Inadequate nutrient intake in Brazilian adolescents

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ABSTRACT

OBJECTIVE: to assess energy and nutrient consumption and the prevalence of inadequate micronutrient intake among Brazilian adolescents.

METHODS: A random sample composed of 6,797 adolescents (49.7% girls), between 10 and 18 years old, was evaluated in the first National Dietary Survey, part of the Household Budget Survey carried out in 2008-2009. Expansion factors, sample complexity design and correction of intraindividual variability were considered. The prevalence of inadequate micronutrient intake was based on the proportion of adolescents with intake below the Estimated Average Requirement. The prevalence of intake above the Tolerable Upper Intake Level (UL) was estimated for sodium.

RESULTS: The mean energy intake ranged between 1,869 kcal (10 to 13 year old females) and 2,198 kcal (14 to 18 year old males). Of the total energy intake, 57% came from carbohydrates, 27% from lipids and about 16% from proteins. Inadequacies were higher for calcium (> 95%), phosphorous (54% to 69%) and vitamins A (66% to 85%), E (100%) and C (27% to 49%). More than 70% of adolescents reported sodium intake above the UL.

CONCLUSIONS: Mean energy consumption and distribution of macronutrients were adequate, but prevalence of inadequate vitamin and mineral intake were high and notable consumption of sodium above the recommended levels, low levels of calcium consumption and, in 14 to 18 year old females, important inadequacies in iron intake were found.

DESCRIPTORS: Adolescent. Adolescent Nutrition. Energy Intake. Micronutrients, deficiency. Nutritional Status. Nutrition Policy. Nutrition Assessment. Diet Surveys.

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INTRODUCTION

Interest in adolescents' diet and nutrition is justified by the evidence linking diet at this stage of life with the risks of chronic illness in adult life.[23]

In Brazil, high levels of consumption of high calorie food, high concentrations of sodium, saturated fat, sugar, sweetened drinks and fast food snacks, as well as low levels of fruit and vegetable consumption[20] is considered to be an important risk factor for obesity and co-morbidities.[26] Consequently, overweight and obesity has increased dramatically among Brazilian adolescents in the last 35 years,[a] as well as diseases associated with obesity.[30]

Adolescents are also susceptible to nutritional deficiencies, especially iron, calcium, zinc and vitamins A, C, D, E and B, due to their bodies' increased demand for nutrients to meet the fast growth rate which characterizes this stage of life.[29]

Study with a probabilistic sample in the city of São Paulo,[32] Southeastern Brazil, revealed a high proportion of adolescents aged 14 to 18 with inadequate magnesium and vitamins A, B6, C and E intake.

In 2008-2009, the IBGE (Brazilian Institute of Geography and Statistics) undertook the 5th Household Budget Survey which included a survey of individuals' diets, consisting of the first National Dietary Survey.[b]

This study aimed to estimate calorie and nutrient consumption and the prevalence of inadequate nutrient intake among Brazilian adolescents.

METHODS

Data from the National Dietary Survey, part of the 2008-2009 Household Budget Survey, was used. More detailed information on the sample and data collection have been previously published.[b] In short, the 2008-2009 Household Budget Survey used two stage cluster sampling. In the first stage, primary sample units (PSU), previously stratified according to the head of household mean income, were selected. The PSU were selected for sampling, with probability proportional to the number of residences in each PSU, which corresponded to the geographically based PSU of the 2000 Demographic Census. In the second stage, permanent residences were selected by simple random sampling, without replacement, in each PSU. Of the 68,373 residences sampled, a subsample of 25% was calculated for the National Dietary Survey, so that a quarter of the residences in each PSU were selected, totaling 16,764 residences. Taking into consideration the 19% of no responses, 13,569 residences were evaluated. All inhabitants aged ten and over took part, totaling 34,032 individuals. Of these, 6,939 were adolescents (20.4%) aged between ten and 18 years, 3,519 female (51.7%). Those who were pregnant and/or breastfeeding were excluded from the study (n = 142), leaving a total of 6,797 adolescents studied, of which 3,377 were female (49.7%). Data collection lasted 12 months and was carried out between 2008 and 2009.

Food intake was estimated by means of two non-consecutive days' food records, proceeding required to estimate habitual consumption.[31] The adolescents interviewed were instructed to note all food and beverages consumed on the days in question in a special notebook, noting time, quantity consumed in portion size, method of preparation and place consumed (in the home or outside the home). A question was included on sugar and/or sweetener consumption. If any of the adolescents were unable to complete the food record, it was filled out with the help of another member of the household or someone nominated by them.

