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ORIGINAL ARTICLE / *ARTIGO ORIGINAL*

Dietary intake of adolescents compared with the Brazilian Food Guide and their differences according to anthropometric data and physical activity

A ingestão dietética de adolescentes em comparação com o Guia Alimentar Brasileiro e suas diferenças de acordo com dados antropométricos e atividade física

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ABSTRACT: ***Objective:*** To assess the dietary intake of adolescents compared with the Brazilian Food Guide and to explore their differences according to anthropometric data and physical activity. ***Methods:*** A total of 476 adolescents from public schools of Piracicaba, SP, Brazil participated in this study. A semi-quantitative food frequency questionnaire was used to estimate food group intake of adolescents. Height, weight and waist circumference of all participants were measured. Physical activity pattern was determined by questioning about participation in regular sport activities. ***Results:*** The prevalence of overweight was 36.1% and 60% were not physically active. 7.8, 7.1, 6.3, and 0.2% of adolescents consumed vegetables, fruits, milk and derivatives, and cereals, respectively, according to recommendations. About 55 and 79% of adolescents consumed excessively oils/fats and sugar/sweets, respectively. Physically active adolescents consumed more cereals, fruits, vegetables, milk and derivatives, and meats and eggs. ***Conclusion:*** Most adolescents did not follow the food group recommendations and those who were physically active have healthier food habits.

Keywords: Adolescent. Eating. Food guide. Physical activity. Body weight. Recommended Dietary Allowances.

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RESUMO: ***Objetivo:*** Avaliar o consumo alimentar de adolescentes em comparação com o Guia Alimentar Brasileiro e explorar suas diferenças segundo dados antropométricos e atividade física. ***Métodos:*** Foram entrevistados 476 adolescentes de escolas públicas de Piracicaba, SP, Brasil. O consumo alimentar foi avaliado por questionário de freqüência alimentar. Altura, peso e circunferência da cintura foram medidos. O padrão de atividade física foi determinado pelo questionamento sobre a participação em atividades físicas regulares. ***Resultados:*** A prevalência de sobrepeso foi de 36,1% e 60% não eram fisicamente ativos. 7,8, 7,1, 6,3 e 0,2% dos adolescentes consumiram legumes, frutas, leite e derivados, e cereais, respectivamente, de acordo com as recomendações. Cerca de 55 e 79% consumiram óleos/gorduras e açúcares/doces em excesso, respectivamente. Adolescentes fisicamente ativos consumiram mais cereais, frutas, legumes, leite e derivados, carnes e ovos. ***Conclusão:*** A maioria dos adolescentes não atingiu as recomendações dos grupos de alimentos e aqueles fisicamente ativos tinham hábitos alimentares mais saudáveis.

Palavras-chave: Adolescente. Ingestão de alimentos. Guias alimentares. Atividade física. Peso corporal. Recomendações nutricionais.

INTRODUCTION

Dietary guidelines are promoted worldwide as an important part of national food and nutrition policies. They are the translation of the nutrition science into public health advice. The purpose of dietary guidelines is to promote population-level dietary patterns that minimize the risk of nutritional deficiency and chronic disease. Especially among children and adolescents, dietary guidelines encourage intake of particular types of foods in an appropriate amount to support growth[1].

Adolescence is a crucial period for the development of dietary behaviors that continue into adulthood. In addition, adolescence is a time of important behavioral changes in which children test their autonomy and gain independence from their parents, which may affect both eating behaviors[2] and physical activity[3].

Inadequate food consumption patterns during childhood and adolescence are linked not only with the occurrence of obesity in youth[4], but also with the subsequent risk of developing diseases such as cancer[5], obesity[6], and cardiovascular diseases[7] in adulthood.

Results of several studies indicate that the dietary pattern of normal weight and overweight children and adolescents differ and that overweight children more often consume food considered unhealthy[8,9]. There are also indications that diet may be correlated with physical activity and sedentary behaviors, but associations remain conflicting in children and adolescents. In adults, higher physical activity has been associated with higher consumption of fruit, fruit juice and vegetables[10-12].

In Brazil, although some studies have examined the relationship between dietary intake, nutritional status and physical activity, few of them compared food consumption with dietary guidelines among young people.

Toral et al.[13] also assessed adolescents from public schools of Piracicaba in 2004, but only 11 schools took part of the sample, and the authors used data regarding just three food groups (fruits, vegetables and sweets). Furthermore, the authors did not evaluate the food consumption considering the nutritional status and the practice of physical activity among adolescents.

