

Nutrition-related habits and associated factors of Brazilian adolescents

Augusto César Ferreira de Moraes · Rômulo Araújo Fernandes · Diego Giulliano Destro Christofaro · Arli Ramos de Oliveira · Alika Terumi Arasaki Nakashima · Felipe Fossati Reichert · Mário Cícero Falcão

Received: 25 September 2009/Revised: 21 June 2010/Accepted: 11 July 2010/Published online: 12 August 2010
© Swiss School of Public Health 2010

Abstract

Objectives To investigate the nutrition-related habits (NRH) of Brazilian adolescents and evaluate the associations with risk factors.

Methods Cross-sectional school-based was carried out among high school adolescents aged 14–18 years ($n = 1,759$) from public and private schools from two cities. The NRH were investigated by the weekly consumption of vegetables,

fruit, sweet food and fried food. Risk factors investigated were: city, sex, age, socioeconomic status and nutritional status. In statistics, Poisson regression was used with robust variance adjustment.

Results Data indicated low consumption of fruits and vegetables, 70.0 and 71.0%, respectively, and high consumption of sweets and fried food, 66.7 and 63%, respectively. Boys showed risk of inadequate intake of

A. C. F. de Moraes (✉)
Post-Graduate Program in Science, Children Institute,
School of Medicine, University of São Paulo, Rua: Abadia dos
Dourados, nº 307-7, Butantã,
São Paulo, SP, Brazil
e-mail: moraes82@yahoo.com.br

A. C. F. de Moraes · F. F. Reichert
GEEAF, Epidemiology of Physical Activity Research Group,
Londrina, Brazil
e-mail: ffreichert@gmail.com

A. C. F. de Moraes · D. G. D. Christofaro
GEPEMENE, Nutrition,
Exercise and Metabolism Research Group, Londrina, Brazil
e-mail: diegochristofaro@yahoo.com.br

R. A. Fernandes
Institute of Biosciences, São Paulo State University,
Rio Claro, Brazil
e-mail: romulo_ef@yahoo.com.br

D. G. D. Christofaro · A. R. de Oliveira · F. F. Reichert
Post-Graduate Associated Program in Physical Education
Londrina, Center of Physical Education and Sport,
State University of Londrina, Londrina, Brazil
e-mail: arli_o@yahoo.com.br

D. G. D. Christofaro
Post-Graduate Program in Collective Health Londrina,
Department of Collective Health,
State University of Londrina, Londrina, Brazil

A. R. de Oliveira
GEPAFIS - Physical Activity and Health Research Group,
State University of Londrina, Londrina, Brazil

F. F. Reichert
School of Physical Education, Federal University of Pelotas,
Pelotas, Brazil

M. C. Falcão
Post-Graduate Program in Science, Children Institute,
School of Medicine, University of São Paulo,
Av. Dr. Enéas Carvalho de Aguiar, 64, Cerqueira César,
São Paulo, SP, Brazil
e-mail: profmariofalcao@yahoo.com.br

R. A. Fernandes
Department of Physical Education,
UNESP Univ Estadual Paulista,
Presidente Prudente-São Paulo, Brazil

A. T. A. Nakashima
Graduate in Nutrition, Campus Maringá, Catholic University
of Paraná PUC-PR, Campus Maringá, Maringá/PR, Brazil
e-mail: alika@uol.com.br

A. T. A. Nakashima
GEPECIN – Group of Research in Science Nutrition,
Catholic University of Paraná PUC-PR, Maringá/PR, Brazil

vegetables [prevalence ratios (PR) 1.10, 95% CI 1.01–1.16] and fruit (PR 1.09, 95% CI 1.01–1.16). Furthermore, adolescents who live in Maringá had greater likelihood of consuming vegetables and fruit (20 and 25%, respectively). However, they presented risk of inadequate consumption of sweets (PR 1.19, 95% CI 1.11–1.28) for adolescents who live in Presidente Prudente.

Conclusion We concluded that inadequate NRH show high prevalence among adolescents and indicate the need to employ educational strategies that promote the adoption of more healthy habits and behaviors.