Data was introduced by interviewers in the homes of the interviewees, using a data entry program specially designed for the food intake module, at the same time as the completed notebooks were collected. At this time, the foods recorded were also checked and any necessary corrections based on standardized survey procedures were made. This program includes a database with around 1,500 items (food, beverages and dishes) based on food and beverages taken from 5,686 records contained in the 2002-2003 Household Budget Survey database of household food and beverage acquisition. Food items which did not appear in the database were included by the interviewers. At the end of the research, 1,971 food, beverages and dishes had been cited.

Quality control of the data collected on food intake was carried out based on partial analyses, such as verifying frequency of the response, mean of items consumed on the first and second days' food records, with local coordinators being periodically informed of inconsistencies and the need for adjustments in the data collection. Details on the pre-test, training, validation of the data collection instrument and data input have been published.[b] When checking data consistency, those adolescents (less than 1%) with incomplete records were excluded. Based on consistency analysis, values were allocated when the quantities reported were considered to be unlikely.[b] The use of soya oil in all methods of baking and sauteed (meat and vegetables) was taken

[a] 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.
[b] Instituto Brasileiro de Geografia e Estatistica. Pesquisa de Orcamentos Familiares, 2008-2009: analise do consumo alimentar pessoal no Brasil. Rio de Janeiro; 2011.

into account. The addition of 10% (standardized) of the volume of sugar to consumed liquids such as fruit juice, coffee, latte, tea and mate was assumed when the adolescent reported preferring sugar and 5% for those who reported using sugar and sweetener.

To estimate calorie, macro and micronutrient intake (calcium, phosphorous, iron, sodium, zinc, vitamins A, C, E and B12), tables of nutritional composition[c] and portion sizes,[19] which had been specially drawn up to analyze the food and dishes in the National Dietary Survey were used. These tables were created based on data available in the Brazilian Table of Food Composition[d] and in the Nutrition Data System for Research database.[e]

Population means (and their respective standard errors) of energy consumption and macronutrients, percentiles of distributions of intake and the rates of prevalence of inadequate micronutrient intake were estimated based on the data from two non-consecutive days' food records, corrected for intra-individual variance.[31] The method used to estimate usual intake and the prevalence of inadequate intake of micronutrients was developed by the National Cancer Institute of the United States.[31] This method consists of a mixed non-linear model divided into two parts. The first is based on a logistic regression model with random effects to estimate the probability of consumption; the second part considers the transformed data to achieve symmetry of distribution and estimates the amount of consumption by linear regression with random effects. As all of the nutrients investigated were consumed usually (fewer than 5% of zeros), it was assumed that the probability of estimated consumption in the first part of the model is equal to 1, meaning that only the second part of the model needs to considered when estimating usual consumption.[31] All of the models used look at the five regions of the country (North, Northeast, South, Southeast and Midwest) and the location of the residence (urban/rural) as co-variables. To estimate the percentage of usual intake of calories coming from protein, carbohydrates and fats, an extension of the National Cancer Institute method for bivariate model was used.[7]

Estimates of standard errors obtained using the National Cancer Institute model are based on assumptions of the observations' independence and equal distribution and a simple random sample. Such assumptions do not apply to the data obtained in a complex sample such as the Household Budget Survey. Thus, the standard errors were estimated using the balanced repeated replication technique, with Fay's modification[5] (1989) as used by Barbosa et al.[2]

Prevalence rates of inadequate intake were estimated according to gender, age group (ten to 13 years old and 14 to 18 years old) and proportion of adolescents with intake below the Estimated Average Requirement Estimated Average Requirement, as proposed by the US Institute of Medicine.[18] The Estimated Average Requirement represents the average of daily ingestion of a nutrient that is estimated to meet the needs of 50% of the healthy population.[11-18]

For iron, the estimate of inadequate intake was calculated using the manually determined probabilistic approach,[15] as distribution of necessity of this nutrient is asymmetrical among women of childbearing age, which is not taken into account in the premises upon which Estimated Average Requirement use is based. Probabilistic sampling was used for both sexes with the aim of facilitating comparison. To begin with, the (10^{th}, 15^{th}, 25^{th}, 50^{th}, 75^{th} and 90^{th}) percentiles were estimated for usual iron intake. Probability of inadequate intake according to gender and age group was associated to each. These probabilities of inadequate intake are according to specified iron intake recommended by the US Institute of Medicine by sex and age groups[15] (2001). The risk of inadequate intake corresponds to the number of individuals in each interval of iron intake, multiplied by the respective probability of inadequate intake, and the prevalence of inadequate iron intake corresponded to the sum of the percentage of individuals with inadequate intake in each percentile. Using this method, it is not possible to calculate standard error for inadequate iron intake.