Considering the importance of establishing eating patterns during adolescence and the need for monitoring the diet of youth individuals to evaluate and support interventions, this study aimed to assess dietary intake of adolescents compared with the Brazilian Food Guide and to explore their differences according to anthropometric data and physical activity.

METHODS

STUDY DESIGN AND POPULATION

This study is linked to the research entitled "Determinant factors for the risk of obesity in adolescents from public schools in Piracicaba, Sao Paulo (Brazil): cross-sectional study as a first step in a cohort study" funded by FAPESP (Protocol no. 2006/61085-0). This is a cross-s-sectional survey carried out between March and May 2009 with a probabilistic sample of 487 adolescents. The inclusion criteria were adolescents of both sexes, from fifth grade of public schools of Piracicaba, Sao Paulo (Brazil). Piracicaba has around 368,000 inhabitants (20% of them adolescents)[14] and shows a predominance of public schools attended in most cases by children and adolescents from lower socioeconomic classes with some homogeneity in eating behaviors[13]. To calculate the sample in the original research, we considered the universe of public schools with ongoing fifth grade classes, distributed in six regions of the city, including rural areas. The sample was drawn in a two-stage sampling of conglomerates. In the first stage, the primary sampling units were all public schools with ongoing fifth grade classes and, in the second stage, the secondary sampling units comprised all fifth grades in each school. Five random drawings were conducted for schools within each region, considering the overweight prevalence range of 20 – 32%, type I error of 5% and type II error of 10%. This procedure identified that an estimated sample of approximately 500 adolescents in 26 schools would be representative. The second round was performed systematically with a random start. To calculate the final sample an overweight prevalence of 26% was considered, according to the last survey carried out in Piracicaba, Sao Paulo, in 2005[15]. Although the socioeconomic data has been collected (income and schooling), we decided not to include them in the analysis due to the large number of missing values. However, as mentioned before, public schools in Piracicaba are attended predominantly by students from low socioeconomic level. The original research was authorized by the Department of Education of the State of São Paulo and the Department of Education of Piracicaba, and approved by the Ethics Committee of the School of Public Health of *Universidade de São Paulo*, under research protocol no. 1633. An informed consent was signed by the adolescents'

parents or legal guardians. During interviews with the students, we obtained demographic, anthropometric, food intake and physical activity data using electronic questionnaires. A pilot study was carried out with 76 adolescents, which enabled adaptations to the final format of the questionnaire. These participants were excluded from the final sample.

DIETARY INTAKE ASSESSMENT

The usual intake was evaluated through the application by trained staff of the Semi-quantitative Food Frequency Questionnaire for Adolescents (SFFQA). The SFFQA was validated for energy and nutrients by Slater et al.[16] and for food groups by Voci et al.[17]. Both of these previous studies produced satisfactory results. The SFFQA included questions regarding usual frequency of intake of 58 specific food items. Participants were asked to indicate how often they consumed each food over the past three months by checking frequency categories from 1 to 7, ranging from never to ≥ 2 times a day. The main characteristic of this SFFQA is the inclusion of food and portions that are often consumed by adolescents. The portions presented in the SFFQA represent the average consumption, in grams, of each food item. Food items were grouped into 8 groups present in the Brazilian Food Guide[18], considering physical characteristics and nutrient content per 100 g. The food groups used for this analysis with their recommended consumption were the following: cereals and derivatives, roots, tubers and derivatives (≥ 6 daily servings); vegetables (≥ 3 daily servings); fruits (≥ 3 daily) servings; meats and eggs (≥ 1 daily serving); milk and derivatives (≥ 3 daily servings); beans and others legumes (≥ 1 daily servings); oils and fats (≤ 1 daily serving); sugar and sweets (≤ 1 daily serving). From data obtained in SFFQA, we calculated the average daily food group intakes and compared to the Brazilian Food Guide for each food group to determine the percentage of adolescents meeting the recommendation. If the total calories were < 500 kcal and ≥ 7500 kcal/d (5 boys and 1 girl), it was considered an outlier or an error, and the participant's data were excluded from further analysis[19]. We also excluded 4 participants (2 boys and 2 girls) without birth date information and 1 (boy) without food intake information. Therefore, the final sample used in analysis was 476 adolescents.

