	44.0	31.0 (25.0-37.8)	1.00
8-11	135	33.0	22.0 (14.6-31.9)	0.71 (0.45-1.12)
12 and +	98	23.0	16.8 (9.5-27.8)	0.54 (0.32-0.92)
Per capita income (in minimum salaries**)			0.0492*	
<1	129	32.0	31.7 (26.3-37.6)	1.00
1 to 2	145	36.0	20.5 (13.8-29.2)	0.64 (0.43-0.97)
≥3	135	32.0	22.5 (16.9-29.4)	0.71 (0.51-0.98)
Occupation of adolescent			0.1651*	
Yes	86	21.0	29.7 (23.4-36.8)	1.26 (0.90-1.75)
No	321	79.0	23.6 (18.7-29.3)	1.00
Body Mass Index (BMI)			0.4659*	
Underweight	14	3.7	12.2 (2.74-40.9)	0.51 (0.13-2.02)
Eutrophic	303	77.7	24.1 (19.2-29.8)	1.00
Overweight	52	13.8	28.7 (18.9-41.1)	1.19 (0.73-1.96)
Obese	19	4.7	32.3 (16.0-54.5)	1.34 (0.72-2.49)

*Valor de p de teste χ^2 . / *p-value of Chi-square test.

**Salário mínimo vigente à época da pesquisa: março a abril/2001 = R\$ 151,00; maio/2001 a março/2002 = R\$ 180,00 e abril a setembro/2002 = R\$ 200,00.

**Minimum wage at the time of the survey: March to April/2001 = R\$ 151.00; May/2001 to March/2002 = R\$ 180.00 and April to September/2002 = R\$ 200.00.

the highest strata (at the threshold of statistical significance). For BMI, overweight or obese adolescents had a lower average score for the component *fruits* (at the threshold of statistical significance) and a higher average score for the group *meat and eggs*.

Discussion

The present study found a higher prevalence of poor quality diet among adolescents resident in households whose head of family had a lower level of schooling.

Table 2 - Mean score of the components of the HEI according to the sex and schooling of head of household, BMI and income per capita. Campinas, São Paulo State, Brazil, 2002.

Tabela 2 - Média de pontos dos componentes do IQD segundo sexo, escolaridade do chefe da família, IMC e renda familiar per capita. Campinas, SP, 2002.

Components	Total		Gender		Level of Schooling of Head of Household Head (in years)				
	Global Average	Male (1)	Female (2)	p value (2)-(1)	0 to 7 (1)	8 to 11 (2)	12 or more (3)	p value (2)-(1)	p value (3)-(1)
Cereals, breads, roots and tubers	7.65	8.19	7.12	0.000	7.58	7.79	7.61	0.564	0.928
Vegetables	4.00	4.31	3.69	0.036	3.54	4.10	4.69	0.208	0.020
Fruits	2.81	2.86	2.76	0.827	1.91	2.95	4.37	0.051	0.000
Milk and dairy products	3.92	4.30	3.54	0.034	3.13	4.04	5.30	0.024	0.000
Meat and eggs	9.17	9.19	9.16	0.911	9.17	8.91	9.54	0.408	0.066
Pulses	6.53	6.71	6.35	0.502	7.26	6.43	5.21	0.145	0.001
Total fat	5.28	5.52	5.04	0.185	5.39	5.31	4.98	0.827	0.288
Cholesterol	7.72	7.58	7.85	0.585	8.33	7.34	7.04	0.090	0.018
Sodium	5.53	4.40	6.64	0.000	5.41	5.62	5.65	0.586	0.608
Variety of diet	7.08	7.44	6.72	0.016	6.56	7.18	7.93	0.134	0.002

