ORIGINAL ARTICLE / *ARTIGO ORIGINAL*

Sociodemographic determinants of food consumption pattern: Pró-Saúde Study

Determinantes sociodemográficos do padrão de consumo de alimentos: Estudo Pró-Saúde

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ABSTRACT: *Aims:* To identify dietary patterns (DP) and to investigate their association with sociodemographic aspects. *Methodology:* A cross-sectional data analysis of a sub-sample from Phase 4 of the Pró-Saúde Longitudinal Study (2012-2013), constituting a total of 520 participants. DP were obtained by principal component analysis from a food frequency questionnaire. Association between DP and sociodemographic aspects was analyzed by adjusted logistic regression. Results: Four DP were identified: processed and ultraprocessed products; fresh food; meats and alcoholic beverages; and traditional Brazilian foods. There was a greater adherence chance to "processed and ultraprocessed products" pattern among adults ≥ 55 years and lower chance among men. The probability of adherence to "fresh food" pattern was directly associated to men, subjects with a high educational level and inversely associated to adults aged ≥ 60 years. There was a lower chance of "meats and alcoholic beverages" pattern among men and increased chance of adherence to "traditional Brazilian foods" pattern among whites, subjects with ≥ 60 years and low schooling. Conclusion: Sociodemographic factors were important determinants of DP, especially gender, schooling and age. Presence of a DP composed of processed and ultraprocessed products indicates the need for awareness strategies and supply limitation in this population, since it affects their health.

Keywords: Food consumption. Principal component analysis. Feeding Behavior. Social Determinants of Health.

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RESUMO: *Objetivos:* Identificar padrões alimentares e investigar sua associação com aspectos sociodemográficos. *Métodos:* Análise de dados seccionais de uma subamostra da fase 4 do Estudo Pró-Saúde (EPS) (2012–2013), com 520 participantes. Obtiveram-se padrões alimentares por análise de componentes principais com base em um questionário de frequência alimentar. A associação entre os padrões alimentares e os aspectos sociodemográficos foi analisada por meio de regressão logística ajustada. *Resultados:* Identificaram-se quatro padrões alimentares: produtos processados e ultraprocessados; alimentos frescos; carnes e bebidas alcoólicas; e alimentos brasileiros tradicionais. Houve maior chance de adesão ao padrão "produtos processados e ultraprocessados" entre adultos com ≥ 55 anos e menor chance entre homens. A chance de adesão ao padrão "alimentos frescos" esteve diretamente associada aos homens e aos indivíduos com médio grau de escolaridade e inversamente associada aos adultos com ≥ 60 anos. Observou-se menor chance de realizar o padrão "carnes e bebidas alcoólicas" entre homens. Já em relação ao padrão "alimentos brasileiros tradicionais", houve chance de adesão aumentada entre brancos e reduzida entre homens, indivíduos com ≥ 60 anos e com baixa escolaridade. *Conclusão:* Fatores sociodemográficos foram importantes determinantes dos padrões alimentares encontrados, especialmente sexo, escolaridade e idade. A presença de padrão alimentar composto de produtos processados e ultraprocessados indica a necessidade de estratégias de conscientização e limitação na oferta desses produtos entre os participantes do EPS, visto seu prejuízo à saúde.

Palavras-chave: Consumo de alimentos. Análise de componente principal. Comportamento Alimentar. Determinantes Sociais da Saúde.

INTRODUCTION

Food choices reflect economic, social, nutritional, cultural, demographic, and other aspects[1]. However, it is still challenging food surveys that consider the multidimensionality and complexity of people's diets in the research on nutritional epidemiology[2].

In Brazil, as in other countries, data from large surveys reveal an exponential increase in the share of ultra-processed and ready-to-eat products in populations' dietary routine, especially among urban areas. Additionally, they have shown a reduction in the consumption of raw and minimally processed foods[3]. It is well known that this is the result of the globalization of agrifood systems, which has greatly contributed to the diversification of food supply, changing food consumption patterns in the contemporary world, with harm to the health of the population[4].

Few studies have investigated the determinants of dietary patterns, especially among the working population. Research related to the Longitudinal Study on Adult Health (ELSA-Brazil), the National Health and Nutrition Examination Survey (NHANES) and the Health Professional's Follow-up Study (HPFS) have shed light on the discussion regarding this topic[1,5].

