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Dietary patterns: are there differences between children and adolescents?

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Abstract *Objective: To identify dietary patterns of children and adolescents from public schools and their relationship with age, gender, city of residence and socioeconomic class. Methods: Cross-sectional study with children and adolescents (aged five to 19 years) from 10 public schools. The Food Consumption Markers Form, recommended by the Brazilian Food and Nutrition Monitoring System, was used to identify dietary patterns through cluster analysis. The Pearson's chi-square test, considering significance at p ≤ 0.05, was used to evaluate the relationship between dietary patterns and age group, gender, socioeconomic class and city of residence. Results: The final sample included 631 students. Five dietary patterns were identified: "bean/milk/yogurt" (23.3%; n = 147), "restricted" (22.7%; n = 143), "healthy" (22.0%; n = 139), "Brazilian processed" (17.4%; n = 110) and "mixed" (14.5%; n = 92). The healthy pattern was positively associated to lower age (< 10 years, children) and the restricted pattern to adolescence, with p<0.001. Dietary patterns were not associated with the other variables. Conclusions: Five dietary patterns were identified. The healthy pattern was positively associated to lower age and the restricted pattern to adolescence.*

Key words *Dietary pattern, Child, Adolescent*

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Introduction

A global food and nutrition transition, characterized by important modifications in dietary patterns and practice of physical activity, is underway[1]. These changes involve a reduction of physical activity and significant increase in consumption of processed foods, in addition to a decreased consumption of fruits and vegetables[1,2]. The concept of a food and nutrition transition has been used to explain the increase in the prevalence of overweight and chronic non-communicable diseases (NCD)[3]. Recent studies have shown a rapid increase of this transition in developing countries undergoing social, economic and technological changes, which result in higher acquisitive power and access to industrialized products of low nutritional value[2,4].

Inadequate nutrition is one of the major behavioral risk factors related to the current epidemic of NCD[3,4], which are the leading cause of death in Brazil and the world[5]. Inappropriate eating habits are characterized by high consumption of foods high in energy and sodium content, saturated fats, trans fats and refined carbohydrates, and by the increased consumption of processed and ultra-processed foods and beverages[3-5].

Childhood and adolescence are life stages essential for learning and establishing healthy eating habits, which tend to be maintained in adult life[6]. Besides providing food, parents also mold children's behaviors and represent role models, especially for younger children[7,8]. Dietary habits of school-age children are also influenced by other adults, and thus schools play a prominent role in the formation of new habits and in maintaining the health of children[9]. Adolescence brings changes in feeding behavior, mainly due to physiological changes and the importance of the social environment for the teenagers[6]. Psychological, socioeconomic and cultural factors are potential determinants of food choices during this period, having a direct effect in the establishment of dietary habits[10]. Thus, feeding patterns reflect individual preferences that are influenced by genetic, cultural, social, environmental, economic and health determinants[11].

In nutritional epidemiology, conventional analyses focus on the study of feeding patterns based on isolated nutrients or food constituents. This type of analysis is limited, since individuals consume a variety of foods, which in turn have a complex and interactive combination of nutrients. In this context, the identification of food patterns provides a real representation of dietary habits. Food patterns are defined as the set or group of foods consumed by a given population, obtained from statistical aggregation or component reduction[12].

The Brazilian Ministry of Health[13] recommends the use of the "Food Consumption Markers Form" for a general evaluation of eating patterns[14]. This information is not intended to quantify ingested calories or macro and micronutrients, but to identify the consumption of the so-called "food consumption markers", which are indicative of healthy or unhealthy eating habits[15]. This form is one of the instruments of the Food and Nutritional Surveillance service, which provides a continuous description of food and nutrition conditions of the population, their determinants and prediction of trends[13].

The complexity of factors related to eating habits in childhood and adolescence and their impact on health, combined to the small number of studies on Brazilian children and teenagers, stresses the importance of analyzing the dietary patterns of these populations. The present study aimed to identify dietary patterns of school-children of two municipalities in the State of Rio Grande do Sul, using data from the Food Consumption Markers Form of the Food and Nutrition Surveillance System (SISVAN), and to investigate their relationship with sex, municipality of residence, age and socioeconomic status.

