Identification of food intake patterns and associated factors in teenagers[1]

Identificação dos padrões de consumo alimentar e fatores associados em adolescentes

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A B S T R A C T

Objective

To identify schoolchildren«s dietary patterns and investigate the demographic, social, and economic determinants of the differences found between patterns.

Methods

The sample consisted of 1,330 students aged 11 to 17 years attending the public schools of *Salvador, Bahia*, Brazil. The subjects' food intake data were collected by a semiquantitative Food Frequency Questionnaire comprising 97 food items. All information was collected during a single interview. The exposure variables were gender, age, and socioeconomic class, and the outcome variables were categorized food consumption pattern in "mixed pattern", "traditional pattern", and "healthy pattern". The data were treated by simple and multiple linear regression analyses and the dietary patterns determined by factor analysis.

Results

Most participants were female (56.9%) and over 13 years old (79.2%). The "mixed pattern" was positively associated with females (β=0.181, *p*<0.001). The "traditional pattern" was negatively associated with classes

D, C, and B (β=-0.149, p<0.007), and the "healthy pattern" was negatively associated with females (β=-0.200, p>0.0001) and classes D, C, and B (β=-0.125, p<0.023).

Conclusion

Three dietary patterns were identified among the adolescents, namely mixed, traditional, and healthy. Gender and socioeconomic class were associated with dietary patterns. Male teenagers and those in the lower socioeconomic classes had a healthier dietary pattern than their peers of higher socioeconomic classes and females.

Indexing terms: Adolescent. Food consumption. Socioeconomic factors. Linear models.

R E S U M O

Objetivo

Identificar os padrões de consumo alimentar entre escolares e investigar os determinantes demográficos, sociais e econômicos dos diferentes padrões encontrados.

Métodos

Foi estudada uma amostra de 1 330 indivíduos entre 11 e 17 anos, estudantes da rede pública de ensino, em Salvador, Bahia. A avaliação do consumo alimentar dos adolescentes foi obtida por meio de Questionário da Frequência Alimentar semiquantitativo, com 97 itens alimentares, sendo as informações coletadas em uma única entrevista com os estudantes. As variáveis de exposição foram sexo, idade e o indicador econômico; a variável desfecho foi padrão de consumo alimentar categorizada em misto, tradicional e saudável. Os dados foram analisados pela regressão linear simples e múltipla, e os padrões alimentares foram obtidos a partir da análise fatorial.

Resultados

A partir da análise das características da população, observou-se o predomínio do sexo feminino (56,9%), e idade maior que 13 anos (79,2%). A adoção do padrão alimentar misto esteve associada positivamente ao sexo feminino (β= 0,181), p<0,001. O padrão tradicional associou-se negativamente às classes D, C, B (β=-0,149), p<0,007, enquanto o padrão alimentar saudável esteve associado negativamente ao sexo feminino (β=-0,200), p<0,0001 e às classes D, C, B (β=-0,125), p<0,023.

Conclusão

Foram identificados, entre os adolescente, três padrões alimentares: misto, tradicional e saudável. Observou--se que o sexo e o indicador da condição econômica estiveram associados aos padrões alimentares. Os adolescentes da classe econômica mais baixa e do sexo masculino adotam consumo alimentar mais saudável em relação àqueles das classes econômicas mais altas e do sexo feminino.

Termos de indexação: *Adolescente. Consumo alimentar. Fatores socioeconômicos. Modelo linear.*

I N T R O D U C T I O N

Food is a human need that encompasses a multiplicity of aspects that influence quality of life. In this context dietary patterns emerge as a strategy to characterize population food intake trends, which contain multiple meanings, including cultural, social, and economic aspects[1,2].

Dietary patterns can be defined as a set or group of foods consumed by a given population[3]. Thus, analysis of dietary patterns could better predict the risk of diseases than analysis of individual nutrients or foods[2,4-7].

Many studies have found an association between dietary patterns and socioeconomic class. However, their results indicate that the relationship between socioeconomic factors and dietary patterns is controversial and varies among populations, suggesting the pertinence of investigating these relationships in other contexts and different population groups[8,9].

For Sichieri *et al.*[8], the factors income and education level better explain the dietary patterns seen in the Brazilian Northeast and Southeast. Studies conducted in *Pelotas* (RS) indicate a higher frequency of poor dietary habits among

adolescents of higher-income families. In *Diamantina* (MG) people with higher income had unhealthier dietary patterns than those with lower income[4]. Nevertheless, other studies reported that higher socioeconomic status encourages children and adolescents to adopt healthier diets, as seen in *Salvador* (BA)[10]. Likewise, higher-income adolescents from *São Paulo* consume more produce[11].