Exploring different scenarios and the relationships that determine dietary patterns is fundamental for understanding and monitoring the evolution of contemporary food consumption habits and practices, how they vary in relation to regional or global differences, and how to direct health actions for each population[6-8]. The objectives of this study were to identify dietary patterns through an empirical approach and to analyze their association with sociodemographic aspects.

METHODS

A cross-sectional study, with data related to phase 4 of Pró-Saúde Study (*Estudo Pró-Saúde* - EPS). The sample consisted of permanent civil servants from a public university in the state of Rio de Janeiro (*Universidade do Estado do Rio de Janeiro* - UERJ) and corresponded to 16% of the participants in the EPS baseline. The collection took place between July 2012 and October 2013, by a previously trained and supervised team[9].

Food consumption was investigated through a semi-quantitative food frequency questionnaire (FFQ), validated by Sichieri and Everhart[10] and composed of 82 food items. Then, foods were grouped according to similarity in nutritional content or culinary preparations[11], forming 25 groups: rice, pasta, breads and crackers, fruits, vegetables, pickled vegetables, beef and innards, pork, processed meats and fish, ultra-processed meats, poultry and fresh fish, milk and dairy products, eggs, beans, fats, sweets, salty snacks and pizzas, coffee and brews, soft drinks, natural juices, alcoholic drinks, appetizers, legumes, cereals, tubers and derivatives.

Food consumption patterns were obtained by the food groups via principal component analysis (PCA). The applicability of the factorial method was verified using Kaiser-Meyer-Olkin Measure of Sampling Adequacy test (KMO> 0.6) and Bartlett's sphericity (p ≤ 0.05).

Kaiser criteria was analyzed to define the numbers of the dietary patterns, indicating retention for factors with eigenvalues greater than 1. Additionally, Cattel graph (screeplot) was analyzed with each component and eigenvalue in a curve, and the points with a greater slope were extracted. These criteria disagreed with each other, indicating retention of eight and five factors, respectively. As such, it was decided to establish four factors for extraction.

The varimax orthogonal rotation of the matrix was performed, to facilitate the definition of the factors. In order to form dietary patterns, food group's values of factor loads greater than │0.30│ were considered to be a significant contribution. Cronbach's alpha test was performed to assess the internal consistency of each extracted factor, and the patterns were named based on the characteristics of the predominant food groups in each component formed.

The sociodemographic profile was investigated by categorizing the following variables: sex (female and male), age (≤44 years, 45–49 years, 50–54 years, 55–59 years and ≥ 60 years), marital status (married or in a civil union, divorced or widowed and single), race (white and non-white), education (completed elementary school, completed high school or completed university or more) and family income *per capita* of the previous month (≤ 3 minimum wages, 3–6 minimum wages and ≥ 6 minimum wages), all described in simple frequencies and percentages.

The test of association between adherence to dietary patterns and sociodemographic variables of interest was carried out by logistic regression with odds ratio calculations and a 95% confidence interval. To this end, each dietary pattern provided individual factor scores, which were divided into tertials and then categorized into low adherence (sum of

the 1st and 2nd tertials) and high adherence (3rd tertial). The crude association was identified by p <0.20, and the adjusted analysis was identified by sociodemographic variables for p ≤ 0.05. The adjustment of the model was verified by the Hosmer-Lemeshow test for p > 0.05. The analyses were performed using the IBM Statistical Package for Social Science (SPSS®) program, version 21.

Adherence to the study was voluntary, data confidentiality was guaranteed and participation was confirmed after participants read and signed the informed consent form. The study was approved by the Research Ethics Committee of the Social Medicine Institute of UERJ, under the Certificate of Presentation for Ethical Appreciation (*Certificado de Apresentação para Apreciação Ética* - CAAE) 0041.0.259.000-11.

RESULTS

A total of 520 individuals participated, the majority were women (51.9%), up to 54 years old (65.9%), non-white (54%), married or in a stable relationship (64.6%), with a higher education (54.4%) and family income *per capita* of up to three minimum wages (70%), shown in Table 1.