Keywords Dietary · Epidemiology · Adolescent behavior · Questionnaires · Socioeconomic factors

Introduction

The overweight prevalence among children and adolescents has increased in recent years and it is considered by the World Health Organization (WHO 1997) to be a public health problem. According to the National Center for Health Statistics (NCHS) reported by Ogden et al. (2008), one in five American children are overweight. In Brazil, the increase in prevalence of overweight was greater than 200% in the last three decades and it is estimated that about 18% of the boys and 15% of the girls who are overweight will be obese (Wang et al. 2002; Brazilian Institute of Geography and Statistics 2006).

This significant increase in the occurrence of overweight, in most cases, is associated with an imbalance between the amount of energy consumed and the amount of energy expended (Bouchard 2000). In Brazil, there are adults' data showing the reduction of cereals, legumes, roots and tubers consumption (Levy-Costa et al. 2005). These changes resulted not only in the decrease of the participation of complex carbohydrates of the diet and increased participation of lipids, but also an increase in the proportion of animal protein and lipids of plant origin (Monteiro et al. 2000). Moreover, the prevalence of consuming weekly high caloric food, such as fast food, sweet food and biscuits have increased in recent years (French et al. 2001; Andrade et al. 2003).

However, despite this worrying status, there are a few studies on the nutrition-related habits (NRH) of young developing societies, as well as possible risk factors associated with them. Thus, the objective of this study was to investigate the NRH of adolescents who live in two Brazilian cities (one from the south and another southeast) and the main risk factors associated.

Methods

A cross-sectional school-based study was carried out with similar methods in Maringá (population: 325,000 inhabitants) and Presidente Prudente (population: 205,000 inhabitants), a south and southeast Brazilian cities, respectively. According to the Atlas of Human Development in Brazil of United Nations Program for Development (United Nations Program for Development 2006), these cities have a high Human Development Index (HDI = 0.84 for both cities, while the HDI for Brazil as a whole is 0.79). The fieldwork started in August and ended in October 2007 (from the end of winter to the beginning of spring).

Sample

A representative sample of high school-aged adolescents aged 14–18 years old; the students of both sexes and with no chronic orthopedic complication were eligible for research. To calculate the sample size, based on many risky behaviors investigated in the study, it was considered a 50% prevalence as most expected, with a confidence interval of 95% (95% CI) and error of 5% points and a design effect of 2, because it is considered a complex sample size. Due to other objectives of the research project and to possible occasional losses and refusals, an extra 20% of adolescents were added to the sample. The sample size obtained allowed to estimate a prevalence of 50% per city with a margin of error of 4% points. Moreover, it was possible to detect grounds of prevalence of 1.3 as statistically significant at 5% level and with power of 80% for exposures with a prevalence of 50%.

The sample was obtained by the classroom selection process of two stages: schools (primary sampling unit) and classrooms. In the first stage, the number of schools with students within the age range under study was identified. The schools were classified into two categories: public and private; so, it was randomly selected with proportional probability of the population, within its strata, on this stage, were selected. On the second stage, classrooms were selected by simple random sampling, so that the student proportion in each grade (from the first to the third grade from high school) was respected.

NRH

The NRH were verified using a semi-quantitative food consumption frequency questionnaire. For example, the participants were asked a question “How many times did you ingest fruit last week?” for assessing the fruit consumption which classified the subjects into the following categories: consumption of less than 1, 1–2, 3–4, 5–6, and

7 days/week. The questionnaire was self-administered in classrooms under the supervision of a researcher, and questioned on four food groups: (1) vegetables and greens, (2) sweet food (cakes, biscuits and sweets), (3) fried food and (4) fruit, with reference to the last week (WHO 2005). No specific amount was recorded; therefore, only data collected were used to assess the frequency of weekly consumption of each food group. The outcomes were considered inadequate intake of the four food groups as per the recommendations of the Brazilian Ministry of Health (2007): as ≥ 4 days/week for fried food and sweet food, and ≤ 4 days/week for fruits and vegetables. Furthermore, we analyzed the reproducibility of the questionnaire by the kappa coefficient (κ) in two pilot studies, with a week interval, conducted in schools that did the final sample. The observed results were high, $\kappa = 0.91$ in the city of Maringá and $\kappa = 0.83$ when performed in the city of Presidente Prudente.

The independent variables were investigated: the search location (city), sex, age, socioeconomic status (SES) (Brazil Criterion of Economic Classification 2006, which divides families into five groups, where “A” is the wealthiest one) and the nutritional status (Conde and Monteiro 2006). For analysis purpose, the levels D and E were combined.