Adolescence encompasses the period from ages 10 to 19 years[12]. This period is biologically important because this is when most psychological and cognitive development and physical growth occur after early childhood[13]. In Brazil 20% of the population is in this phase of life, adolescence. Adolescents are considered a low-risk segment for morbidity and mortality from many diseases, so they have received little attention from public policies, especially with respect to health care[14].

Few studies have investigated the association between the dietary patterns of adolescents attending public schools and social and environmental factors[15]. Knowing the effects of dietary patterns on disease promotion and prevention and understanding their relationship with socioeconomic factors are important aspects for developing intervention programs and health-promoting measures[8,16]. Hence, the objective of this study is to identify the dietary patterns of adolescents attending the public schools of *Salvador* (BA) and determine the demographic, social, and economic factors associated with each dietary pattern.

METHODS

This cross-sectional study was conducted in the urban area of *Salvador* (BA), from June to December 2009, and involved 207 public schools included in the 2009 school list provided by the Department of Education and Culture of *Bahia* State. Students aged 11 to 17 years enrolled in the sixth, seventh, and eighth grades of the selected schools were eligible to participate in the study. This study is part of a broader study investigating the risk factors for asthma whose sample size is based on a 24.6% prevalence of asthma symptoms[17], a confidence level of 95.0%, and a maximum allowable error of 3.0%. The final sample size was 1,027 students, but 1,330 students were interviewed.

The sampling strategy used by the present study is complex because selection of the grades and finally, the classes that encompassed this population group required taking into account both the age bracket of adolescents, which, according to the World Health Organization (WHO), ranges from 10 to 19 years, and the schools listed in the state network. Students aged 10, 18, and 19 were excluded from this population group because very few students in the study grades were that old. Therefore, the sampling calculation used Simple Random Sampling Without Replacement (SRSWOR); schoolchildren selection relied on a two-stage cluster sampling: the first stage consisted of selecting the schools, and the second stage of selecting the classes. Twenty-one schools were selected from the 207 state schools, and three classes were selected from each school and in each, given that each class had approximately 30 students. All students who agreed to participate in the study and obtained their guardians' consent were interviewed. The study was approved by the Research Ethics Committee of *Universidade Federal da Bahia* (UFBA) Institute of Collective Health under Protocol number 002/08 CEP/ISC. The students' guardians who agreed with their children's participation in the study signed a free and informed consent form or provided their fingerprints if they were illiterate.

Adolescents who were pregnant, breastfeeding, or wearing casts were excluded.

A semiquantitative Food Frequency Questionnaire (FFQ) with 97 food items was used for collecting the adolescents' food intake data. Food item intake frequency was divided into five categories: never/rarely=0; 1 to 3 times a month=1; once a week=2; 2 to 4 times a week=3;

≥4 times a week=4; and the number of times the food was consumed during the day. The interviews were conducted by trained dieticians and dietary technicians from July to December 2009 using a standardized and validated questionnaire. All data were collected during a single interview. The FFQ was administered directly to the students who informed the foods consumed at and away from home.

Social and economic information regarding the ownership of goods, home appliances, and education level of the family head (incomplete elementary school, elementary school, high school, and higher education) were provided by the adolescent's guardian and noted in a standardized questionnaire. Their socioeconomic class was given by the *Critério de Classificação Econômica Brasil* (CEEB, Brazilian Economic Classification Criterion) created by the *Associação Brasileira de Empresas de Pesquisas*[18] (Brazilian Association of Market Research Companies), which classifies the Brazilian population into the following socioeconomic classes: A1, A2, B1, B2, C1, C2, D, and E. Nobody in the study population represented the A strata. The strata were associated with the following incomes: A (A1/A2): more than 30 minimum salaries (m.s); B (B1/B2): 15 to 30 m.s; C (C1/C2): 6 to 15 m.s; D: 2 to 6 m.s; and E: up to 2 m.s The minimum salary per month in 2009 corresponded to R$465,00. The CEEB indicator uses the following information to determine socioeconomic class: ownership of goods and home appliances, and education level of the family head (incomplete elementary school, elementary school, high school, and higher education). In the present study, the families were categorized as having better socioeconomic status (classes B, C, and D) or worse socioeconomic status (class E). Age was categorized as <13, 13-15, and >15 years.