Methods

This cross-sectional study was conducted with children from 5 to 9 years and adolescents aged 10 to 19 years, of both sexes. This study is part of a project undertaken by the Collaborating Center on Food and Nutrition of School Children of the Federal University of Rio Grande do Sul (CECANE UFRGS), in partnership with the National Fund of the Development of Education of the Brazilian Ministry of Education, aiming to include the Food and Nutrition Education (FNE) program in ten schools in Rio Grande do Sul (six in São Leopoldo and four located in Porto Alegre). The study was implemented in two stages: evaluation of the food and nutrition situation of the school community, which was conducted by analysis of data on the feeding behavior and socio-economic conditions of the students; and establishment of FNE activities. The convenience sample included 719 students, and the data were collected during the year of 2012 by dietitians and academics of the nutrition course.

For students under 10 years of age (children), parents/guardians were sent a self-explanatory questionnaire, which contained the Brazil Economic Classification Criterion of the Brazilian Association of Research Companies (ABEP)[16], the SISVAN´s Food Consumption Markers Form[15], and questions on the gender and place of residence of the child. Teachers were also instructed on the questionnaire, and were available for helping parents/guardians.

For students with 10 years or more (teenagers), data collection occurred in schools. Trained professionals presented the self-assessment questionnaire to the students and remained present while they were answered. The questionnaire included identification of gender, place of residence the SISVAN´s Food Consumption Markers Form[15] and the ABEP questionnaire[16].

Age was determined from date of birth, obtained from the students´ registration forms. Socioeconomic status was determined according to the ABEP score system[16], which defines economic classes as A1, A2, B1, B2, C1, C2, D and E, according to the monthly family income. For data analysis, classes were grouped as A (A1, A2), B (B1, B2), and C (C1, C2). Classes D and E remained separated.

To Food Consumption Markers Form, recommended by the Brazilian Ministry of Health and adopted by SISVAN[15], was used to evaluate food consumption. This tool determines the frequency of consumption, in the seven days preceding the survey, of ten food groups, preparations and foods which are considered food consumption markers: raw salads; vegetables and cooked vegetables (except potatoes and cassava); fruits; beans; milk or yogurt; crisp or fried foods; burgers and processed meats; crackers or packaged snacks; cookies, sweets and chocolates and soft drinks. This questionnaire contains eight growing scores for assessment of frequency of use, ranging from "I didn't eat for the last seven days" to "I ate during the last seven days".

The questionnaires were reviewed and data were entered in duplicate into the Excel® software, to ascertain data consistency. Food patterns were identified by cluster analysis, using the k-means method of the software Statistical Package for the Social Sciences (SPSS) version 18.0. The k-means algorithm is a method of non-hierarchical clustering in which the homogeneity of the groups is measured through the Euclidean distance[17]. Each sample element is grouped in the center of greater similarity. The number of groups is specified a priori. Studies on analysis of food patterns suggest that when the k-means algorithm of the SPSS software is used for data analysis, as in the present study, the sample size must be greater than 500 individuals[18].

The general characteristics of the sample, as well as the proportion of students classified in each pattern, are described in percentage and absolute number. The normality of variables was tested, and asymmetric variables are presented as medians and interquartile intervals. The frequency of weekly consumption of foods/food groups is also presented as medians and interquartile intervals. A median greater than or equal to the 75th percentile of intake of each food/food group was defined as a cut-off for frequent consumption.

The food patterns observed in the present study were named according to the characteristics of food consumption within each group, considering the prevalent characteristics of foods/food groups consumption patterns as shown by the median frequency of each of the items of the questionnaire as compared with the total sample. Considering that the patterns are obtained after the analysis, the nomenclature is presented in the Results section. The Kruskal-Wallis test was used to compare the weekly frequency of consumption of each food according with the dietary habit. The relationship of food patterns with sociodemographic indicators was analyzed by the Pearson's Chi-square test. The data were considered significant when $p \leq 0.05$.

The study followed the Guidelines and Regulatory Norms for Research Involving Human Beings from Resolution 466/2012, which in turn revoked the 196/CNS/MS, in force at the beginning of the study, and was approved by the Research Ethics Committee of Hospital de Clínicas de Porto Alegre. All participants received the results of their assessments and the school received the general results of the screening performed with students.