Statistical analysis

The significance of the bivariate analysis was tested by Chi-square. In addition, unadjusted and adjusted prevalence ratios (PR) with 95% CI were calculated with Poisson regression, which is preferable than logistics regression for binary outcomes with high prevalence (Barros and Hirakata 2003). Adjusted analysis was performed according to a two-level, hierarchical model determined a priori: (1) sex, age and socioeconomic level at the most distal level, and (2) nutritional status at the second level. In this model, the effect of each variable on the outcome is adjusted for other variables in the same level or above in the hierarchical model (Victora et al. 1997). For a variable to be retained in the model, a significance level was set at $p < 0.20$. The level of significance (α of 5%) was checked by the Wald test for heterogeneity by dichotomous variables, and Wald test for linear trend by ordinal categorical variables. The statistical analyses were conducted in Stata[®], version 8.0 and 5% α was used.

The study was approved by the Ethics in Research of the University Center of Maringá authorized by Ethics Committee of Research Projects of University of São Paulo Clinics Hospital and the Paulista State University, campus de Presidente Prudente. Confidentiality was ensured and informed consents were obtained from each subject.

Results

In Presidente Prudente, four public and two private schools were selected, while in Maringá eight public and four private schools were selected. The sample distribution was done by city: 991 in Maringá (45.5% of boys) and 768 (47.3% of boys) in Presidente Prudente, amounting to a total sample of 1,759 adolescents (814 boys). Approximately 22% of the sample was classified in the highest stratum of economic level (level A) and 75.9% was classified as eutrophic. Mean age, body mass, height and BMI were: 15.7 ± 1.1 years old, 61.3 ± 13.5 kg, 168.7 ± 8.3 cm and 21.4 ± 3.7 kg/m², respectively. After the field work, in Presidente Prudente, the identified response rate was 89.5%, while in Maringá this rate was 88.2%. In addition, in Presidente Prudente, three pregnant girls were excluded from the analyzed sample.

Figure 1 shows the prevalence of outcomes in each city. Highest inadequate intake of fruits and vegetables was observed in Presidente Prudente ($p = 0.001$), while adolescents from Maringá showed a higher inadequate consumption of sweet food ($p = 0.001$). In relation to fried food consumption, there were no statistical differences between the two cities.

In Table 1, note that the inadequate intake of fruit (four or less days per week) is positively associated with male gender and economic level. The inadequate intake of vegetables was higher in boys and low weight adolescents; however, it was lower in obese adolescents. High consumption of sweet food (less than 3 days/week) showed up as a protective factor against overweight and obesity. In relation to inadequate intake of fried food, a relation on the examined ages was found; however, there is no tendency to increase as the person gets older. There were no statistically significant differences in the socioeconomic level and the outcomes evaluated.

Table 2 presents the association between outcomes and independent variables of adolescents from Presidente Prudente, noted that the inadequate intake of fried food was

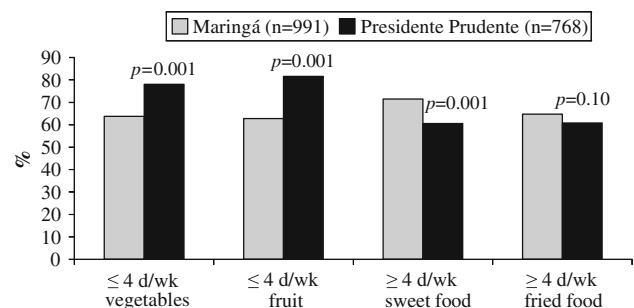


Fig. 1 Prevalence (%) of inadequate intake of food groups studied in each city

Table 1 Adjusted prevalence ratio (PR) with a confidence interval of 95% (95% CI) for independent variables in relation to the outcome among Brazilian adolescents, Maringá, PR and Presidente Prudente, SP (2007), $n = 1,759$