Components	Body Mass Index (BMI)			Family income per capita (in minimum salaries)				
	Underweight/ Eutrophic (1)	Overweight/ Obese (2)	p value (2)-(1)	< 1 (1)	1 a 2 (2)	> 3 (3)	p value (2)-(1)	p value (3)-(1)
Cereals, breads, roots and tubers	7.64	7.60	0.910	7.46	8.10	7.34	0.124	0.807
Vegetables	4.00	4.08	0.832	3.49	4.09	4.40	0.033	0.017
Fruits	3.11	1.89	0.016	1.35	2.89	4.19	0.003	0.000
Milk and dairy products	4.13	3.30	0.026	3.04	3.81	4.91	0.040	0.000
Meat and eggs	9.12	9.50	0.095	8.84	9.15	9.53	0.329	0.029
Pulses	6.38	6.39	0.983	7.52	7.26	4.71	0.587	0.000
Total fat	5.30	5.03	0.567	5.63	5.19	5.01	0.328	0.261
Cholesterol	7.50	8.46	0.023	7.99	7.97	7.16	0.977	0.173
Sodium	5.35	6.40	0.030	5.99	5.01	5.65	0.081	0.570
Variety of diet	7.29	6.34	0.014	6.17	7.20	7.86	0.026	0.000

Additionally, differences were identified between sex, schooling, income and the BMI of the adolescent in relation to different components of the quality of diet index.

The HEI score (59.7) revealed by the present study was similar to that found in population studies of adolescents performed in municipal districts in the state of São Paulo^{11,15}, and in Chile¹⁶. It was slightly lower than the score verified in the study by Fernández et al.¹⁷, of adolescents in the city of Guadalajara (Spain) and that found for North American adolescents by Goodwin et al.¹⁸.

In the segment of greater level of schooling of the head of the family (12 years or more) a lower prevalence of poor quality of

diet was observed among adolescents in Campinas, as was observed in studies performed in other countries^{18,19}. Education is a factor of inequality, capable of perpetuating the cycle of poverty from generation to generation and preventing the individual from reaching the goals necessary for human development, one of which is adequate diet²⁰.

Regarding the components of the HEI, those that had lower scores were *fruits*, *vegetables*, and *milk and dairy products*. These findings are consistent with other Brazilian studies that also observed low intake of fruits, vegetables and milk and dairy products in the diet of adolescents^{3,11,15}. The component with the highest score was *meat*

Tabela 3 - Modelo de regressão linear múltipla: variáveis associadas a cada componente do IQD em adolescentes de 12 a 19 anos. Campinas, SP, 2002.

Table 3 - Multiple linear regression model: variables associated with each HEI component in 12 to 19 year-old adolescents. Campinas, São Paulo State, Brazil, 2002.

Components	Coefficient (β)	CI95%	Value of p	Deff
Cereals, breads, roots and tubers				
Income <i>per capita</i> in minimum salaries ($\geq 3 / < 1$)	-0.61	-1.16 a -0.07	0.029	1.10
Vegetables				
Level of schooling of head of family in years (12 or more / 0 to 7)	0.94	-0.03-1.91	0.056	1.48
Fruits				
Income <i>per capita</i> in minimum salaries (1 to 2 / < 1)	1.35	0.32-2.38	0.012	1.25
Income <i>per capita</i> in minimum salaries ($\geq 3 / < 1$)	2.41	1.26-3.55	0.000	1.25
BMI (overweight and obese / underweight and eutrophic)	-0.94	-1.88 a 0.04	0.051	0.93
Milk and dairy products				
Level of schooling of head of family in years (8 to 11 / 0 to 7)	0.83	0.14-1.52	0.019	1.10
Level of schooling of head of family in years (12 or more / 0 to 7)	1.83	0.82-2.83	0.001	1.67
Meat and eggs				
BMI (overweight and obese / underweight and eutrophic)	0.49	0.05 a 0.93	0.029	0.71
Pulses				
Income <i>per capita</i> in minimum salaries ($\geq 3 / < 1$)	-2.89	-3.78 a -2.00	0.000	0.69
Total fat				
Gender (feminine / masculine)	-0.97	-1.64 a -0.29	0.006	0.79
Sodium				
Gender (feminine / masculine)	0.84	0.34-1.35	0.002	0.77
Variety of diet				
Income <i>per capita</i> in minimum salaries (1 a 2 / < 1)	0.71	0.04-1.39	0.038	1.09
Income <i>per capita</i> in minimum salaries ($\geq 3 / < 1$)	1.20	0.58-1.82	0.000	0.93

Todos os componentes do IQD foram ajustados às calorias da dieta.
All components of the HEI were adjusted to calories of diet.

and eggs, a result similar to the findings of studies of adolescents in other countries^{16,17} and some municipal districts in the state of São Paulo¹⁵.