For sodium intake, values above the tolerable upper intake level were considered inappropriate.[14] That was used because of the very high levels of sodium intake in Brazil.[28]

All of the estimates were calculated using Statistical Analysis System software, version 9.3, taking into account expansion factors in the Household Budget Survey 2008-2009 and the complexity of the sample design. All of the analyses were stratified by the adolescents' gender and age group.

The research protocol was approved by the Ethics Committee of the *Instituto de Medicina Social, Universidade do Estado do Rio de Janeiro* (CAAE 0011.0.259.000-11).

RESULTS

Mean energy intake varied between 1,869 kcal in adolescent females aged ten to 13 years old and

[c] Instituto Brasileiro de Geografia e Estatística. Pesquisa de Orçamentos Familiares, 2008-2009: tabela de composição nutricional dos alimentos consumidos no Brasil. Rio de Janeiro; 2011.

[d] Universidade Estadual de Campinas, Núcleo de Estudos e Pesquisas em Alimentação: tabela brasileira de composição de alimentos; versão 2. 2.ed. Campinas: NEPA; 2006 [cited 2011 Jul]. Available from http://www.unicamp.br/nepa/taco/contar/taco_versao2.pdf

[e] University of Minnesota, Nutrition Coordinating Center. Nutrition data system for research - NDSR. Minneapolis; 2003 [cited 2011 Jul]. Available from: http://www.ncc.umn.edu/products/ndsr.html

2,198 kcal in males aged 14 to 18 years old. There were no differences verified among the age groups with regards total energy and macronutrients in the females' diets. However, in adolescent males, the 14 to 18 age group presented higher energy, protein and fat intake than those aged 10 to 13 years old. The percentage contribution of macronutrients to total energy intake was approximately 57% for carbohydrates, 16% protein and 27% lipids (Table 1).

Regardless of gender and age group, almost 100% of adolescents showed inadequate intake of calcium and vitamin E. Around two thirds or more of adolescents showed inadequate intake of phosphorous and vitamin A and a third inadequate vitamin C intake. As for sodium intake, more than 70% of adolescents showed intake above the tolerable upper intake level (Tables 2 and 3).

Among the males, the prevalence of inadequate phosphorous intake was higher among those aged 10 to 13, and that of vitamins A and C was higher among the 14 to 18 age group, as was excessive sodium intake (Table 2). Adolescent females aged between 14 and 18 showed a higher prevalence of inadequate iron intake compared with those aged 10 to 13, who, in turn, show a higher prevalence of excessive sodium intake (Table 3).

Higher prevalence of excessive sodium intake was observed in adolescent males (both age groups) and of vitamins A and C in adolescent females (only in the 14 to 18 age group). The adolescent girls aged 14 to 18 had a higher prevalence of inadequate phosphorous and iron intake that adolescent boys of the same age (Tables 2 and 3).

DISCUSSION

Almost all of the Brazilian adolescents in the study showed inadequate intake of calcium and vitamin E and, in lower but still significant proportions (around 2/3 of the adolescents), inadequate phosphorous and vitamin A intake and around 1/3 did not consume sufficient vitamin C. Although there were small differences between the genders, the deficiencies are relevant to both.

As regards calcium, not even the 10% of the sample who consumed the most calcium (90th percentile) reached the nutritional recommendation of 1,100 mg/day. Methodological differences in assessing food intake and inadequate nutrient consumption makes it difficult to compare results between studies; however, inadequate intake of micronutrients observed in the National Dietary Survey data confirms what has been revealed in other studies carried out in Brazil, irrespective of the method of analyzing inadequate intake,[32] and in other emerging[6,27] and developed countries.[10]

In this study, inadequate calcium and phosphorous intake may be related to low consumption of milk and dairy products, which are the principle dietary sources, as dairy products, fruit and vegetables are among the least frequently consumed foods among Brazilian adolescents.[b] The low levels of milk and dairy products consumed by adolescents have been associated to

Table 1. Sample size, mean and 95% confidence interval in calorie and macronutrients intake and contribution of macronutrient to total caloric intake among adolescents, according to sex and age. Brazil, 2008-2009.