Level ^a	Variables	PR (95% CI)			
		Vegetable (≤ 4 days/week)	Fruit (≤ 4 days/week)	Sweet food (≥ 4 days/week)	Fried food (≥ 4 days/week)
1	<i>Gender</i>	$p = 0.001^{\ddagger}$	$p = 0.002^{\ddagger}$	$p = 0.131^{\ddagger}$	$p = 0.252^{\ddagger}$
	Female	1.0	1.0	1.0	1.0
	Male	1.10 (1.04–1.18)	1.10 (1.03–1.16)	0.95 (0.89–1.02)	1.05 (0.98–1.13)
	<i>Age (years)</i>	$p = 0.565^{\dagger}$	$p = 0.380^{\dagger}$	$p = 0.271^{\dagger}$	$p = 0.034^{\dagger}$
	14	1.0	1.0	1.0	1.0
	15	1.03 (0.93–1.13)	0.94 (0.86–1.03)	1.04 (0.92–1.16)	1.27 (1.11–1.45)
	16	1.04 (0.94–1.15)	1.01 (0.92–1.10)	1.07 (0.96–1.20)	1.30 (1.13–1.49)
	17	1.05 (0.94–1.16)	0.99 (0.90–1.09)	0.97 (0.85–1.10)	1.16 (1.00–1.35)
	18	0.98 (0.83–1.17)	0.96 (0.81–1.13)	1.15 (0.97–1.35)	1.32 (1.09–1.61)
	<i>Socioeconomic level</i>	$p = 0.295^{\dagger}$	$p = 0.063^{\dagger}$	$p = 0.643^{\dagger}$	$p = 0.733^{\dagger}$
D and E (poorest)	1.0	1.0	1.0	1.0	
C	1.01 (0.84–1.22)	1.12 (0.91–1.38)	0.88 (0.75–1.04)	1.02 (0.84–1.25)	
B	0.96 (0.80–1.16)	1.09 (0.89–1.34)	0.97 (0.84–1.13)	0.98 (0.81–1.19)	
A (wealthiest)	0.91 (0.75–1.10)	0.99 (0.80–1.23)	1.07 (0.91–1.25)	0.99 (0.81–1.21)	
2	<i>Nutritional status</i>	$p = 0.055^{\dagger}$	$p = 0.933^{\dagger}$	$p = 0.003^{\dagger}$	$p = 0.002^{\dagger}$
	Normal weight	1.0	1.0	1.0	1.0
	Underweight	1.18 (1.05–1.33)	1.03 (0.88–1.19)	1.11 (0.96–1.28)	1.10 (0.94–1.30)
	Overweight	0.96 (0.87–1.04)	0.99 (0.91–1.07)	0.89 (0.80–0.99)	0.82 (0.73–0.93)
	Obesity	0.83 (0.70–0.99)	1.00 (0.87–1.14)	0.78 (0.65–0.94)	0.86 (0.73–1.03)

[‡] Wald test for heterogeneity

[†] Wald test for trend

^a The effect of each variable on the outcome is adjusted for other variables (gender, age, socioeconomic level and nutritional status; when $p < 0.20$) in the same level or above in the hierarchical model

lower among individuals aged 14 and obese, while overweight was associated, as a protection, to the low fruit consumption.

Table 3 presents the association between food consumption and the independent variables for adolescents who live in Maringá. The boys showed higher risk of inadequate intake of fruits, vegetables and fried food. On the other hand, they had protection for sweet food consumption. In crude analysis, young people from higher economic level showed lower probability of sweet food consumption, after adjustment, this association lost its significance. The nutritional status showed an inverse association with high consumption of sweet food, indicating that obese adolescents showed lower frequency of weekly consumption of sweet food.

Discussion

A cross-sectional study has been developed with Brazilian adolescents from two different cities, which were not more

than 200 km away from each other and belong to different regions of the country (south and southeast). This study analyzes the consumption of different kinds of food as well as possible risk factors and it was unable to detect a high occurrence of inadequate diet.

Information indicated a low consumption of healthy foods such as fruits/vegetables and a high consumption of unhealthy foods such as sweets/fried, where fractions exceeding 60% of the sample exhibit these nourishment behaviors. These results indicate a high proportion of young people who have harmful habits to health and agree with the findings of Neutzling et al. (2007), who found high consumption of diets rich in fat (36.6%) and low in fiber (83.9%) among adolescents in Pelotas, RS, another Brazilian southern city. In addition, Toral et al. (2006) observed in their study among adolescents of São Paulo insufficient consumption (1 serving per day) of fruits (87.6%) and vegetables (89.7%) of their sample. The inadequate food intake in this age group might be due to a lack of knowledge about some aspects of food, which was evidenced by Toral et al. (2006).