Dietary patterns were identified by factor analysis using Principal Component Analysis (PCA)[6,18]. First, the number of factors was given by values greater than one for variance and the number of components that remained in the screen plot whose points of maximum slope indicated the most appropriate number of retained components that would define the dietary patterns[4,6,9]. Many authors find factor analysis suitable for determining dietary patterns[2,19].

For factor analysis, the foods were grouped according to their nutritional characteristics, the intake habits of this population, and the study objectives (Table 1). Next, the frequencies of the foods consumed from each food group were added, constituting the numerator of the summary measurement. The denominator corresponded to the maximum number of foods that an individual could consume per food group multiplied by five[7]. A score was generated for each food group. Factor analysis was performed after this procedure.

Factor analysis requires meeting some prerequisites. The first regards the ratio between the number of individuals and the number of foods (variables in the FFQ). The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy tested the appropriateness of the data for factor analysis[4,5,7,9]. Varimax rotation examined the exploratory factor structure (pattern) of the FFQ, considering factor loadings greater than 0.30[7]. Factor analysis groups the foods listed in the FFQ according to the degree of correlation between them and creates new variables called factors or principal components to represent these groups. The total variance explained by the three generated factors identified the number of factors retained by factor analysis, in addition to those given by the screen plot.

Simple and multiple regression analysis assessed the potential risks associated with the dietary patterns of the study population. Multivariate regression analyzed the relationships between dietary patterns and the variables economic class, age, and gender. The associations were controlled for age. The confidence level was set at 95% and the significance level at 5%. The analyses were weighted by the Data Analysis and Statistical Software (Stata) Survey Commands

Table 1. Grouping of foods used in factor analysis according to their nutritional characteristics. *Salvador* (BA), Brazil, 2009-2010.

Groups	Foods
Sugar/Sweets	Sugar, homemade sweets, candy, lollypops, chocolate bars, ice cream/popsicles, gelatin desserts, cocoa powder, frozen yogurt.
Dairy products	Whole milk, low-fat milk, fermented milk products, whole/diet/light yogurt, instant cocoa mix, yellow cheese, white cheese, cream cheese.
Grains	Rice, pasta, noodle, whole-grain or regular breakfast cereal, wheat germ, baby cereal, cornmeal, popcorn, granola.
Soda	Regular/diet/light soda.
Drink mixes	Drink mixes, fruit drink mixes, carbonated drinks, energy drinks.
Fast foods	Deep-fried preparations, hot dogs, French fries, pizza, sandwiches, corn/potato chips, bacon crisps, soup mixes.
Sauces	Ketchup, mayonnaise, salad dressing, processed pizza sauce.
Fats/oils	Butter, margarine, oil, olive oil.
Typical foods	*Feijoada, dobradinha, feijão tropeiro, acarajé, abará, vatapá, caruru*, coconut milk, palm oil.
Non-starchy vegetables	Lettuce, cabbage, cauliflower, squash, carrot, potato, chayote, gherkin, beetroot, okra, vegetable soup with noodles, salad.
Fruits	Pineapple, avocado, acerola, Prata banana, plantain, cashew, jackfruit, papaya, mango, apple, watermelon, acai berry, melon, orange, mandarin orange, strawberry.
Seafood	Seafood.
Poultry	Poultry.
Beef	Beef, organ meats, charqui.
Processed meats	Calabrese sausage, ham, mortadella, hot dog.
Eggs	Boiled and fried eggs, egg preparations.
Tubers	Cassava, yam, sweet potato.
Breads/cakes	Bread, cookies, homemade cake, cake mix.
Legumes	Beans, peanuts.
Fruit juice	Fruit juice, pulp juice.
Coffee	Coffee.
Tea	Tea.

(SVY). The database was created and processed by the software Epi Info version 6.04, and analyzed by the software Stata version 10.

R E S U L T S

Most of the study sample were females (56.9%) older than 13 years. Approximately half the sample was from class E and the other half from classes B, C, and D.

Food Frequency Questionnaire analysis resulted in three dietary patterns named "mixed", "traditional", and "healthy" (Table 1). Although all foods occur in each of these three patterns,

the "mixed" pattern had a prevalence of fast foods, sugar, sweets, processed beverages, dairy products, soda, and typical foods; the "traditional" pattern had a prevalence of poultry, processed meats, beef, eggs, coffee, breads/cakes, and cassava flour; and the "healthy" pattern had a prevalence of fruits, vegetables, and grains.