Results

A total of 719 students were originally recruited, but 88 (12.0%) of them were lost due to incomplete filling of the SISVAN Food Consumption Markers Form, so that the final sample comprised 631 students. Table 1 presents the characterization of the sample studied. There was a predominance of teenagers (65.2%), males (52.6%) and of economic classes B (49.4%) and C (44.1%), with 401 (63.5%) students living in the city of São Leopoldo.

Five dietary patterns were identified from the cluster analysis (Table 1). Analyses were conducted with two to six groups, and the results obtained with five groups were the best to explain the consumption pattern of this sample. Figure 1 shows the median weekly frequency of consumption of foods according to the dietary pattern. A significant difference was observed for all foods evaluated among the five identified patterns ($p < 0.001$).

Table 2 presents the distribution of the food patterns and the median frequency of weekly consumption of foods/food groups for each pattern identified. The "bean/milk/yogurt" pattern represented the consumption of 23.3% (n = 147) of the students, and was characterized by high consumption of milk/yogurt and beans and low consumption of salads, vegetables and cooked vegetables; fruits; fried foods; cookies, biscuits, sweets; and soft drinks. The "restricted" pattern was the second most prevalent, representing 22.6% (n = 143) of the sample, and is characterized by low consumption of all food groups, with higher consumption of beans and soft drinks. This pattern included the smaller variety of food items. The "healthy" pattern represented 22.0% (n = 139) of the students, and was characterized by high consumption of healthy food markers (salads, vegetables and cooked vegetables; fruits; beans; milk/yogurt) and low consumption of unhealthy markers (fried foods; burger and processed meats; crackers or packaged snacks; cookies, sweets, candies and chocolates; and soft drinks). The "Brazilian industrialized" pattern was characterized by low consumption of salads, vegetables and cooked vegetables; burgers and processed meats; and high consumption of beans; milk/yogurt; fried foods; cookies, sweets, candies and chocolates; and soft drinks, and represented the consumption of 17.4% (n = 110) of the sample. The "mixed" pattern was the least prevalent, representing 14.5% (n = 92) of the students and is characterized by frequent consumption of all food groups.

Table 3 presents the relationship between food patterns and sociodemographic characteristics such as gender, age, economic class and place of residence. It is noteworthy that the healthy eating pattern showed association with children ($p < 0.001$), so that 29.1% of the children presented this pattern x 18.2% teenagers. Furthermore, the restricted pattern was positively associated with teenagers ($p < 0.001$): 30.4% teenagers presented this pattern x 8.2% children. The other variables did not present significant associations ($p > 0.05$).

Table 1. Characterization of the sample of children and adolescents in public schools, RS/Brazil.

Variables	**n (631)**	**%**
Dietary Pattern		
Brazilian processed	110	17.4
Healthy	139	22.0
Mixed	92	14.6
Beans, milk/yougurt	147	23.3
Restricted	143	22.7
Gender		
Male	332	52.6
Female	299	47.4
Age		
Children (< 10 years)	220	34.8
Teenagers	411	65.2
Economic Clas		
A	19	3.5
B	269	49.4
C	240	44.1
D	16	3.0
City of residence		
Porto Alegre	230	36.5
São Leopoldo	401	63.5

n: absolute number.

Discussion

The present study aimed to identify food consumption patterns among schoolchildren of two municipalities of Rio Grande do Sul and investigate the association of these patterns with age, gender, city of residence and socioeconomic level. Five food consumption patterns were identified: beans/milk/yogurt, restricted, healthy, Brazilian industrialized and mixed. The healthy and restricted patterns showed positive association with children and teenagers respectively. The other variables (gender, economic class and place of residence) showed no association with dietary patterns.