In the present study, adolescents from the segment of higher family income had a lower consumption of the group *cereals and derivatives*, as verified by Levy-Costa et al.²¹ using data from the “Pesquisa de Orçamentos Familiares” (Household Food Budget Survey - HFBS) to evaluate the evolution of food consumption in the metropolitan areas of Brazil.

A higher score was observed for the component *vegetables*, at the threshold of statistical significance, in the segment

of greater schooling of head of family, as reported in other studies^{11,22,23}.

The component *fruits* had the highest score in segments of higher income, corroborating findings of other studies^{3,21,24}. In situations of food insecurity the consumption of *fruits* is drastically reduced as a result of the higher prices of this type of food. The study by Panigassi et al.²⁵ demonstrated a strong decreasing tendency in the intake of fruits from those families with secure diets to those with light, moderate or serious food insecurity. For BMI, lower consumption of fruits (at the threshold of statistical significance) was identified in adolescents with overweight/obesity. Using data on the

food intake of North American children and adolescents participating in the National Health and Nutrition Examination Survey, Lorson et al.²⁶ also found that obese individuals ate significantly less fruit compared to eutrophic individuals, a finding that has been verified by other authors²⁷. Fruit is rich in micronutrients and fibers²⁸ and has low energy density, which provides a positive increase in satiety and satiation, contributing to the control of healthy body weight²⁹.

For the component *milk and dairy products*, significantly higher scores were found for higher levels of schooling, corroborating findings of a number of studies performed in other locations^{11,22,23}. The results of PeNSE³ revealed a positive association with the regular consumption of milk with level of maternal schooling. Milk and derivative products are sources of calcium, an essential nutrient, especially in adolescence, for the processes of bone formation and proper linear growth and for the prevention of the development of osteoporosis in adult life²⁸.

For the group *meat and eggs*, a significantly higher score was found in overweight or obese adolescents, as has been observed by other studies^{27,30}.

A lower average score was observed for the *pulses* group, in the segment with higher family income. PeNSE³ showed a significant reduction in the regular frequency of bean consumption with an increase in maternal schooling level, and among adolescents studying in private schools. Results of studies in Brazil found that the consumption of beans and other pulses revealed a tendency to decline with increased spending power²¹, although beans are excellent sources of protein, fibers, carbohydrates, and micronutrients, and possess a nutritional profile suitable for all ages³¹.

For the component *total fat*, there was greater consumption among girls than among boys, a result that can be explained by the more regular intake of sweet biscuits and cold meats according to the findings of PeNSE³. For the component *sodium*, there was lower consumption among girls, as was also observed in the study by Godoy

et al.¹¹. Feskanich et al.³² and Brown et al.³³ also verified greater intake of sodium among boys. The excessive consumption of sodium is an important risk factor for arterial hypertension, coronary disease and cerebrovascular accident². Based on HFBS data for 2002-03, Sarno et al.³⁴ found that the quantity of available sodium for consumption in Brazilian households (4.5 grams/person/day) more than twice exceeded the maximum recommended dose, making this intake a significant issue for public health policy in relation to non-communicable diseases. Actions aimed at addressing this issue have been conducted through a partnership between the Department of Health and the food industry that provides for the gradual reduction of sodium in various industrialized products by 2014³⁵.

In relation to *variety of diet* it was found that greater family income led to a higher average score for the component, as was also found by Godoy et al.¹¹ in relation to the level of schooling of the head of the family. Variety of food is an essential requisite of a healthy diet, as it guarantees the provision of a range of nutrients, preventing the development of nutritional deficiencies²⁸.

The present study revealed the existence of social inequality in the diet of adolescents, influencing the scores of various HEI components, and also the global indicator. These findings indicate the necessity of special attention for more socially vulnerable segments, but even among groups with higher levels of income and schooling, the intake of fruits, vegetables and milk and derivatives was below recommended levels, which indicates the importance of overall orientation.

