



DIETARY PATTERNS AND SOCIOECONOMIC AND DEMOGRAPHIC FACTORS IN ADOLESCENTS FROM A CAPITAL IN NORTHEAST BRAZIL

PADRÕES ALIMENTARES E FATORES SOCIOECONÔMICOS E DEMOGRÁFICOS EM ADOLESCENTES DE UMA CAPITAL DO NORDESTE BRASILEIRO

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ABSTRACT: Objective: To identify dietary patterns in adolescents and evaluate their association with socioeconomic factors in São Luís, Maranhão. **Methods:** Cross-sectional study using a Food Frequency Questionnaire to assess food consumption and subsequent extraction of dietary patterns by Principal Component Analysis. Hierarchical modeling and Poisson regression were used to assess associated factors. **Results:** Among 2,496 adolescents evaluated, 52.4% were female, 63.6% reported brown skin color, and 53.7% belonged to socioeconomic class C. Five dietary patterns were identified: energy-dense, prudent, traditional Brazilian, sugar-sweetened beverages, and alcoholic/energy beverages. The variables sex, socioeconomic classification, skin color, college/university student status and marital status were associated with the dietary patterns extracted. **Conclusion:** Socioeconomic factors were decisive in the adherence to dietary patterns, demonstrating the need to establish public policies that encourage healthy food choices and consider these factors.

KEYWORDS: Adolescents. Principal Component Analysis. Socioeconomic factors. Nutrition.

RESUMO: Objetivo: identificar os padrões alimentares e avaliar sua associação com fatores socioeconômicos em adolescentes de São Luís, Maranhão. **Métodos:** Realizou-se um estudo transversal com a aplicação de um Questionário de Frequência Alimentar para avaliação do consumo alimentar e posterior extração de padrões alimentares por Análise de Componentes Principais. Foi utilizada modelagem hierarquizada e regressão de Poisson para avaliação dos fatores associados. **Resultados:** Foram avaliados 2496 adolescentes, sendo 52,4% do sexo feminino, 63,6% de cor parda e 53,7% pertencentes a classe-C. Foram identificados cinco padrões alimentares: denso em energia, prudente, tradicional brasileiro, bebidas com açúcar e bebidas alcóolicas/energéticas. As variáveis sexo, situação socioeconômica, raça, ser universitário e a situação conjugal foram associadas aos padrões alimentares encontrados. **Conclusão:** Os aspectos socioeconômicos foram determinantes na aderência aos padrões alimentares, tornando-se necessária implementação de políticas públicas que incentivem escolha de alimentos saudáveis, levando em consideração esses aspectos.

PALAVRAS-CHAVE: Adolescentes. Análise de Componente Principal. Fatores socioeconômicos. Nutrição.

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INTRODUCTION

Adolescence is the second fastest period of human growth and has a central place in the individual's learning and overall development¹. The World Health Organization (WHO) defines adolescence as the period of life between the ages of 10 and 19 years² and during this time, important physiological, psychological and social changes occur that influence the development of habits, including eating habits³.

The complexity of the human diet has challenged researchers to find more effective ways to assess food consumption. Among the various forms of assessment, dietary patterns (DP) stand out for reflecting the variability inherent in the food consumption of a population, by analyzing a series of foods or nutrients that are grouped by statistical analysis, generating food combinations⁴.

Numerous individual and collective factors are related to food choices and hence to dietary patterns, including socioeconomic and environmental factors that directly influence access to food and the act of eating^{5,6}. Borges et al⁷ investigated the DP of European and Brazilian adolescents and identified similar patterns. In addition, they found that in both groups, DPs were associated with socioeconomic factors like mother's education and socioeconomic status⁷.

It is a recognized fact that the prevalence of health problems such as excess weight and Chronic Noncommunicable Diseases (NCDs) does not affect a given population homogeneously. Health problems and eating habits are influenced by cultural, economic, social and religious factors^{5,7}. Thus, understanding the DPs and the factors that influence them at such an important stage of life is important for guiding interventions to prevent diseases in adulthood, especially the NCDs⁶. Furthermore, data on DPs and their determinants are applicable to the development of public health promotion policies aimed at creating environments that favor healthy food choices.