Energy and nutrients	Males (n = 3,420)		Females (n = 3,377)	
	10 to 13 years old	14 to 18 years old	10 to 13 years old	14 to 18 years old
	(n = 1,515)	(n = 1,905)	(n = 1,566)	(n = 1,811)
Energy (kcal)	1,952 1,922;1,981	2,198 2,156;2,240	1,869 1,811;1,927	1,912 1,858;1,965
Protein				
Mean intake (g)	76 74;79	88 86;91	73 71;76	72 71;74
% total caloric intake	15.7 15.3;16.1	16.2 16.0;16.4	15.8 15.4;16.2	15.2 14.8;15.6
Carbohydrates				
Mean intake (g)	276 270;282	306 300;311	264 253;276	272 264;279
% total caloric intake	57.2 56.0;58.4	56.4 55.8;57.0	57.0 56.0;58.0	57.3 56.5;58.1
Total lipids				
Mean intake (g)	60 58;62	68 66;69	58 57;60	60 57;63
% total caloric intake	27.2 26.6;27.8	27.4 27.2;27.6	27.5 27.1;27.9	27.7 26.9;28.5

Table 2. Nutritional Reference (EAR), percentiles of consumption (10, 25, 50, 75 and 90), prevalence and 95% confidence interval of inadequate micronutrient intake among adolescent boys, according to age. Brazil, 2008-2009.

Micronutrients	10 to 13 years old							14 to 18 years old						
	Reference intakes	10	25	50	75	90	% of inadequacy	Reference intakes	10	25	50	75	90	% of inadequacy
Calcium (mg)	1,100	243	340	482	666	875	96.5 95.6;97.5	1,100	263	365	514	704	924	95.4 94.5-96.3
Phosphorous (mg)	1,055	548	697	902	1,157	1,436	66.3 63.8;68.7	1,055	623	791	1,017	1,295	1,604	54.1 51.0-57.1
Iron (mg)	5.9	6.2	8.2	10.8	13.9	17.2	8.5[b]	7.7	7.6	9.8	12.7	16.2	19.9	11.8
Sodium (mg)	2,200	1,889	2,375	3,013	3,765	4,557	81.0[a] 79.5;82.4	2,300	2,230	2,775	3,491	4,318	5,186	88.4 86.2-90.7
Zinc (mg)	7.0	5.9	7.6	9.9	12.9	16.1	19.2 15.7;22.8	8.5	7.0	8.9	11.6	14.9	18.6	21.6 18.4-24.8
Vitamin A (mg)	445	135	201	311	473	680	71.8 67.8;75.8	630	143	213	327	497	717	85.6 83.7-87.6
Vitamin B12 (mcg)	1.5	1.8	2.6	3.7	5.3	7.3	5.2 3.3;7.2	2.0	2.1	2.9	4.1	5.9	8.1	9.1 6.6-11.5
Vitamin E (mg)	9.0	2.2	2.9	3.8	5.0	6.2	99.3 99.0;99.5	12.0	2.5	3.3	4.4	5.6	6.9	99.9 99.8-100.0
Vitamin C (mg)	39.0	17.8	35.9	74.0	143.4	253.0	27.5 22.1;32.8	63.0	14.9	31.3	65.1	127.5	225.2	48.8 46.7-50.9

EAR: Estimated Average Requirements
[a] Estimate based on UL (tolerable upper intake level)
[b] Estimated by the probabilistic approach for which it is not possible to estimate the standard error

Table 3. Reference Intakes (EAR), intake percentiles (10, 25, 50, 75 and 90), prevalence and 95% confidence interval of inadequate micronutrient intake among adolescent girls according to age. Brazil, 2008-2009.