Table 2 Adjusted prevalence ratio (PR) with a confidence interval of 95% (95% CI) for independent variables in relation to the outcome among adolescents of Presidente Prudente, SP, Brazil (2007), $n = 768$

Level ^a	Variables	PR (95% CI)			
		Vegetable (≤ 4 days/week)	Fruit (≤ 4 days/week)	Sweet food (≥ 4 days/week)	Fried food (≥ 4 days/week)
1	<i>Gender</i>	$p = 0.182^{\ddagger}$	$p = 0.483^{\ddagger}$	$p = 0.981^{\ddagger}$	$p = 0.649^{\ddagger}$
	Female	1.0	1.0	1.0	1.0
	Male	1.06 (0.98–1.14)	1.02 (0.96–1.10)	1.00 (0.89–1.12)	0.98 (0.87–1.10)
	<i>Age (years)</i>	$p = 0.992^{\dagger}$	$p = 0.966^{\dagger}$	$p = 0.374^{\dagger}$	$p = 0.025^{\dagger}$
	14	1.0	1.0	1.0	1.0
	15	0.98 (0.89–1.09)	0.93 (0.85–1.03)	1.02 (0.86–1.20)	1.21 (1.01–1.44)
	16	0.99 (0.89–1.11)	1.04 (0.95–1.14)	1.04 (0.88–1.24)	1.23 (1.02–1.48)
	17	1.03 (0.91–1.15)	0.98 (0.88–1.08)	1.05 (0.88–1.26)	1.30 (1.07–1.56)
	18	0.91 (0.73–1.13)	0.89 (0.72–1.10)	1.00 (0.74–1.37)	1.10 (0.79–1.54)
	<i>Socioeconomic level</i>	$p = 0.061^{\dagger}$	$p = 0.440^{\dagger}$	$p = 0.294^{\dagger}$	$p = 0.900^{\dagger}$
	D and E (poorest)	1.0	1.0	1.0	1.0
C	0.94 (0.68–1.31)	1.15 (0.72–1.82)	1.89 (0.58–6.16)	0.88 (0.55–1.42)	
B	0.94 (0.69–1.30)	1.11 (0.70–1.76)	2.07 (0.64–6.70)	0.85 (0.53–1.36)	
A (wealthiest)	0.85 (0.61–1.18)	1.11 (0.70–1.76)	2.42 (0.74–7.84)	0.85 (0.53–1.36)	
2	<i>Nutritional status</i>	$p = 0.008^{\dagger}$	$p = 0.211^{\dagger}$	$p = 0.154^{\dagger}$	$p = 0.030^{\dagger}$
	Normal weight	1.0	1.0	1.0	1.0
	Underweight	1.09 (0.95–1.26)	1.00 (0.84–1.18)	1.12 (0.89–1.43)	1.00 (0.75–1.32)
	Overweight	0.98 (0.88–1.08)	1.00 (0.92–1.10)	0.85 (0.71–1.01)	0.79 (0.66–0.96)
	Obesity	0.61 (0.45–0.84)	0.82 (0.66–1.02)	0.90 (0.69–1.18)	0.89 (0.68–1.18)

[‡] Wald test for heterogeneity

[†] Wald test for trend

^a The effect of each variable on the outcome is adjusted for other variables (gender, age, socioeconomic level and nutritional status; when $p < 0.20$) in the same level or above in the hierarchical model

This nutritional transition is observed in other South American countries. Romaguera et al. (2008) found low consumption of fruits, vegetables and a total energy intake from simple sugars of 20.0 and 24.1% of saturated fat in Argentine adolescents. These dietary patterns may be attributed to the phenomena of globalization and urbanization (Lazarou and Kalavana 2009). These results show a major outbreak of fighting for public health managers and demonstrate the importance of establishing information policy about the importance of adopting healthy dietary habits in adolescence.

For risk factors, the results of this study showed that boys in both cities presented higher probability of inadequate consumption of fruit and vegetable, differing from data presented in literature (Neutzling et al. 2007). These results can be explained by the fact that girls have more knowledge on nutritional (Pirouznia 2001) awareness and also make diets for loss of weight more often than and consequently consuming more fruits and vegetables (Yannakoulia et al. 2004).