The intense changes that have occurred in the food consumption of the Brazilian population, the influence of the environment on food choices, and the nutritional vulnerability of adolescents highlight the value of greater knowledge about food consumption in this population and their determinants. In view of this, this study aimed to identify food consumption patterns and evaluate their association with socioeconomic and demographic factors in adolescents from a birth cohort in the city of São Luís do Maranhão.

METHODOLOGY

STUDY DESIGN AND SAMPLE

A cross-sectional study was with data from a Brazilian birth cohort entitled "Lifelong determinants of obesity, precursors of chronic diseases, human capital and mental health - RPS Birth Cohorts Consortium", conducted in the city of São Luís, Maranhão.

The study began at birth in ten public and private hospitals in the city, from March 1997 to February 1998. The study sample included 96.3% of hospital births. Systematic sampling was used with proportional stratification according to the number of births in each maternity hospital. The total of 2,541 hospital births included women living in São Luís and, excluding multiple births and stillbirths, the final sample totaled 2,443 births. The sample was enough to detect significant prevalence ratios for the results of interest, with 80% power.

At 18 and 19 years of age, the participants in this cohort underwent a new assessment in 2016. A sample of 687 adolescents were identified and agreed to participate in this phase. Due to the difficulty in locating the individuals and aiming to increase the size and power of the study sample as well as prevent future losses, other adolescents born in the city of São Luís in 1997, who were not selected to participate in the cohort at birth (in the initial phase), were included. Thus, 1,828 adolescents were included in the research so that 2,515 adolescents participated in this phase. Further details of the sample are described in another publication⁸. This study considered data from 2,496 participants because 17 of them lack information on dietary intake.

DATA COLLECTION PROCEDURES

Data collection was carried out by trained interviewers. The food questionnaires were applied only by nutritionists, in a suitable room, located in the city of São Luís, Maranhão.

The information was recorded in the program Research Electronic Data Capture (REDCAP®)⁹ and the socioeconomic, demographic, anthropometric and food consumption data were obtained through standardized questionnaires.

Food consumption was assessed by a Food Frequency Questionnaire (FFQ) validated for the adolescent population of São Luís, Maranhão. This tool consists of 106 food items, divided into 7 food groups: cereals and tubers; milk and dairy products; fruits, vegetables and greens; meat and eggs; sweets; beverages; and miscellaneous foods. For each food item, participants were asked about the frequency of consumption and the amount consumed. Eight response options were used for frequency of consumption: never or <1 time/month; 1 to 3 times/month; 1 time a week; 2 to 4 times/week; 5 to 6 times/week; 1 time a day; 2 to 4 times/day; ≥5 times/day.

To obtain data on quantities consumed, an average serving size was proposed for each food, and the respondent was asked to report whether they consumed an amount equal to, greater than or less than it. The average serving size was obtained from the Table of Food Consumption in Household Measures¹⁰. Daily food intake (grams or milliliters) was converted into the amount of macronutrients using the Brazilian Food Composition Table (TACO)¹¹ and the USDA Nutrient Database for Standard Reference¹² or the Nutritional Facts labels. Food consumption data was analyzed by STATA 14.0. In the present study, the response variable for food consumption was the DP of the adolescents, and the independent variables were their characteristics: sex (male; female); skin color (white; black; brown); college/university student (yes; no); marital status (no partner; stable union); socioeconomic classification, according to the Brazilian Association of Research Companies (ABEP)¹³ (A/B; C; D/E); number of residents in the household (≤ 3 people; 4 to 5 people; ≥ 6 people); beneficiary of Bolsa Família Program (yes; no).

STATISTICAL ANALYSIS

Data were analyzed using the STATA® version 14.0. In the descriptive analysis, categorical variables were presented using absolute frequencies and relative frequencies.

The dietary patterns were extracted using the principal components factor analysis (PCA) and varimax orthogonal rotation. The data suitability for the factor analysis was confirmed using the Kaiser-Meyer-Olkin (KMO) coefficient, with a KMO ≥ 0.60 being considered adequate.