Micronutrients	10 to 13 years old							14 to 18 years old						
	Reference intakes	10	25	50	75	90	% of inadequacy	Reference intakes	10	25	50	75	90	% of inadequacy
Calcium (mg)	1,100	238	331	469	651	857	96.8 96.4;97.3	1,100	237	332	468	647	850	97.0 96.0;97.9
Phosphorous (mg)	1,055	533	679	882	1,128	1,399	68.8 65.1;72.5	1,055	528	674	874	1,118	1,393	69.4 65.2;73.6
Iron (mg)	5.7	5.8	7.7	10.2	13.2	16.5	10.7[b]	7.9	6.0	7.9	10.5	13.5	16.8	25.0
Sodium (mg)	2,200	1,747	2,203	2,815	3,530	4,290	75.1[a] 72.0;78.2	2,300	1,718	2,173	2,774	3,493	4,239	69.9 68.3;71.6
Zinc (mg)	7.0	5.6	7.2	9.5	12.3	15.4	22.5 19.8;25.2	7.3	5.7	7.3	9.6	12.5	15.7	24.7 20.7;28.7
Vitamin A (mg)	420	141	211	326	496	713	65.8 62.9;68.8	485	145	217	337	510	729	72.3 66.4;78.3
Vitamin B12 (mcg)	1.5	1.9	2.6	3.8	5.5	7.5	4.7 2.8;6.7	2.0	1.9	2.7	3.8	5.4	7.4	11.7 6.3;17.1
Vitamin E (mg)	9.0	2.0	2.7	3.6	4.6	5.8	99.6 99.4;99.8	12.0	2.1	2.8	3.7	4.8	6.0	100.0 100.0;100.0
Vitamin C (mg)	39.0	16.1	33.2	68.5	133.9	235.9	30.1 26.5;33.6	56.0	18.5	37.5	76.6	148.1	256.0	38.0 32.5;43.5

EAR: Estimated Average Requirements
[a] Estimate based on UL (tolerable upper intake level)
[b] Estimated by the probabilistic approach for which it is not possible to estimate the standard error

increased consumption of soft drinks and other sweetened drinks,[6] which, in turn, have been associated with being overweight in adolescence.[22]

Adequate calcium and phosphorous intake in adolescence is critical in achieving peak bone mass and maintaining skeletal integrity and consequent prevention of osteoporosis and fractures in adult life.[4] Another possible additional role played by calcium in preventing chronic illness such as high blood pressure and obesity,[3] indicates the damage which deficiency of this mineral may do to health.

Vitamins A, C and E were also the nutrients with the highest prevalence of inadequate intake in adolescents aged 14 to 18 in São Paulo, Southeastern Brazil,[32] evaluated using the Estimated Average Requirement method. Prevalence rates similar to those found in this study for vitamin E (almost 100%) and vitamin A (for example: for male and female adolescents prevalence rates of 78% and 71% were estimated in SP, *versus* 85.6% and 72.3% in this study, respectively). However, the prevalence of inadequate vitamin C was higher in SP (79% *versus* 48.8% for males and 53% *versus* 38% for females).

These nutrients were also those which had the highest prevalence of inadequate intake in the diet of American adolescents,[25] although less so than those observed in Brazil.

In addition to these vitamins' importance in meeting the demands of satisfactory growth and bodily changes inherent to puberty, their functions as anti-oxidants and, possibly, protectors against cardiovascular disease stand out.[11-13,15] The high prevalence of inadequate consumption of these nutrients observed in Brazilian adolescents may signify increased risk of developing these diseases.

Low levels of fruit and vegetable consumption have been observed in the Brazilian population in general[21] and may explain inadequate vitamin intake, especially of vitamin C, which has its main sources in these foods. Mean daily intake per capita of fruit and vegetables observed in adolescents were below 100 g, much below the 400 g/day recommended to protect health and diminish the risk of illness.[18] Adolescents are the age group with the lowest consumption of these foods,[b] in Brazil and in other countries.[10]

Overall, the inadequate micronutrient intake observed were similar for both genders, with the exception of iron and phosphorous, which were more inadequate in females, especially in the 14 to 18 age group.

The most notable differences in prevalence rates of inadequate micronutrient intake between the age groups were related to iron and vitamin B12, being twice as high (for iron) and almost three times as high (for vitamin B12) in the 14-18 year olds than in the younger group. The lower iron intake observed among 14 to 18 year olds makes them more vulnerable to anemia due to lack of iron, which is highly prevalent among Brazilian adolescents of both genders.[24] The greater inadequacy of iron observed in females compared to males of the same age, in the second half of adolescence, may be associated with this group's lower intake of the nutrient, as the values of the percentiles are lower than the values for the males, although needs are similar for both groups (7.9 mg for females and 7.7 mg for males).