The design effect (*deff*) is a useful parameter in epidemiological studies that use conglomerates at any stage of the sampling process, as it signals the suitability of the sample complex in terms of precision, taking as a base data supplied by a simple random sample³⁶. Table 3 shows the values of the design effect for the models developed for each component. The results indicate that this study was capable of detecting

small differences between the average score of each component, of up to 0.49 for the meat and eggs group, with the majority of components with *deff* close to 1. This means that the sample complex did not affect the precision of the calculations.

One of the limits of the present sample refers to the application of only one 24-hour recall survey, which does not necessarily reflect the usual food intake of adolescents, due to the variability of consumption. Memory errors, difficulty in quantifying the size of portions, the under or over reporting of food, among others, are also concerns³⁷. However, R24h is considered a suitable tool for evaluating the average intake of foods and nutrients for a large number of individuals³⁸. Another limitation of this study was the fact that the survey covered a broad subject, without specific focus or concentrating on any one diet item. The cross-sectional study, in turn, prevents the interpretation of results for cause and effect, such as association with BMI. The use of self-reported information for size and height represented a further limitation, especially in adolescents passing through a phase of rapid growth and physical development. A study of adolescents in Florianópolis revealed that only the minimum percentage reported weight and health exactly³⁹. However the author verified that the reported measurements were very close to true measurements, and considered the information valid for use in epidemiological studies³⁹, as has been established by other authors⁴⁰. This study referred to data collected in 2001-2002 and serves as a base line for monitoring the quality of diet of adolescents when using data from the periodic health surveys implemented for this population group. With respect to the instrument used to evaluate quality of diet it is necessary to consider if the HEI is capable of capturing the complexity of food consumption patterns, used for directing health promotion strategies and nutritional education. It is, however,

an instrument with limitations, as each of the components contributes equally to the total score, without considering the impact of each food group on health⁴¹. The overall HEI score, compared to the score of its components, displays less frequent associations with its independent variables, as synthesizing the elements of diet does not reveal the specifics of each component. In this study the association with overall indicator was only verified in bivariate analysis for income and level of schooling of head of family, and for components, associations with income, schooling, gender and BMI was verified. In the study of Godoy et al.¹¹, the overall HEI was associated only with gender, however when each component was analyzed with sex and level of schooling of head of family a number of associations were observed. The results of the study revealed that as well as overall HEI it is relevant to analyses each component of the indicator separately.

The findings of this study warn of the existence of poor dietary quality of adolescents and the need to promote healthy eating, especially for groups that are more socially vulnerable. It also indicated the need to monitor the dietary habits of this age group to detect tendencies of change, and the incorporation of a healthy dietary profile, as well as to accompany the level of social inequality prevalent in diet.

Collaborators

D. de Assumpção was responsible for developing the proposal of this study, and for performing the revision of literature, data analysis and the preparing wording of the text. M. B. A. Barros orientated the proposal of the study, performed data analysis, and prepared the wording of the text. C. L. G. Cesar, M. Goldbaum, M. B. A. Barros, L. Carandina, M. C. G. P. Alves and R. M. Fisberg developed the ISA-SP, created the instruments, coordinated field research and contributed to the revision of the article.