The number of retained factors was based on the following criteria: components with eigenvalues greater than 1.0, Cattell graph (scree plot) and conceptual meaning of the identified

patterns. Interpretation of each principal component was based on foods with factor loadings ≥ 0.3 or ≤ -0.3 , which is considered an important contribution to the pattern¹⁴. The principal components were labeled based on the nutritional composition of the foods in each factor. Each adolescent received a score for each factor retained. The DPs were categorized into quartiles, in which the upper quartile of the distribution represented greater adherence to the pattern.

Hierarchical modeling was used to assess the factors associated with dietary patterns. Poisson regression with robust variance estimation was used to estimate the prevalence ratios (PR) of the independent variables (socioeconomic and demographic characteristics of the adolescents) with the dependent variables (dietary patterns). The constitution and ordering of the levels followed a previous theoretical model of determination and temporal precedence. Non-modifiable sociodemographic variables of the adolescent (sex and skin color), which are not explained by any antecedent variable, were placed in the first level. The modifiable socioeconomic and demographic variables (economic class, marital status of the adolescent, college/university student status, number of people in the household, and marital status of the parents) were placed in the second level. Social assistance (Bolsa Família Program) constituted the third level. The ordering of the third level was temporal.

Variables with $p < 0.05$ at any level of the theoretical model were considered significant and composed the group of variables at the next level. This procedure was repeated up to the third level. The prevalence ratio was interpreted at the level to which the variable belongs. The estimates were calculated by 95% confidence intervals.

ETHICAL AND LEGAL ASPECTS

This study was approved by the Research Ethics Committee of the University Hospital of the Federal University of Maranhão (ref. No. 1,302,489 – CAAE No. 49096315,2,0000,5086). All participants signed the Free and Informed Consent Form.

RESULTS

The study included 2,496 adolescents, with 52.4% of females and 63.5% self-reported as brown. Most of the adolescents (73.5%) were not college students, and 53.7% belonged to socioeconomic class C, which corresponded to an average monthly household income between R\$1,625.00 and R\$2,705.00. The vast majority (96.3%) of the adolescents did not have a partner, 54.1% of households had 4-5 residents, and 50.5% were not beneficiaries of the Bolsa Família Program (Table 1).

Table 1. Sociodemographic and nutritional characterization of the population of adolescents aged 18 and 19 years, from the RPS birth cohort, São Luís, Maranhão, Brazil, 2019.

VARIABLE	N	%
Sex		
Male	1187	47.44
Female	1309	52.44
Skin color		
White	499	19.99
Black	411	16.47
Brown	1586	63.54
College/university student		
No	662	73.48
Yes	1834	26.52
Marital status		
No partner	2405	96.35
Consensual union	91	3.65
Social class		
A/B	696	28.09
C	1331	53.71
D-E	451	18.20
Number of residents in the household*		
≤3 people	669	26.80
4-5 people	1351	54.13
≥ 6 people	476	19.07
Separated/divorced parents		
No	1284	51.44
Yes	1212	48.56
Bolsa Família**		
No	530	50.52
Yes	519	49.48

*n=2.596 adolescents. ** n=1.049 adolescents.

The factor analysis adequacy to identify the DPs was evaluated as suitable for the PCA (KMO = 0.787). Based on the screen plot (4 points identified at the steepest slope), the interpretation of the retained factors and eigenvalues ≥ 1.5 , it was determined the extraction of five patterns. After the factor rotation process, the extraction of the components explained 32.8% of the total variance (Table 2). The five dietary patterns were identified as energy-dense, prudent, traditional Brazilian, sugar-sweetened beverages and alcoholic/energy beverages. The energy-dense pattern explained the largest proportion of the total variance (8.8%) and most significantly represented the food consumption of the sample (Table 2).

Table 2. Distribution of factor loadings of the main dietary patterns identified in adolescents aged 18 and 19 years, from the RPS birth cohort, São Luís, Maranhão, Brazil, 2019.