For testing the appropriateness of using factor analysis, the first criterion to be met was determining the ratio between the number of individuals and the number of foods listed in the FFQ, which was 14:1. For PCA, the KMO was 0.946, and Bartlett's test of sphericity was

13044.43 (*p*=0.000). These results indicate that the method is appropriate for this analysis. PCA resulted in three factors with a root greater than 1 that explained 47.9% of the total variance. Foods from each group with loadings below 0.30 were excluded to simplify the analysis. Also, these food items contributed little to the dietary patterns (Table 2).

The factors gender and socioeconomic class were associated with the three dietary patterns identified in this study (Table 3). The "mixed" pattern was positively associated with being female (β=0.181, *p*<0.001); the "traditional" pattern was negatively associated with classes D, C, and B (β=-0.149, *p*<0.007); and the "healthy" pattern was negatively associated with being female (β=-0.200, *p*<0.000) and the classes D, C, and B (β=-0.125, *p*<0.023).

DISCUSSION

Analysis of the dietary patterns of the study adolescents identified three dietary patterns named "mixed," "traditional," and "healthy." The "mixed" pattern contained a prevalence of fast foods, sugar and sweets, processed beverages, soda, and some seafood, fruits, and legumes; the "traditional" pattern contained a prevalence of poultry, processed meats, beef, eggs, coffee, and manioc flour; and the "healthy" pattern contained a prevalence of produce and grains.

The dietary pattern of the study adolescents was associated with gender. Females prefer the "mixed" pattern and males, the "healthy" pattern. Gender did not influence adherence to the "traditional" pattern. Therefore,

Table 2. Distribution of the factor loadings of the dietary patterns of the study population. *Salvador* (BA), Brazil, 2009-2010.

Variables	Mixed	Traditional	Healthy	h²
Dairy products	0.621	-	0.360	0.574
Grains	0.415	0.451	0.488	0.613
Tubers	-	-	0.644	0.508
Cassava flour	-	0.522	-	0.302
Breads/Cakes	0.470	0.486	-	0.542
Fast foods	0.779	-	-	0.670
Typical foods	0.630	-	0.344	0.536
Sugar/Sweets	0.732	-	-	0.633
Fats/Oils	0.409	0.500	-	0.421
Legumes	0.411	0.349	0.381	0.436
Fruits	0.398	-	0.685	0.659
Fruit juice	0.331	-	0.300	0.246
Non-starchy vegetables	-	-	0.728	0.619
Beef	0.337	0.596	-	0.544
Poultry	-	0.607	-	0.449
Seafood	0.390	-	0.378	0.351
Processed meats	0.360	0.602	-	0.492
Eggs	-	0.585	-	0.390
Coffee	-	0.513	-	0.294
Tea	-	-	0.568	0.330
Drink mixes	0.670	-	-	0.499
Soda	0.665	-	-	0.445
Sauces	0.585	-	0.306	0.462
Accumulated variance	36.00	42.47	47.90	
KMO	0.946			
Bartlett's coefficient	13044.43	(*p*=0.000)		

Note: KMO: Kaiser-Meyer-Olkin.

Table 3. Factors associated with the dietary patterns of the study population. *Salvador* (BA), Brazil, 2009-2010.

Variables	Dietary pattern 1 - Mixed			
	β [b]	*p*-value	β [a1]	*p*-value
Gender				
Male	*		*	
Female	0.172	0.002	0.181	0.001
Economic class				
Class E	*		*	0.080
Classes D, C, B	0.089	0.100	0.095	
Variables	Dietary pattern 2 - Traditional			
	β [b]	*p*-value	β [a1]	*p*-value
Gender				
Male	*		*	
Female	0.043	0.433	0.040	0.471
Economic class				
Class E	*		*	
Classes D, C, B	-0.150	0.033	-0.149	0.007
Variables	Dietary pattern 3 - Healthy			
	β [b]	*p*-value	β [a1]	*p*-value
Gender				
Male	*		*	
Female	-0.193	0.000	-0.200	0.000
Economic class				
Class E	*		*	
Classes D, C, B	-0.115	0.035	-0.125	0.023

Note: β [b]: Unadjusted coefficient; β [a1]: Coefficient adjusted for gender, age, and patterns 2 and 3; β [a2]: Coefficient adjusted for gender, age, and patterns 1 and 3; β [a3]: Coefficient adjusted for gender, age, and patterns 1 and 2.

males have healthier dietary patterns than females.