PHYSICAL ACTIVITY

A validated questionnaire was used to assess habitual physical activity[20]. Participants were asked to recall the typical activities, number of times in average week, time spent per session of activity, active transport (i.e., cycling and walking) and team sports over the past year. From each adolescent's responses, we computed physical activity per day (hours/day). Participants were classified into two groups: physically active (≥ 300 minutes per week) and not physically active (< 300 minutes per week)[21].

ANTHROPOMETRIC MEASUREMENTS

Anthropometric measurements were performed by trained staff. Weight was measured on an electronic platform scale with 0.1 kg precision. Height has been measured without shoes with a standard stadiometer set to the wall with no baseboards. All measurement procedures were performed according to the standardization proposed by Lohman et al.[22]. Height and weight were assessed twice and the mean value was used. Body Mass Index (BMI) was calculated and expressed as standard deviation (Z scores) of the WHO 2007 growth reference for school-aged children and adolescents[23]. The cutoff used to identify overweight adolescents was ≥ 1 (Z scores) and obese was ≥ 2 (Z scores). There was no outlier in the anthropometric data. Adolescents were classified into two groups according to the nutritional status: normal weight (underweight + normal weight) and overweight (overweight + obese). Demographics information (age and sex) were obtained during interviews.

STATISTICAL ANALYSES

Descriptive statistics (mean, standard deviation, proportion) were calculated and then further statistical analyses were conducted to determine the possible relationship between participant's demographics, physical activity and their dietary patterns. Mean differences of consumption according to anthropometric data and physical activity pattern were tested using Student's *t*-test. A p-value < 0.05 was considered statistically significant. All data analyses were performed using STATA version 11.0.

RESULTS

The present data analysis included 260 girls (54.6%) and 216 boys (45.4%). The mean age of the participants was 11.1 ± 0.81. Characteristics regarding the anthropometric data and physical activity pattern of adolescents stratified by sex are shown in Table 1.

The prevalence of overweight among participants was nearest 36.0%. There was no significant difference comparing boys and girls ($p = 0.244$). Almost 60% of adolescents (boys and girls) practiced less than 300 minutes of physical activity per week.

Among the participants, no adolescent met recommendations for all eight food groups in the Brazilian Food Guide. None of the food groups had 100% of adolescents fulfilling the recommendation. Only 7.8, 7.1, 6.3, and 0.2% of adolescents consumed vegetables, fruits, milk and derivatives, and cereals, respectively according to servings recommended in the Brazilian Food Guide (Table 2). About 55% of adolescents consumed more oils/fats than recommendation and 79.0% have exceeded the daily limit for sugar/sweets. Eating patterns showed no significant difference between sexes for majority food groups, only

for milk and derivatives the consumption was higher among boys ($p = 0.0043$) (data not shown in table).

Among boys with normal weight, the consumption of cereals and derivatives was higher ($p = 0.0082$), and for girls, the group of beans and others legumes also was higher ($p = 0.0301$) among normal weight adolescents (Tables 3 and 4). The consumption of cereals (boys: $p < 0.001$; girls: $p = 0.03$), fruits (boys: $p = 0.03$; girls: $p = 0.005$) and meat and eggs (boys: $p = 0.05$; girls: $p = 0.04$) was higher among physically active adolescents. Milk and derivatives and vegetables intake was higher among physically active boys ($p = 0.02$) and girls ($p = 0.03$), respectively.

Table 1. Characteristics of the study subjects.

	Boys Mean ± SD	Girls Mean ± SD	Total Mean ± SD
Weight (kg)	40.4 ± 10.1	42.8 ± 12.4	41.7 ± 11.5
Height (cm)	146.1 ± 7.8	147.6 ± 7.8	146.9 ± 7.8
Waist circumference (cm)	67.2 ± 10.0	67.4 ± 11.0	67.3 ± 10.5
BMI (kg/m^2)	18.8 ± 3.7	19.4 ± 4.4	19.1 ± 4.1
	n (%)	n (%)	n (%)
Overweight	78 (36.1)	94 (36.2)	304 (36.1)
Not physically active	111 (51.4)	170 (65.4)	281 (59.0)
Total	216 (45.4)	260 (54.6)	476 (100)

SD: standard deviation.

Table 2. Percentage of compliance with the Brazilian Food Guide recommendations among adolescents, according to food group and sex.