FOOD	PATTERN				
	Energy-dense	Prudent	Traditional Brazilian	Sugar-sweetened beverages	Alcoholic/energy beverages
High in fat	0.7677				
Sweets	0.6210				
Cake and cookies	0.6055				
Processed meats	0.5649				
Soda and juice	0.5280				
Sauces	0.5076				
Dairy products	0.3796				
Vegetables		0.5947			
Fruits		0.5441			
Tubers		0.4803			
Poultry		0.4869			
Processed cereals		0.4210			
Eggs		0.4252			
Nuts		0.3940			
Fish		0.3814			
Meat and offal		0.3754			
Rice			0.5815		
Bread			0.5425		
Coffee			0.4945		
Fats			0.4523		
Beans			0.4246		
Flour			0.4095		
Sugar				0.7580	
Fresh juice				0.6887	
Milk				0.5198	
Powdered chocolate				0.4027	
Energy drinks					0.7055
Alcoholic drinks					0.6763
Number of items	7	9	6	4	2
Proportional variance	8.79%	7.27%	6.01%	5.86%	4.84%
Cumulative variance	8.79%	16.07%	22.08%	27.93	32.77%

* Factor categories ≥ 0.3 and ≤ 0.3 ; KMO = 0.7868.

The adjustment in the hierarchical analysis showed that female adolescents had a lower adherence to the energy-dense pattern (PR 0.66; 95% CI 0.58–0.73). Black and brown adolescents had greater adherence to energy-dense pattern (black: PR 1.26; 95% CI 1.04–1.52; brown: PR 1.18; 95% CI 1.01–1.37). Socioeconomic class C had the greater the adherence to the energy-dense pattern (C: PR 1.22; 95% CI 1.05–1.40; D/E: PR 1.33; 95% CI 1.11–1.60). Likewise, the more residents live in the house (≥ 6 people), the greater the adherence to the energy-dense DP (PR 1.19; 95% CI 1.03 – 1.45) (Table 3).

Table 3. Crude and adjusted Prevalence Ratios (PR) and confidence intervals (95% CI) for the association between socioeconomic and demographic characteristics and the energy-dense, prudent and traditional Brazilian Dietary Patterns in adolescents from the RPS birth cohort, São Luís, MA, Brazil, 2016.

Levels of Hierarchical Modeling	Variable	Energy Dense Pattern		Prudent Pattern		Traditional Brazilian Pattern	
		Ajusted		Ajusted		Ajusted	
		PR	CI 95%	PR	CI 95%	PR	CI 95%
Level 1: Non-modifiable sociodemographic variables	Sex						
	Female	0.66	0.58-0.73	1.07	0.96-1.20	1.18	1.05-1.32
	Skin color						
	Black	1.26	1.04-1.52	1.16	0.96-1.40	0.81	0.67-0.99
	Brown	1.18	1.01-1.37	1.14	0.98-1.33	0.98	0.85-1.13
	CEB*						
Level 2: Modifiable socioeconomic and demographic variables	C	1.22	1.05-1.40	1.00	0.87-1.16	0.91	0.79-1.04
	D/E	1.33	1.11-1.60	1.00	0.84-1.20	0.81	0.67-0.98
	Marital status						
	Consensual union	0.89	0.65-1.23	1.31	1.01-1.71	1.13	0.84-1.50
	University						
	Yes	0.94	0.82-1.08	0.76	0.66-0.88	1.00	0.87-1.14
	Residents in household						
	4 a 5 people	1.04	0.90-1.20	1.09	0.95-1.26	0.99	0.86-1.14
	≥ 6 people	1.19	1.03-1.45	1.04	0.87-1.24	1.02	0.86-1.21
	Divorced parents						
Level 3: Social welfare variable	Yes	1.07	0.96-1.21	1.01	0.90-1.14	1.02	0.91-1.15
	Bolsa Família						
	Yes	0.99	0.87-1.13	1.10	0.95-1.25	0.95	0.79-1.15

*Brazilian socioeconomic class; Reference categories of the variables analyzed: sex – male; skin color – white; CEB: A/B; Marital status – no partner; college/university student – no; number of residents in the household - ≤ 3; Divorced parents – no; Bolsa Família Beneficiary – no

A greater adherence to the prudent DP was found in adolescents in consensual unions (PR 1.31; 95% CI 1.01 – 1.71), while a lower adherence was found in undergraduate adolescents (PR 0.76; 95% CI 0.66 – 0.88). The traditional Brazilian pattern showed greater adherence among female adolescents (PR 1.18; 95% CI 1.05 – 1.32), and lower adherence among black adolescents (PR 0.81; 95% CI 0.67 – 0.99) and those from socioeconomic classes D/E (PR 0.81; 95% CI 0.67 – 0.98).