References

1. World Health Organization. *Child and adolescent health and development: progress report 2009: highlights*. Geneva; 2010.
2. Brasil. Ministério da Saúde. Secretaria de Vigilância em Saúde. Departamento de Análise de Situação de Saúde. *Plano de ações estratégicas para o enfrentamento das doenças crônicas não transmissíveis (DCNT) no Brasil 2011-2022*. Brasília; 2011.
3. Levy RB, Castro IRR, Cardoso LO, Tavares LF, Sardinha LMV, Gomes FS et al. Consumo e comportamento alimentar entre adolescentes brasileiros: Pesquisa Nacional de Saúde do Escolar (PeNSE), 2009. *Rev Cien Saúde Colet* 2010; 15(S2): 3085-97.
4. Toral N, Slater B, Cintra IP, Fisberg M. Comportamento alimentar de adolescentes em relação ao consumo de frutas e verduras *Rev Nutr* 2006; 19(3): 331-40.
5. Instituto Brasileiro de Geografia e Estatística. *Pesquisa de Orçamentos Familiares – 2008-2009: análise do consumo alimentar pessoal no Brasil*. Rio de Janeiro; 2011.
6. Instituto Brasileiro de Geografia e Estatística. *Pesquisa de Orçamentos Familiares – 2008-2009: antropometria e estado nutricional de crianças, adolescentes e adultos no Brasil*. Rio de Janeiro; 2010.
7. Cervato AM, Vieira VL. Índices dietéticos na avaliação da qualidade global da dieta. *Rev Nutr* 2003; 16(3): 347-55.
8. Kennedy ET, Ohls J, Carlson S, Fleming K. The Healthy Eating Index: Design and applications. *J Am Diet Assoc* 1995; 95: 1103-8.
9. Fisberg RM, Slater B, Barros RR, Lima FD, Cesar CLG, Carandina L et al. Índice de Qualidade da Dieta: avaliação da adaptação e aplicabilidade. *Rev Nutr* 2004; 17(3): 301-8.
10. Alves MCGP. Plano de amostragem. In: Barros MBA, Cesar CLG, Carandina L, Goldbaum M, org. *As dimensões da saúde: inquérito populacional em Campinas*. São Paulo: Aderaldo & Rothschild; 2008. p. 46-55.
11. Godoy FC, Andrade SC, Morimoto JM, Carandina L, Goldbaum M, Barros MBA et al. Índice de qualidade da dieta de adolescentes residentes no distrito do Butantã, município de São Paulo, Brasil. *Rev Nutr* 2006; 19(6): 663-71.
12. Thompson FE, Byers T. Dietary assessment resource manual. *J Nutr* 1994; (S124): 2245-317.
13. Onis M de, Onyango AW, Borghi E, Siyam A, Nishida C, Siekmann J. Development of a WHO growth reference for school-aged children and adolescents. *Bull World Health Organ* 2007; 85: 660-67.
14. Nielsen SJ, Adair L. An alternative to dietary data exclusions. *J Am Diet Assoc* 2007; 107: 792-99.
15. Andrade SC de, Barros MBA, Carandina L, Goldbaum M, Cesar CLG, Fisberg RM. Dietary Quality Index and associated factors among adolescents of the State of Sao Paulo, Brazil. *J Peds* 2010; 156(3): 456-60.
16. Pinheiro AC, Atalah E. Propuesta de una metodología de análisis de la calidad global de la alimentación. *Rev Méd Chile* 2005; 133(2): 175-82.
17. Fernández I, Aguilar Vilas MV, Mateos Vega CJ, Martínez Para MC. Calidad de la dieta de una población de jóvenes de Guadalajara. *Nutr Hosp* 2009; 24: 200-6.
18. Goodwin DK, Knol LK, Eddy JM, Fitzhugh EC, Kendrick O, Donohue RE. Sociodemographic correlates of overall quality of dietary intake of US adolescents. *Nutr Res* 2006; 26: 105-10.
19. Garriguet D. Diet quality in Canada. *Stat Canada* 2009; 20(3): 1-12.
20. Gomes MA, Pereira MLD. Família em situação de vulnerabilidade social: uma questão de políticas públicas. *Cien Saúde Colet* 2005; 10(2): 357-63.
21. Levy-Costa RB, Sichieri R, Pontes NS, Monteiro CA. Disponibilidade domiciliar de alimentos no Brasil: distribuição e evolução. *Rev Saúde Pública* 2005; 39(4): 530-40.
22. Fisberg RM, Morimoto JM, Bueno MB. Hábito alimentar: Qualidade da dieta. In: Barros MBA, Cesar CLG, Carandina L, Goldbaum M (org). *As dimensões da saúde. Inquérito populacional em Campinas*. São Paulo: Aderaldo & Rothschild; 2008. p. 59-66.
23. Ortiz-Hernández L, Gómez-Tello BL. Food consumption in Mexican adolescents. *Rev Panam Salud Publica/Pan Am J Public Health* 2008; 24(2): 127-35.
24. Riediger ND, Shoostari S, Moghadasian MH. The influence of sociodemographic factors on patterns of fruit and vegetable consumption in Canadian adolescents. *J Am Diet Assoc* 2007; 107: 1511-8.
25. Panigassi G, Segall-Corrêa AM, Marin-León L, Pérez-Escamilla R, Maranhã LK, Sampaio MFA. Insegurança alimentar intrafamiliar e perfil de consumo de alimentos. *Rev Nutr* 2008; 21(S): 135-44.
26. Lorson BA, Melgar-Quinonez HR, Taylor CA. Correlates of fruit and vegetable intakes in US children. *J Am Diet Assoc* 2009; 109: 474-78.
27. Amin TT, Al-Sultan AI, Ali A. Overweight and obesity and their relation to dietary habits and sócio-demographic characteristics among male primary school children in Al-Hassa, Kingdom of Saudi Arabia. *Eur J Nutr* 2008; 47(6): 310-18.
28. Brasil. Ministério da Saúde. Secretaria de Atenção à Saúde. Coordenação-Geral da Política de Alimentação e Nutrição. *Guia alimentar para a população brasileira: promovendo a alimentação saudável*. Brasília; 2006. 210p.