These results are in agreement with those of other studies on this subject. Bigio *et al.*[11] conducted a study with 812 adolescents aged 12 to 19 years in *São Paulo* (SP) and found that males consumed more fruits and non-starchy vegetables than females. In South Africa a study found that females consume fast foods more often than males[20]. This behavior may result in higher calorie intake and stem from the fact that females stay at home more and are more inactive than males. In *João Pessoa* (PB) Farias Junior *et al.*[21] found that males were more physically active than females. This may be explained by biological, sociocultural, and body image differences and different gender attributes. Gender differences with respect to healthy food habits were also found in *Pelotas* (RS) since male adolescents followed the recommendations of consuming healthy foods (grains and milk, for example) more often than female adolescents[9].

However, some studies show opposite results, such as a study conducted in the Balearic Islands in the Mediterranean Sea that found that boys adhered more to the Western diet while girls, to the Mediterranean diet, a diet high in healthy foods[22]. In the United States of America, a study conducted from 1977 and 2006 with 31,337 children and adolescents found that males consumed larger portions than females[23].

In the present study, the "traditional" and "healthy" dietary patterns were associated with low socioeconomic class. Adolescents from higher socioeconomic classes adhere less to healthier patterns and more to the Western diet. These

findings corroborate those of Olinto *et al.*[19] who found that individuals from *Pelotas* (RS) of lower socioeconomic classes adhered more to the traditional Brazilian dietary pattern than those of higher socioeconomic classes, who consumed more ready-to-eat processed foods typical of the Western diet. In Brazil, Silva *et al.*[24] and Levy-Costa *et al.*[25] found a direct relationship between higher socioeconomic class and consumption of diets with high fat and simple sugar contents. Better socioeconomic status has been associated with consumption of unhealthy foods because unlike individuals of low socioeconomic classes who can only afford staple foods, such as rice, beans, bread, milk, and coffee (regardless of low produce intake), those of higher socioeconomic classes can afford ready-to-eat processed foods.

In Western Australia, Ambrosini *et al.*[15] found that low income was associated with the Western diet in 14-year-old adolescents. Low food availability is often due to low income, which usually has a negative impact on the amount and quality of the foods consumed by poor families[26]. This situation frequently leads to compensatory eating practices, such as higher intake of fast foods, soda, canned foods, sweets, or candy[27], as seen in some of our study participants. A study in Spain showed that the intake of sweets, pastry (a source of fat), sugar, and savory snacks was higher among adolescents from lower income families[28]. In *Salvador* (BA) D'Innocenzo *et al.*[10] found that children aged 4 to 11 years of higher socioeconomic classes consumed a higher amount of healthy foods than those of low socioeconomic classes. However, the sample of the said study consisted mostly of children, not adolescents, and D'Innocenzo *et al.*[10] included children from higher-income neighborhoods whose characteristics differ from those of the present study population, probably contributing to the different results.

Food intake expresses food availability in regional contexts and in contexts related not only to local cultural aspects but also to the conditions of different social strata, which will influence the acquisition of different types of food[9]. These specificities explain the diversity of dietary patterns since each population and region have their own characteristics. These characteristics will impact the formation of each dietary pattern differently and hinder the comparison of dietary pattern studies in different contexts.

The association between better income and foods in the "mixed" pattern seems to be mediated by changes imposed especially by the modern lifestyle adopted by Brazilian families in the last decades. For some authors, food away from home and a greater availability of fast and processed foods are directly associated with family income[29], education level[11], and food availability.

Although food intake studies have limitations, such as memory bias, classification, and quantification, and because the present study is cross-sectional, thereby preventing: the establishment of causal relationships; the contemplation of the temporal sequence of exposure and effect; and the subjectivity associated with factor analysis and the number of study factors[9,19]; the results confirm that socioeconomic conditions determine dietary patterns[15,18,25].

CONCLUSION

The study adolescents presented three dietary patterns, namely mixed, traditional, and healthy. The food choices of adolescents attending state schools who live mostly in the outskirts of *Salvador* (BA) are influenced by socioeconomic class and gender. Low-income male adolescents have a healthier dietary pattern than those of higher income families and female adolescents. Considering the vulnerability of children and adolescents to overweight and other diseases, studies such as this one should be encouraged and developed to elucidate the nutritional profile of these individuals and make scientific contributions to the scarcity of this information in the literature.

CONTRIBUTORS

JMO MASCARENHAS and ML BARRETO helped to conceive the study, analyze the data, interpret the results, and write the manuscript. RCR SILVA, AMO ASSIS, and MLP SANTANA helped to interpret the results and write the manuscript. LTLP MORAES analyzed the data.

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