The sugar-sweetened beverages showed lower adherence among brown adolescents (PR 0.80; 95% CI 0.70 – 0.91) and those from lower socioeconomic classes (C: PR 0.78; 95% CI 0.69 – 0.90; D/E: PR 0.62; 95% CI 0.54 – 0.75). Female adolescents showed greater adherence to this pattern (PR 1.16; 95% CI 1.04 – 1.30). In the alcoholic and energy beverage DP, the sex variable showed an association, with lower adherence between female adolescents (PR 0.83; 95% CI 0.74 – 0.94) and college/university student (PR 0.84; 95% CI 0.72 – 0.97) (Table 4).

Table 4. Crude and adjusted prevalence ratios (PR) and confidence intervals (95% CI) for the association between socioeconomic and demographic characteristics and the dietary patterns sugar-sweetened beverages and alcoholic and energy beverages in adolescents from the RPS birth cohort, São Luís, MA, Brazil, 2016.

Levels of Hierarchical Modeling	Variable	Sugar-Sweetened Beverages Pattern		Alcoholic and Energy Beverages Pattern	
		Adjusted		Adjusted	
		PR	CI 95%	PR	CI 95%
Level 1: Non-modifiable sociodemographic variables	Sex				
	Female	1.16	1.04-1.30	0.83	0.74-0.94
	Skin color				
	Black	0.84	0.70-1.01	0.90	0.73-1.10
	Brown	0.80	0.70-0.91	1.02	0.88-1.20
Level 2: Modifiable socioeconomic and demographic variables	CEB*				
	C	0.78	0.69-0.90	0.87	0.76-1.01
	D/E	0.62	0.54-0.75	0.90	0.74-1.08
	Marital status				
	Consensual union	0.73	0.51-1.05	0.98	0.70-1.35
	University				
	Yes	1.08	0.95-1.24	0.84	0.72-0.97
	Residents in household				
	4 a 5 people	0.91	0.80-1.05	0.98	0.84-1.13
	≥ 6 people	0.90	0.75-1.07	0.99	0.82-1.19
Level 3: Social welfare variable	Divorced parents				
	Yes	0.90	0.80-1.01	1.07	0.88-1.30
	Bolsa Família				
	Yes	0.86	0.72-1.05	1.09	0.94-1.27

*Brazilian socioeconomic class; Reference categories of the variables analyzed: sex – male; skin color – white; CEB: A/B; Marital status – no partner; college/university student – no; number of residents in the household - ≤ 3; Divorced parents – no; Bolsa Família Beneficiary – no.

DISCUSSION

Five dietary patterns were extracted among the 2,496 adolescents studied: energy-dense, prudent, traditional Brazilian, sugar-sweetened beverages, and alcoholic/energy beverages. These factors explained 32.6% of the variance, with the energy-dense being the most characteristic pattern of food consumption of the sample. In addition, some significant associations between DP and socioeconomic factors were identified such as skin color, socioeconomic class, sex, marital status, college/university student status, and number of residents in the household.

The strengths of this study are the identification of the main food consumption patterns of adolescents from São Luís based on a considerable sample size of the population studied. However, one of the limitations was that the sample was initially restricted to adolescents participating in the birth cohort. Nevertheless, because a larger number of interviewees was required, more adolescents born in the same year were invited to participate in the research. Despite this, no difference was found between the group of individuals from birth and the group included in the adolescence for the independent variables socioeconomic class, skin color, marital status, and nutritional status.

In line with some studies carried out on this topic that showed greater adherence to “Western” style patterns^{15,16}, the present study found a higher prevalence of consumption of the energy-dense pattern, which are fat-rich foods, sweets, cakes and cookies, processed meats, soft drinks and juice,

saucers and dairy products compared to the consumption of foods of the prudent pattern, consisting of vegetables, fruits, tubers, poultry, processed cereals, eggs, nuts, fish and meat and offal. The 2017-2018 Family Budget Survey (POF) found that the highest share of ultra-processed foods, regarding total calories, was consumed by adolescents (26.7%) compared to adults (19.5%) and the elderly (15.1%)¹⁷.