Food group	Boys (n = 216)	Girls (n = 260)	Total (476)
	n (%)	n (%)	n (%)
Cereals and derivatives, roots, tubers and derivatives	1 (0.5)	0 (0)	1 (0.2)
Vegetables	23 (10.6)	14 (5.4)	37 (7.8)
Fruits	15 (7.0)	19 (7.3)	34 (7.1)
Meats and eggs	120 (55.6)	127 (48.8)	247 (51.9)
Milk and derivatives	17 (7.9)	13 (5.0)	30 (6.3)
Beans and others legumes	158 (73.1)	185 (71.1)	343 (72.1)
Oils and fats	103 (47.7)	108 (41.5)	211 (44.3)
Sugar and sweets	48 (22.2)	52 (20.0)	100 (21.0)

It is important to highlight that participants did not reach recommendations for the majority of food groups (cereals and derivatives, vegetables, fruits, milk and derivatives, and oils and fats) for both sexes, independently of nutritional status and physical active pattern (data not shown in tables).

Table 3. Dietary intake (serving/day) of food groups among boys, stratified by nutritional status and physical activity pattern.

Food Group	Normal weight	Overweight	Physically active	Not physically active
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
Cereals and derivatives, roots, tubers and derivatives	2.1 ± 1.1*	1.7 ± 0.9	2.2 ± 1.2*	1.7 ± 0.8
Vegetables	1.2 ± 1.2	1.3 ± 1.0	1.4 ± 1.3	1.1 ± 1.1
Fruits	1.2 ± 1.0	1.3 ± 0.9	1.4 ± 1.1*	1.1 ± 0.8
Meats and eggs	1.3 ± 1.0	1.2 ± 0.8	1.4 ± 1.1*	1.2 ± 0.8
Milk and derivatives	1.5 ± 0.9	1.6 ± 0.9	1.7 ± 0.9*	1.4 ± 0.8
Beans and others legumes	1.2 ± 0.7	1.2 ± 0.7	1.1 ± 0.8	1.2 ± 0.7
Oils and fats	1.3 ± 0.9	1.2 ± 0.9	1.3 ± 0.9	1.2 ± 0.9
Sugar and sweets	1.9 ± 1.2	2.0 ± 1.2	2.0 ± 1.3	1.9 ± 1.1

SD: Standard deviation.
*Student's *t*-test; p-value < 0.05.

Table 4. Dietary intake (serving/day) of food groups among girls, stratified by nutritional status and physical activity pattern.

Food Group	Normal weight	Overweight	Physically active	Not physically active
	Mean ± SD	Mean ± SD	Mean ±SD	Mean ± SD
Cereals and derivatives, roots, tubers and derivatives	1.8 ± 1.0	1.8 ± 1.0	2.0 ± 1.1*	1.7 ± 1.0
Vegetables	1.1 ± 0.9	1.3 ± 1.2	1.3 ± 1.1*	1.1 ± 1.0
Fruits	1.2 ± 1.0	1.3 ± 1.2	1.4 ± 1.2*	1.1 ± 1.0
Meats and eggs	1.2 ± 0.8	1.2 ± 0.8	1.3 ± 0.9*	1.1 ± 0.8
Milk and derivatives	1.4 ± 0.9	1.3 ± 0.8	1.5 ± 1.0	1.3 ± 0.8
Beans and others legumes	1.2 ± 0.7*	1.0 ± 0.7	1.1 ± 0.7	1.2 ± 0.7
Oils and fats	1.4 ± 0.9	1.2 ± 0.8	1.3 ± 0.8	1.3 ± 0.9
Sugar and sweets	2.1 ± 1.3	2.0 ± 1.2	2.0 ± 1.2	2.0 ± 1.3

SD: Standard deviation; *Student's *t*-test; p-value < 0.05

DISCUSSION

Our results showed that the participants had a low compliance to the Brazilian Food Guide and healthy eating patterns were not common. Adolescents eat less than one half of the recommended amount of fruits, vegetables, and milk and derivatives, and less than one third of the recommended amount of cereals and derivatives. Less than 10% of adolescents reached the minimum daily recommendations for these food groups. In contrast, they consumed twice as much sugar and sweets than recommended. Enns et al.[24] showed that for any given Food Guide Pyramid group, less than 50% of adolescents consumed the recommended number of servings. Another study conducted in United States reported that, compared with recommendations, most children and adolescents did not meet any recommendations[25].