It is important to stress that this is the first study to investigate food patterns using the SISVAN Food Consumption Markers Form. Previous studies that used this same instrument analyzed the data in terms of food consumption[19-21], and not food patterns. Food consumption analysis considers specific nutrients or foods, while food patterns assess the overall dietary pattern. This analysis is therefore closer to reality, since foods and nutrients are not consumed alone and

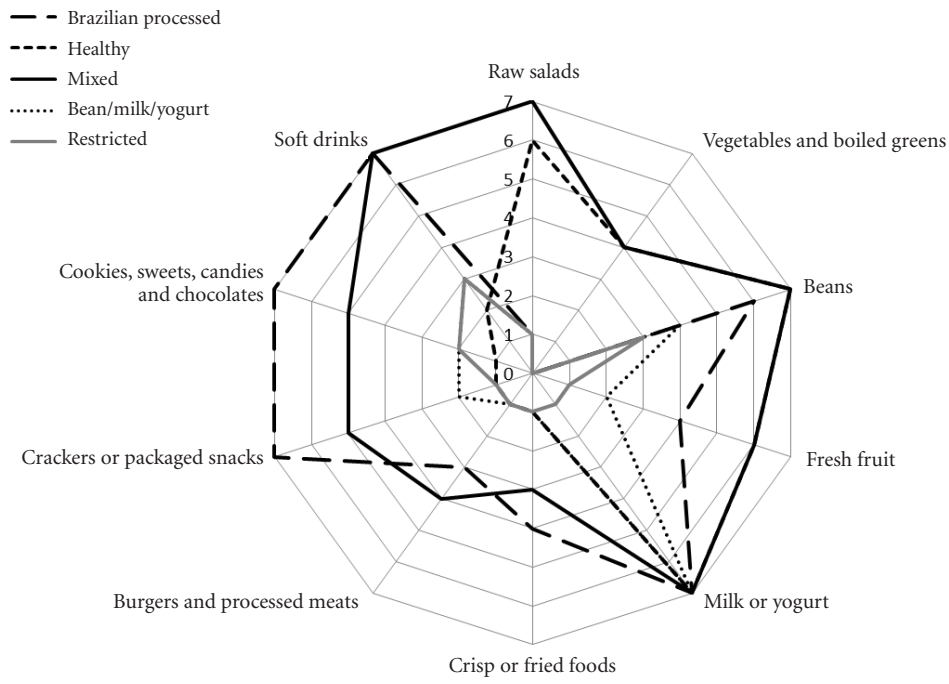

Figure 1.Median weekly frequency of consumption of foods according to the eating pattern of children and teenagers from public schools in two municipalities of RS/Brazil.

[*] Statistically significant difference ($p < 0.001$) among the five dietary patterns identified, Kruskal-Wallis test.

may be combined in many complex and interactive ways[12,22].

Although dietary patterns observed in the present investigation show some similarities with results described in other studies, the comparison should be cautious, due to the differences in the characteristics of the study population and the instruments used to assess food consumption. Tavares et al.[23] have recently identified food patterns of teenagers through surveys using surveillance systems and stressed the fact that cluster analysis is suitable for evaluation of food consumption.

The bean/milk/yogurt pattern was characterized by high consumption of milk and yogurt and intermediate consumption of beans, which represent healthy aspects of the traditional Brazilian dietary pattern[24]. Rodrigues et al.[24] identified a similar eating pattern, also composed predominantly by beans and milk, in teenagers of Mato Grosso, but they named it as "traditional" pattern. The pattern showed association with adolescents with no excess weight, which can indicate its nutritional appropriateness. This pattern is also in accordance with the so-called "ovo-lacto" pattern by Villa et al.[8] in children, that was characterized by the consumption of eggs, cheese and sweetened dairy drinks.

The restricted pattern was characterized by low consumption of all foods/food groups, with higher/consumption of beans and soda. This pattern included the smaller variety of food items. Hoffmann et al.[17] have also identified a "restricted" pattern among pregnant women in Porto Alegre, with a large proportion (42%) of foods from the Food Frequency Questionnaires (FFQs) not being consumed by at least half the women. This pattern was also characterized by higher consumption of soft drinks in both studies.

As its name suggests, the healthy pattern was characterized by high consumption of healthy food markers (salads, vegetables, fruits, beans and milk) and low consumption of items that characterize an unhealthy dietary pattern (pro-

Table 2. Distribution of the median frequency of weekly consumption of food groups for total sample and five food patterns identified in children and adolescents in public schools, RS/Brazil.