These findings are consistent with the results of this study, which demonstrate a high consumption of ultra-processed foods, a pattern that represented 8.63% of the total variance. Ultra-processed foods, 1 of the 4 groups that make up the NOVA classification system of the Dietary Guidelines for the Brazilian Population, are industrial formulations of processed food substances that contain little or no whole food and usually include flavorings, colorings, emulsifiers and other cosmetic additives¹⁸. The greater consumption of this food group makes this group of adolescents more vulnerable to nutritional changes^{8,18}.

From a nutritional point of view, adolescents belong to an extremely vulnerable risk group with regard to lifestyle, because, among many behaviors, the most notable are the greater frequency in fast-food shops and consumption of foods and beverages with high energy density. This leads to high energy and fat consumption and a greater risk of developing comorbidities such as obesity, hyperlipidemia or hyperglycemia^{6,8}.

A systematic review identified as main dietary patterns of adolescents the Western, Healthy and Traditional patterns, with 61%, 42% and 38%, respectively¹³. This finding is in agreement with the results of the present study, in which the energy-dense pattern, consisting of foods with a nutritional composition similar to that of the Western pattern, showed also the greatest variance.

In 2018, a study highlighted that in Europe and Brazil, dietary patterns of adolescents have a limited variety of foods, with high intake of snacks and sugar-sweetened beverages⁷. In Europe, accounting for 21% of the variance for boys and 24% of the variance for girls, the patterns identified were Western, traditional European and breakfast among boys; and breakfast, Western, traditional European and monotonous among girls. In Brazil, explaining 23% of the variance in both sexes, the DPs identified were: traditional Brazilian, Western, snacks and healthy among boys; and Western, breakfast, sweets and fried foods, and traditional Brazilian among girls⁷.

The energy-dense DP had an association with the variable sex, in which female adolescents showed a lower adherence to it. The lower adherence to this pattern can be explained by a greater concern with the body and nutritional status by girls in this age group, since the concern with body image¹⁶ makes this group less likely to follow a Western dietary pattern, similar to the energy-dense DP. Maia et al.⁵ studied Brazilian adolescents aged 13 to 17 and found a different result from the present study: the pattern composed of unhealthy foods (soft drinks, sweets, fried snacks and ultra-processed salty foods) had more adherence in females. A justification for this controversial result can be the different age range of the studies.

This study demonstrates that the lower the social class and the greater the number of residents in the household, the greater the adherence to the energy-dense DP. These findings can be justified by the lower market price, shorter preparation time and easier access to foods of this pattern¹⁹. The greater adherence to this pattern by individuals with lower incomes can contribute to the increase of excess weight in this population.

Cutler et al.²⁰, in their cohort study with American adolescents, found the pattern fast food, similar to the energy-dense of the present study. The results demonstrated greater adherence to the Fast Food DP in adolescents with lower incomes. Another study conducted with children and adolescents enrolled in the public school system in Salvador (BA), using Principal Component Analysis, indicated

greater adherence to the so-called Obesogenic DP in lower-income families, drawing attention to the risk this DP poses to development of NCDs^{6,21}.

The findings of the present study showed greater adherence of black adolescents to the energy-dense DP, as well as lower adherence to the Traditional Brazilian pattern. These results are controversial though, with national surveys¹⁴ finding that black individuals consumed more traditional foods such as rice and beans, suggesting a process of possible transition in food consumption by black adolescents. The scarcity of studies on the magnitude and influence of racial inequalities in health and food consumption in Brazil is emphasized²².

College/university students showed lower adherence to the prudent DP. Actually, there is a difficulty in maintaining a healthy diet in the university environment due to the workload, stress, dietary trends and poor time management²³. Similar results were found by Oliveira et al.²⁴, who indicated that, due to practicality, lack of time and unwillingness to prepare meals, college/university students prefer quick, easy-to-prepare or ready-made meals, without set times and of low nutritional quality. Greater incentive and easier access to university restaurants and popular restaurants that provide quality and healthy meals can be an efficient strategy to increase adherence to this pattern.