In the present study, there were significant differences on the frequency of consumption of sweet food, fruits and

vegetables among adolescents on the evaluated cities, thus indicating the influence of characteristics and cultural sociodemographic. However, the association between socioeconomic levels was different in each city. In Maringá, adolescents had the highest SES protection for the inadequate intake of fruits and sweet food, while adolescents from Presidente Prudente living in the same SES as Maringá had risk for this behavior, although not to statistical significance. Several are the determinants of food choice (culture, income, availability of products, among others). Furthermore, we evidenced the great variability between cities and how individuals are susceptible to the social environment and culture influences their choices (Jomori et al. 2008; Marmot 2009).

Regarding the association between age and consumption of fried food, it was observed that magnitude varied between age groups, thus not showing a trend of age increase/decrease. These data differ from other studies, where there was more frequency increase on the fried foods consumption in older adolescents (17–18 years) than younger adolescents (13–14 years) (McNaughton et al. 2008). These results, in part, can be explained by the fact

Table 3 Adjusted prevalence ratio (PR) with a confidence interval of 95% (95% CI) for independent variables in relation to the outcome among adolescents of Maringá/PR, Brazil (2007), $n = 991$

Level ^a	Variables	PR (95% CI)			
		Vegetable (≤ 4 d/wk)	Fruit (≤ 4 d/wk)	Sweet food (≥ 4 d/wk)	Fried food (≥ 4 d/wk)
1	<i>Gender</i>	$p = 0.003^{\ddagger}$	$p = 0.002^{\ddagger}$	$p = 0.049^{\ddagger}$	$p = 0.044^{\ddagger}$
	Female	1.0	1.0	1.0	1.0
	Male	1.16 (1.06–1.28)	1.16 (1.05–1.28)	0.92 (0.85–1.00)	1.11 (1.01–1.22)
	<i>Age (years)</i>	$p = 0.582^{\dagger}$	$p = 0.604^{\dagger}$	$p = 0.655^{\dagger}$	$p = 0.658^{\dagger}$
	14	1.0	1.0	1.0	1.0
	15	1.14 (0.93–1.39)	0.95 (0.79–1.15)	1.05 (0.89–1.23)	1.35 (1.08–1.69)
	16	1.14 (0.94–1.38)	0.99 (0.83–1.19)	1.07 (0.92–1.25)	1.37 (1.10–1.71)
	17	1.12 (0.91–1.38)	0.99 (0.82–1.20)	0.90 (0.75–1.07)	1.10 (0.86–1.40)
	18	1.11 (0.84–1.46)	1.03 (0.79–1.35)	1.22 (1.00–1.49)	1.53 (1.17–1.99)
	<i>Socioeconomic level</i>	$p = 0.560^{\dagger}$	$p = 0.012^{\dagger}$	$p = 0.066^{\dagger}$	$p = 0.902^{\dagger}$
	D and E (poorest)	1.0	1.0	1.0	1.0
	C	1.03 (0.83–1.27)	1.12 (0.89–1.42)	0.86 (0.73–1.00)	1.04 (0.84–1.30)
	B	0.93 (0.76–1.15)	1.10 (0.88–1.38)	0.95 (0.82–1.09)	0.99 (0.80–1.22)
A (wealthiest)	0.99 (0.78–1.24)	0.85 (0.64–1.11)	0.95 (0.80–1.12)	1.02 (0.81–1.29)	
2	<i>Nutritional status</i>	$p = 0.803^{\dagger}$	$p = 0.471^{\dagger}$	$p = 0.007^{\dagger}$	$p = 0.030^{\dagger}$
	Normal weight	1.0	1.0	1.0	1.0
	Underweight	1.28 (1.07–1.52)	1.04 (0.80–1.34)	1.07 (0.89–1.28)	1.16 (0.95–1.42)
	Overweight	0.93 (0.80–1.08)	0.97 (0.84–1.12)	0.93 (0.82–1.06)	0.86 (0.74–1.00)
	Obesity	1.03 (0.85–1.24)	1.12 (0.95–1.32)	0.71 (0.55–0.90)	0.86 (0.69–1.07)

[‡] Wald test for heterogeneity

[†] Wald test for trend

^a The effect of each variable on the outcome is adjusted for other variables (gender, age, socioeconomic level and nutritional status; when $p < 0.20$) in the same level or above in the hierarchical model

that older adolescents added more risk factors to health than younger adolescents (Pan and Pratt 2008).