Foods/ food group	Food Patterns											
	Total sample		Brazilian industrialized		Healthy		Mixed		Beans, milk/ yogurt		Restricted	
	n	%	n	%	n	%	n	%	n	%	n	%
	631	100	110	17.4	139	22.0	92	14.6	147	23.3	143	22.7
	<---------- median (P25 - P75) ---------->											
Raw salads (lettuce, tomato, carrot, cucumber, cabbage, etc)	2 (1-5)		1 (0-2)		6 (4-7)		7 (5-7)		1 (0-2)		1 (0-3)	
Vegetables and cooked vegetables (kale, pumpkin, chayote, broccoli, spinach, etc) (except potatoes and cassava)	1 (0-3)		0 (0-1)		4 (2-6)		4 (2-6)		0 (0-1)		0 (0-2)	
Fresh fruit or fruit salad	3 (1-6)		4 (1-6)		6 (5-7)		6 (4-7)		2 (1-3)		1(1-2)	
Beans	5 (3-7)		6 (3 -7)		7 (5-7)		7 (5-7)		4 (2-7)		3 (1-6)	
Milk or yogurt	7 (2-7)		7 (4-7)		7 (5-7)		7 (4-7)		7 (7- 7)		1 (0-2)	
Potato chips, packaged potato and fried foods (chicken croquette, kebab, pastry, etc)	1 (0-3)		4 (2- 6)		1 (0-1)		3 (1-5)		1 (0- 2)		1 (0-2)	
Burgers and processed meats (knackwurst, mortadella, salami, ham, sausage, etc)	2 (0-4)		3 (1- 5)		1 (0-3)		4 (2-7)		1 (1-3)		1 (0-2)	
Crackers or packaged snacks	3 (1-5)		7 (5-7)		1 (0-3)		5 (3-7)		2 (1-4)		1 (1-2)	
Biscuits/sweetened or stuffed cookies, sweets, candies and chocolates (bar or bonbon)	3 (1-5)		7 (5-7)		1 (1-2)		5 (4-7)		2 (1-3)		2 (1-3)	
Soft Drink (not diet or light)	3 (2-6)		7 (4-7)		2 (1-3)		7 (4-7)		3 (2- 5)		3 (1-5)	

P: percentile, n: absolute number.

cessed meats, chips, cookies, candy and sodas). A study with children from Salvador/BA identified a similar dietary pattern, with a predominance of fruits, vegetables and grain legumes[25]. This pattern was also identified in students in other countries such as Scotland[26] and England[27], where it was also called "healthy".

The Brazilian processed pattern was characterized by high consumption of processed foods such as snacks, cookies, candy and sodas, as well as fried foods. This pattern of food consumption is similar to that identified in children from Salvador, consisting of fried foods, sweets, snacks and soda/artificial juice[25]. The "Western" food pattern observed in adolescents from Mato Grosso, also characterized by processed foods, dairy products, processed meats, sweetened drinks, fast food, fried banana and sweets[24], with the exception of fruits and beans, was also similar to patterns found in this study.

The mixed pattern was characterized by the presence of food markers of both healthy and unhealthy dietary patterns, and included the largest variety of food items. Nobre et al.[28] identified a very similar pattern, called "mixed diet" composed of leafy vegetables, fruits, beans, milk

Table 3. Association of sociodemographic characteristics with the five food patterns identified in the sample of children and adolescents in public schools, RS/Brazil.

Variables	Food Patterns											
	Brazilian processed		Healthy		Mixed		Beans, milk/ yogurt		Restricted			
	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	Total (%)	P*
Gender												
Male	58	(17.5)	62	(18.7)	46	(13.9)	86	(25.9)	80	(24.1)	332 (100.0)	0.164*
Female	52	(17.4)	77	(25.8)	46	(15.4)	61	(20.4)	63	(21.1)	299 (100.0)	
Age												
Children (<10 years)	40	(18.2)	64	(29.1)†	37	(16.8)	61	(27.7)	18	(8.2)	220 (100.0)	**<0.001***
Adolescents (≥10 years)	70	(17.0)	75	(18.2)	55	(13.4)	86	(20.9)	125	(30.4) †	411 (100.0)	
Economic Class												
A	3	(15.8)	7	(36.8)	2	(10.5)	1	(5.3)	6	(31.6)	19 (100.0)	0.766*
B	41	(15.2)	61	(22.7)	37	(13.8)	60	(22.3)	70	(26.0)	269 (100.0)	
C	48	(20.0)	49	(20.4)	38	(15.8)	61	(25.4)	44	(18.2)	240 (100.0)	
D	2	(12.5)	2	(12.5)	2	(12.5)	5	(31.3)	5	(31.3)	16 (100.0)	
City												
Porto Alegre	37	(16.1)	56	(24.3)	24	(10.4)	62	(27.0)	51	(22.2)	230 (100.0)	0.106*
São Leopoldo	73	(18.2)	83	(20.7)	68	(17.0)	85	(21.2)	92	(22.9)	401 (100.0)	