We also observed a high percentage of adolescents with sodium intake above the biologically tolerable daily intake and which, probably, does not place the individuals at risk of adverse effects (above 70% in females and above 80% in males). The median sodium consumption for both sexes in both age groups, especially in males (3,013 mg for those aged ten to 13 and 3,491 mg for those aged 14 to 18), is above the recommended daily intake of 2,300 mg.[14] High salt content in adolescents' diet may be associated with the large amounts of processed food consumed by the Brazilian population.[b]

Assessing adequate energy intake in adolescents is a complex task, as energy needs estimated for this age group are established based on equations which take into consideration variables such as gender, age, weight and physical activity, as well as additional energy to be stored and for growth.[16] Energy needs for sedentary adolescents aged ten to 18, taking into consideration reference weight and height, would be 1,798 kcal to 2,383 kcal for males and 1,617 kcal to 1,690 kcal for females.[16] Thus, the mean values observed in Brazilian adolescents would be, relatively, within expected levels for male adolescents (1,952 kcal to 2,198 kcal), although a little over the expected levels for females (1,869 kcal to 1,912 kcal). It was decided to compare estimates for sedentary adolescents due to the high prevalence of sedentary Brazilian teenagers.[9]

The contribution of macronutrients to total energy intake observed in the adolescents studied was found to be within the acceptable limits set by the US Institute of Medicine which recommend that this should vary between 45% and 65% for carbohydrates, 10% to 30% for proteins and 25% to 35% for lipids, for the population of the United States and Canada aged 4 to 18 years old. These guidelines show limits associated with nutritional adequacy and reduced risk of chronic diseases. However, the *Guia Alimentar para a População Brasileira* (Food Guide for the Brazilian Population)[f] sets this distribution as 55% to 75% for

[f] Ministério da Saúde, Secretaria de Atenção Básica, Departamento de Atenção à Saúde. Guia alimentar para a populaçâo brasileira: promovendo a alimentação saudável. Brasília (DF); 2006. (Série A. Normais e Manuais Técnicos). Available from: http://bvsms.saude.gov.br/bvs/publicacoes/guia_alimentar_populacao_brasileira_2008.pdf

carbohydrates, 15% to 30% for lipids and 10% to 15% for proteins. Thus, the means observed in this study are within the Brazilian recommended guidelines for lipids (27%), carbohydrates (57%) and slightly higher for proteins (16%). Despite the acceptable percentage distribution of macronutrients, adolescents are the age group with the highest mean per capita consumption of cookies and soft drinks, which are significant sources of simple sugars. Moreover, adolescents in the 14 to 18 age group had the highest mean fat consumption compared to adults and the elderly,[b] which may explain the higher absolute consumption of carbohydrates and lipids and the consequent increase in calories observed in this age group.

Studies carried out on Brazilian adolescents have shown high lipid intake[20] and carbohydrate and protein consumption within or above recommended guidelines,[8] results comparable with those observed in this study, expect with regards to fat consumption, for which we observed a lower contribution to total calorie consumption.

There are a variety of methods which can be used to estimate individual dietary intake. The method chosen for the National Dietary Survey was to use food records from two non-consecutive days. This method was chosen mainly due to the need to interfere as little as possible in the Household Budget Survey data collection, in which information on expenditure was recorded in a notebook,[33] as well as having the advantage of not being reliant on memory. However, as with other methods of assessing food intake, this is also subject to errors in estimating consumption, as there is the possibility that the results include some degree of underestimation. A limitation of the study was the fact that not having been adopted criteria to exclude underestimates and correct for underestimates, as this proceeding may lead to overestimating inadequate intake of nutrients. However, appropriate statistical procedures were applied to minimize the effect of intra-individual variability and remove outliers for both under – and overestimates of nutrient intake.[1]

This was a pioneering study in Brazil as it estimated individual dietary intake in a nationally representative probabilistic sample of adolescents, which allowed this population's intake of energy and nutrients and the prevalence of inadequate micronutrient intake to be described. Although the means of energy consumption and the distribution of macronutrients were adequate, there were high rates or inadequate intake of micronutrients such as calcium, phosphorous, sodium and vitamins A, E and C in both genders and age groups. Inadequate iron intake also proved to be relevant to adolescent females aged between 14 and 18 years old.

Inadequate micronutrient intake is particularly worrying in adolescence, when needs are increased due to the growth and bodily changes inherent to puberty. Developing interventions to reduce these deficiencies, as well as to diminish excessive consumption of food items associated with obesity and other chronic illnesses is a challenge for public policies promoting health in adolescence and, consequently, in adulthood.

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