Another finding in relation to the prudent DP is that adolescents in consensual unions had greater adherence to it, which is in agreement with a study of Haapala et al.²⁵ indicating that individuals with a partner consume a healthier diet, rich in fruit and vegetables, than those without a partner.

This study found that adolescents from lower social classes (D/E) showed lower adherence to the traditional Brazilian DP. This finding points to a possible replacement of traditional Brazilian foods such as rice, beans, flour and coffee by ultra-processed foods, foods that belong to the energy-dense DP, to which adolescents from classes D/E showed greater adherence. Data from the 2017-2018 POF demonstrate a decrease in the consumption of beans and rice among adolescents compared to previous data, with a more pronounced reduction in the lowest-quarter income¹⁷. The increase in the price of foods like rice and beans, and a greater access to ultra-processed foods with lower increase in price may justify this finding²⁶.

The sugar-sweetened beverages DP showed greater adherence among females. Because this pattern was not assessed by other studies, it made the comparison using the same methodology challenging to evaluate. Corroborating the results of this study, the data from POF (2017-2018) show the frequency of fruit juice/pulp and dairy beverage consumption higher in women than in men¹⁷. Adolescents from lower social classes and brown skin color showed lower adherence to this DP. Lower consumption of fruit juice/pulp and dairy beverages in these adolescents may be due to the higher consumption of soft drinks and industrialized juices, as observed in the present study.

The PCA analysis in this study extracted the dietary pattern alcoholic and energy beverages in the group of adolescents, indicating an increased alcohol consumption in this population. Alves et al.²⁷ analyzed DPs in Brazilian adolescents by region but this DP was not identified in any of them. Early exposure to alcohol increases the risk of adolescents becoming alcohol consumers in adulthood, in addition to being more vulnerable to traffic accidents, poor school performance and aggressive behavior^{28,29}.

Adherence to the alcoholic and energy beverages DP was lower among female college/university students in this study. The literature agrees with this finding, in which the consumption of alcoholic and energy beverages is higher among male than female adolescents^{28,29}. This factor may be associated with greater cultural and media encouragement of alcohol consumption by male adolescents.

The study of dietary patterns is necessary and important to understand the diet of a population in a broader way, taking into account the food combinations. As indicated by the research, the creation

of prevention strategies is vital to promote the health of this group, encourage the healthy habit choices that will be consolidated in adulthood, and must promote ongoing education and awareness among healthcare practitioners who monitor this population about the impact of social determinants on diet³⁰. These interventions not only prevent NCDs in adulthood, but also encourage healthy eating habits and contribute to a lower demand for treatments for preventable diseases³¹.

This study presents information and reflections on the DP of adolescents from a capital city in northeastern Brazil that can guide interventions for health promotion. To attain that, the practical implications may be done in agreement with the socioeconomic aspects and their relationships with the DPs found in this study, which include: actions that encourage the reduction of consumption of ultra-processed foods among adolescents and promote healthier eating patterns; actions that address the relationship between body image and healthy food choices; public policies and social programs that increase access to healthy foods for low-income families; public health programs that address racial inequalities and promote nutritional education and access to healthy foods for the black population; healthy eating support programs specifically aimed at college/university students; educational campaigns that emphasize the effects of excessive consumption of sugar-sweetened beverages and encourage healthier alternatives; campaigns that challenge cultural and social norms that promote alcohol consumption among adolescents and that help raise awareness and education about the risks associated with excessive consumption of alcohol and energy beverages.

CONCLUSION

This study identified five dietary patterns - energy-dense, prudent, traditional Brazilian, sugar-sweetened beverages and alcoholic/energy beverages. The energy-dense DP – ultra-processed foods – represented most of the food consumption, while the prudent DP – vegetables, fruits, tubers, eggs, poultry, fish, processed cereals, nuts, meats and offal – presented the smallest contribution. Socioeconomic and demographic factors (sex, social class, skin color, marital status, number of residents in household and divorced parents) were determinant of adherence to the dietary patterns.

From this perspective, it is necessary to implement public policies that encourage healthy food choices and improve the eating behavior of adolescents, taking into account sociodemographic aspects, to promote health and reduce the risk of NCDs. The State must adopt complex measures and coordinated actions at different levels and sectors with the participation of civil society, improving actions based on schools, universities and the community to promote healthy eating.

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