* Pearson's Chi-square test. † identifies the association found; P: percentile, n: absolute number.

and dairy products, rice, roots, flour products, sweet and savoury biscuits, cakes and meats, in preschool children from Minas Gerais.

Despite evidences that traditional foods in the Brazilian diet such as beans are not as available as they used to be (Family Budgets Survey[29]), the present results show frequent consumption of beans, with median consumption greater than or equal to the 75th percentile, in all food patterns (77.3%), with the exception of the restricted pattern. Milk and yogurt, which are markers of a healthy dietary pattern[19], were also very frequent. This result corroborates the findings of the National Health Survey of 2013[30], in which the regular consumption of beans was reported by 71.9% of the adult Brazilian population.

A significant association of food patterns with age was observed in the present study. The positive association observed between the healthy pattern and age <10 years (children), as compared to adolescents, supports previous reports. In a representative sample in Australia, healthier feeding patterns were observed more frequently in younger children than in older children and adolescents, indicating that the quality of dietary patterns tends to decrease with age[31]. This relationship was also confirmed among American children and adolescents[32]. Northstone et al.[27] investigated the maintenance of dietary patterns in a longitudinal study and found that 50% of children with a healthy eating pattern at the age of seven still had that pattern at the age of 13, while 20% migrated from a healthy to an industrialized food pattern (processed foods, processed meats and sweets)[27]. These findings are probably related to the process of learning dietary habits, since children are very influenced by parents[33] and, as they grow, they acquire greater independence and begin to decide about their food habits.

The social environment has greater importance during adolescence, interfering with dietary habits that therefore tend to be modified[6]. A study with teenagers, using data from the National Survey of School Children Health (PeNSE), identified three dietary patterns: mixed, unhealthy and healthy. Higher frequencies of the healthy pattern were observed among teens of capital cities in the South, Southeast and Central-West states[23].

In the present study, no relationships were observed between dietary patterns and economic class. In Brazil, this relationship is not consensual[34]. Healthy eating patterns among children

from Salvador were related to higher economic classes[25]. However, Silva et al. found an association between higher socioeconomic status and an obesogenic eating pattern (consisting of milk and dairy products, oils and fats, sweets and fried foods), while the traditional eating pattern (meats, eggs, vegetables, roots and fruits) showed no association with socioeconomic level[34]. Villa et al.[8] observed a relationship between eating patterns and economic conditions of the family in children. Similar to the present study, McNaughton et al.[35] found no association between dietary patterns and socioeconomic indicators in adolescents in Australia. These results suggest that other studies are needed to clarify the interfering factors in this relationship.

The use of a methodology that assesses eating patterns using the SISVAN Food Consumption Markers Form represents a strong point of the present study. This questionnaire was chosen because it is considered a practical and informative method, facilitating both data collection as analysis. Another advantage of this instrument is its small size, since the use of longer FFQs with questions about food portions can overtax the respondent and result in omission of information[36]. This study has as limitation the fact that the results are restricted to the population under study, due to the type of sample selection (non probabilistic) and its delineation (cross-sectional).

Conclusion

Five dietary patterns were identified, with an association of the healthy pattern with childhood and the restricted pattern with adolescence. Analysis of the dietary intake of children and adolescents, through the identification of food patterns, can contribute to the implementation of programs aiming at the development of healthy food habits and choices. The results also suggested that the Food Consumption Markers Form is an adequate instrument for the analysis of eating patterns of these populations, contributing with activities of promotion and prevention in health.

Collaborations

RS Corrêa, PH Vencato, FC Rockett and VL Bosa participated in the project design, data collection, analysis of results and writing and review of the article.

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