The findings in this study corroborate with available data in the literature, which indicate changes in food consumption in the last three decades in metropolitan Brazilian regions (Levy-Costa et al. 2005). This study highlights a systematic increase in consumption of fats and processed foods with high amounts of sugar and a decreased consumption of fruits and vegetables, which was also observed in adolescents from both surveyed cities.

In a meta-analysis, Snethen et al. (2006) demonstrated a positive association between inadequate dietary habits and overweight and obesity, which was not found in this study. However, consider the cross of the design study (cross-sectional) and susceptibility of reverse causality in this association.

Please note that the instrument used in this study found just the weekly frequency of consumption of each food category, the quantity of each consumed food was not collected, presenting as a limitation of the study. Therefore,

comparison with other studies should be undertaken with caution since the differences in instruments can lead to a collection of different aspects of eating habits (Field et al. 2003; Zapata et al. 2008).

Another relevant limitation of this study is not having evaluated behavioral variables that could be associated with eating habits, in particular, smoking habits and physical activity practice. Recent studies have observed that these behaviors may be associated positively in relation to physical activity (Kourlaba et al. 2009) and negatively to smoking habits (Vereecken et al. 2009) with healthy dietary patterns in this age group.

Based on the presented results, we have observed that the frequencies of inadequate consumption of healthy food are as big as unhealthy food. Changes in adolescents' dietary patterns are consistent with obesity increase, which in this study also showed high prevalence. However, the adolescents' nourishment behavior is strongly associated with each cultural aspect and nutritional status which are the suggesting measures for nutrition education to be developed for this age group.

Acknowledgments The authors would like to thank William F. Hanes for the grammatical revision of the manuscript.

Conflict of interest The authors declare that they have no competing interests.