29. Rolls BJ, Ello-Martin JA, Tohill BC. What can intervention studies tell us about the relationship between fruit and vegetable consumption and weight management? *Nutr Rev* 2004; 62(1): 1-17.
30. Villa I, Yngve A, Poortvliet E, Grjibovski A, Liiv K, Sjöström M et al. Dietary intake among under-, normal- and overweight 9- and 15-year-old Estonian and Swedish schoolchildren. *Public Health Nutr* 2007; 10(3): 311-22.
31. Winham D, Webb D, Barr A. Beans and good health. *Nutr Today* 2008; 43(5): 201-9.
32. Feskanich D, Rockett HRH, Colditz GA. Modifying the Healthy Eating Index to assess diet quality in children and adolescents. *J Am Diet Assoc* 2004; 104(9): 1375-83.
33. Brown IJ, Tzoulaki I, Candeias V, Elliott P. Salt intakes around the world: implications for public health. *Int J Epidemiol* 2009; 38(9): 791-813.
34. Sarno F, Claro RM, Levy RB, Bandoni DH, Ferreira SRG, Monteiro CA. Estimativa de consumo de sódio pela população brasileira, 2002-2003. *Rev Saúde Pública* 2009; 43(2): 219-25.
35. Ministério da Saúde. Consea acompanhará acordos para redução de sódio e gordura nos alimentos.. Disponível em http://portal.saude.gov.br/portal/aplicacoes/noticias/default.cfm?pg=dspDetalheNoticia&id_area=124&CO_NOTICIA=12686 [Acessado em 4 de julho de 2011]
36. Sousa MH, Silva NN. Estimativas obtidas de um levantamento complexo. *Rev Saúde Pública* 2003; 37(5): 662-70.
37. Fisberg RM, Martini LA, Slater B. Métodos de inquéritos alimentares. In: Fisberg RM, Slater B, Marchioni DML, Martini LA. *Inquéritos alimentares: métodos e bases científicas*. São Paulo: Editora Manole; 2005. p. 1-31.
38. Willett WC. *Nutritional epidemiology*. 2nd ed. New York: Oxford University Press; 1998.
39. Júnior JCF. Validade das medidas autorreferidas de peso e estatura para o diagnóstico do estado nutricional de adolescentes. *Rev Bras Saúde Matern Infant* 2007; 7(2): 167-174.
40. Fonseca H, Silva AM, Matos MG, Esteves I, Costa P, Guerra A et al. Validity of BMI based on self-reported weight and height in adolescents. *Acta Paediatrica* 2010; 99(1): 83-88.
41. Waijers PMCM, Feskens EJM, Ocké MC. A critical review of predefined diet quality scores. *Br J Nutr* 2007; 97(2): 219-31.

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