Unhealthy eating patterns identified in this study are consistent with previous literature[26-28]. Akman et al.[26] found that the consumption of fruits and vegetables was below, while saturated fat consumption was higher, than recommendations among adolescents. Unsatisfactory consumption of fruit, vegetables as well as milk and derivatives has been reported among adolescents living in ten cities of Europe, and the consumption of sweets exceeded the recommendation[27]. Vegetables and fruits consumption when young is linked to many positive health outcomes. It promotes optimal health in childhood, growth and intellectual development, and lower levels of body fat[29]. The recommendations for milk and derivatives were met only by 6.3% of adolescents in the present study. This food group intake was compared with other studies. Zhang et al.[28] verified that nearly 30% of Chinese adolescents consumed the recommended number of servings. In view of the substantial health benefits of these foods, there is an urgent need to encourage Brazilian adolescents to increase consumption of vegetables, fruits, and milk and derivatives.

Furthermore, this is a worrying characteristic, because adolescence is a transition period characterized by biological and social changes, especially changes in behavior. It is well accepted that an individual's eating habits begin to form early in life and dietary habits developed during adolescence can carry into adulthood[30]. Furthermore, nutritional needs increase sharply during adolescence because of the increased growth rate and changes in body composition.

Although we have observed significant differences comparing normal weight and overweight adolescents only for cereals and beans and others legumes, several studies have reported the relationship between diet components, eating behaviors, and nutritional status of adolescents[9,31,32]. Adherence to the Mediterranean diet guidelines was associated with BMI reduction in Greek adolescents[33]. The mechanism underlying the associations remains unclear, but we suppose that such dietary patterns with low total energy in the diet are related to a balanced physical activity pattern and a general positive attitude about health.

We identified a high prevalence of sedentary behaviors among adolescents and these findings are in line with others studies[34,35]. Among Saudi adolescents, almost half of the boys and three quarters of the girls did not meet daily physical activitiy guidelines[35].

In the present study, physically active adolescents consumed more cereals, fruits, meats, vegetables (for girls), and milk and derivatives (for boys). So, physical activity appears to be more associated with healthy choices, while sedentary activities are related more to unhealthy choices[36]. Ample evidence shows that high levels of physical activity are associated with healthy dietary habits. A recent study on Saudi adolescents has also reported a positive association between breakfast, consumption of fruits and vegetables and physical activity in males and females[35]. Another study, with adolescents from the Balearic Islands aged 12 to 17 years, have shown that active boys frequently consumed breakfast cereals and fresh fruit, and active girls consumed yogurt, cheese, breakfast cereals, and fresh fruit. Grao-Curces et al.[36] also demonstrated that less sedentary adolescents showed greater adherence to the Mediterranean food pattern. In contrast, sedentary girls consumed high fat foods and soft drinks[37]. Among adolescents from Riyadh, Collison et al.[38] found that exercise was positively correlated with fruit, vegetable and cereal without sugar intake in both genders.

When interpreting the findings of this study, some methodological issues must be addressed. This cross-sectional survey was conducted in samples of adolescents from 26 schools in six regions of Piracicaba, São Paulo. We cannot say that the results are representative of all Brazilian adolescents. The generalization therefore must be made very cautiously. Another important methodological issue is that a 58-item SFFQA was used to assess the quantity of foods consumed daily in this study. Dietary intake data collected via SFFQA may be crude because this instrument is restricted to a short list of food items. However, previous validation study showed that the SFFQA has satisfactory reproducibility and reasonable validity among adolescents[17]. Accurate reporting of dietary intake for young people is also of concern. There may be errors in assessing the frequency of consumption of foods and differences in perceptions of portion size. Under- and over-reporting of food intake may occur, particularly in this age group. However, this problem has been tackled by excluding individuals with energy intake under or above a certain cutoff point. Therefore, the problem of under- and over-reporting will not influence the results seriously, if it exists. And finally, physical activity among youths is difficult to be measured, because the capacity to understand and to recall the concepts of time, duration, and intensity of past activity is associated inversely with age. Despite its limitations, the study provided useful knowledge on compliance with the national dietary guidelines for Brazilian population.

CONCLUSION

In this study, we have demonstrated that adolescents from low socioeconomic level do not have healthy eating patterns, and their eating habits do not meet the recommendations of the Brazilian Food Guide. In the light of actual food-based concepts, adolescents consume far too little cereals, fruit, vegetables, milk and derivatives, but far too much meet sugar/sweets. The results point to the need of educational interventions to improve dietary habits of adolescents and to promote practice of physical activity for health maintenance in later life.

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