References

- ABEP, Brazilian Criteria for Economic Classification (2006) Brazilian Association of Research Institute. <http://www.abep.org>
- Andrade RG, Pereira RA, Sichieri R (2003) Food intake in overweight and normal-weight adolescents in the city of Rio de Janeiro. *Cad Saude Publica* 19:1485–1495. doi:10.1590/S0102-311X2003000500027
- Barros A, Hirakata V (2003) Alternatives for logistic regression in cross-sectional studies: an empirical comparison of models that directly estimate the prevalence ratio. *BMC Med Res Methodol* 3:21. doi:10.1186/1471-2288-3-21
- Bouchard C (2000) The obesity epidemic: introduction. In: Bouchard C (ed) *Physical activity and obesity*. Human Kinetics Book, Champaign, IL, pp 3–20
- Conde WL, Monteiro CA (2006) Body mass index cutoff points for evaluation of nutritional status in Brazilian children and adolescents. *J Pediatr* 82:266–272. doi:10.2223/JPED.1502
- Field AE, Austin SB, Taylor CB, Malspeis S, Rosner B, Rockett HR, Gillman MW, Colditz GA (2003) Relation between dieting and weight change among preadolescents and adolescents. *Pediatrics* 112:900–906. doi:10.1542/peds.112.4.900
- French S, Story M, Jeffery R (2001) Environmental influences on eating and physical activity. *Ann Rev Public Health* 22:309–335. doi:10.1146/annurev.publhealth.22.1.309
- Jomori MM, Proença RPC, Calvo MCM (2008) Food choice factors. *Rev Nutr* 21:63–73. doi:10.1590/S1415-52732008000100007
- Kourlaba G, Panagiotakos DB, Mihos K, Alevizos A, Marayiannis K, Mariolis A, Tountas Y (2009) Dietary patterns in relation to socio-economic and lifestyle characteristics among Greek adolescents: a multivariate analysis. *Public Health Nutr* 12:1366–1372. doi:10.1017/s1368980008004060
- Lazarou C, Kalavana T (2009) Urbanization influences dietary habits of Cypriot children: the CYKIDS study. *Int J Public Health* 54:69–77. doi:10.1007/s00038-009-8054-0
- Levy-Costa RB, Sichieri R, Pontes NS, Monteiro CA (2005) Household food availability in Brazil: distribution and trends (1974–2003). *Rev Saude Pública* 39:530–540. doi:10.1590/S0034-89102005000400003
- Marmot M (2009) Social determinants and adolescent health. *Int J Public Health* 54:S125–S127. doi:10.1007/s00038-009-5402-z
- McNaughton AS, Ball K, Mishra GD, Crawford DA (2008) Dietary patterns of adolescents and risk of obesity and hypertension. *J Nutr* 138:364–370
- Ministry of Health (2007) General coordination of food and nutrition policy. Healthy eating for adolescents. <http://www.saude.gov.br/nutricao>
- Ministry of Health, Ministry of Planning, Budget and Management, the Brazilian Institute of Geography and Statistics (2006) Research of family budgets 2002–2003. Anthropometry and to analyze the nutritional status of children and adolescents in Brazil. <http://www.saude.gov.br>
- Monteiro CA, Mondini L, Costa RBL (2000) Secular changes in dietary patterns in the metropolitan areas of Brazil (1988–1996). *Rev Saude Pública* 34:251–258. doi:10.1590/S0034-891020000300007
- Neutzling MB, Araújo CLP, Vieira MFA, Hallal PC, Menezes AMB (2007) Frequency of high-fat and low-fiber diets among adolescents. *Rev Saude Pública* 41:336–342. doi:10.1590/S0034-89102007000300003
- Ogden CL, Flegal KM, Carroll MD (2008) High body mass index for age among US children and adolescents, 2003–2006. *JAMA* 299:2401–2405. doi:10.1001/jama.299.20.2401
- Pan Y, Pratt CA (2008) Metabolic syndrome and its association with diet and physical activity in US adolescents. *J Am Diet Assoc* 108:276–286. doi:10.1016/j.jada.2007.10.049
- Pirouzian M (2001) The association between nutrition knowledge and eating behavior in male and female adolescents in the US. *Int J Food Sci Nutr* 52:127–132
- Romaguera D, Samman N, Rossi A, Miranda C, Pons A, Tur JA (2008) Dietary patterns of the Andean population of Puna and Quebrada of Humahuaca, Jujuy, Argentina. *Br J Nutr* 99:390–397. doi:10.1017/S0007114507801061
- Snethen JA, Broome ME, Cashin SE (2006) Effective weight loss for overweight children: a meta-analysis of intervention studies. *J Pediatr Nurs* 21:45–56. doi:10.1016/j.pedn.2005.06.006
- Toral N, Slater B, Cintra IP, Fisberg M (2006) Adolescent eating behavior regarding fruit and vegetable intakes. *Rev Nutr* 19:331–340. doi:10.1590/S1415-52732006000300004
- United Nations Development Programme (UNDP) (2006) Human Development Report 2006—beyond scarcity: power, poverty and the global water. <http://hdr.undp.org/en/media/HDR06-complete.pdf>
- Vereecken C, Dupuy M, Rasmussen M, Kelly C, Nansel TR, Al Sabbah H, Baldassari D, Jordan MD, Maes L, Niclasen BV, Ahluwalia N, HBSC Eating & Dieting Focus Group (2009) Breakfast consumption and its socio-demographic and lifestyle correlates in schoolchildren in 41 countries participating in the HBSC study. *Int J Public Health* 54(Suppl 2):180–190
- Victora CG, Huttly SR, Fuchs SC, Olinto MT (1997) The role of conceptual frameworks in epidemiological analysis: a hierarchical approach. *Int J Epidemiol* 26:224–227
- Wang Y, Monteiro C, Popkin BM (2002) Trends of obesity and underweight in older children and adolescents in the United States, Brazil, China, and Russia. *Am J Clin Nutr* 75:971–977
- World Health Organization (WHO) (1997) Obesity: preventing and managing the global epidemic. Report of a WHO consultation on obesity. WHO, Geneva
- World Health Organization (WHO) (2005). Global school-based student health survey. http://www.who.int/school_youth_health/media/en/gshs_chile_questionnaire2004.pdf
- Yannakoulia M, Karayiannis D, Terzidou M, Kokkevi A, Sidossis LS (2004) Nutrition-related habits of Greek adolescents. *Eur J Clin Nutr* 58:580–586. doi:10.1038/sj.ejcn.1601849
- Zapata LB, Bryant Ca, McDermontt RJ, Hefelfinger JA (2008) Dietary and physical activity behaviors of middle school youth: the youth physical activity and nutrition survey. *J School Health* 78:9–18. doi:10.1111/j.1746-1561.2007.00260.x