After verifying the applicability of the factor analysis (KMO=0.752 and Bartlett's sphericity p = 0.001), four food consumption patterns were extracted, which explained 37.3% of the total data variance (Table 2), characterized as follows:
- "processed and ultra-processed products": pasta, breads and crackers, fats, sweets, snacks, pizzas, appetizers, soft drinks and ultra-processed meats;
- "fresh foods": fruits, vegetables, poultry and fresh fish, milk and dairy products, coffee and brews, natural juice and legumes;
- "meats and alcoholic beverages": beef, pork, processed meats and fish, pickled vegetables and alcoholic beverages;
- "traditional Brazilian foods": rice, beans, cereals, roots, tubers and derivatives.

Cronbach's alpha test showed good internal consistency in the "processed and ultra-processed products" and "fresh food" patterns, but low internal consistency in the "meat and alcoholic drinks" and "traditional Brazilian foods" patterns. The low internal consistency can be justified by the presence of few food items in the composition of the "meat and alcoholic drinks" and "traditional Brazilian foods" patterns. Even so, from a nutritional point of view, the foods represented well the food patterns identified

The final model of multiple logistic regression, for each dietary pattern, according to socioeconomic variables, is described in Table 3.

It is observed that individuals between 50 and 54 years old and ≥ 60 years old were two or almost three times more likely to adhere to the "processed and ultra-processed products" pattern, when compared to individuals under 44 years old (odds ratio ranging from 2.00 to 2.79). There was less chance of adherence among men for this pattern.

The probability of achieving a "fresh food" pattern was higher among men and individuals with a medium level of education and lower among individuals aged ≥ 60 years. There was less chance of achieving a "meat and alcoholic beverages" pattern among men.

Table 1. Sociodemographic characteristics of the study population. Pró-Saúde Study, Rio de Janeiro, Brazil, 2012–2013.

Variables	Characterization of the sample (n = 520)	
	n	%
Sex		
Female	270	51.9
Male	250	48.1
Age (years)		
≤ 44	100	19.2
45 – 49	115	22.1
50 – 54	128	24.6
55 – 59	82	15.8
≥ 60	95	18.3
Race		
Whites	239	46
Non whites	267	54
Marital status		
Single	74	14.2
Married/Civil Union	336	64.6
Separated/Widowed	107	20.6
Education level		
Higher education or more	283	54.4
Completed elementary education	49	9.4
Completed high school education	184	35.4
Per capita income (minimum wages)		
≤ 3	364	70
3 – 6	123	23.7
≥ 6	23	4.4

Table 2. Distribution of rotated factorial loads of the dietary patterns. Pró-Saúde Study, Rio de Janeiro, Brazil, 2012–2013.

Food groups	Identified factors			
	Processed and ultra-processed products	Fresh food	Meats and alcoholic beverages	Traditional Brazilian foods.
Bread products	0.571			
Breads and crackers	0.427			
Fats	0.466			
Sweets	0.644			
Salty snacks and pizzas	0.691			
Soft drinks	0.545			
Appetizers	0.581			
Ultra-processed meats	0.583			
Fruits		0.697		
Greens		0.701		
Poultry and fresh fish		0.325		
Milk and milk products		0.627		
Coffee and brews		0.457		
Natural Juice		0.326		
Legumes		0.483		
Pickled vegetables			0.446	
Beef and innards			0.569	
Pork			0.649	
Processed meat and fish			0.484	
Alcoholic beverages			0.499	
Rice				0.747
Beans				0.78
Cereals				0.386
Roots, tubers and derivatives				0.410
Eigenvalues	2.99	2.41	1.99	1.93
Explained variance (%)	11.95	9.63	7.97	7.73
Total explained variance	37.30%			

*Extraction method: principal component analysis with varimax orthogonal rotation.

Table 3. Logistic regression analysis adjusted between dietary patterns and sociodemographic variables. Pró-Saúde Study, Rio de Janeiro, Brazil, 2012–2013.

Variables	Processed and ultra-processed products;	Fresh food	Meats and alcoholic beverages;	Traditional Brazilian foods
	OR (95%CI)	OR (95%CI)	OR (95%CI)	OR(95%CI)
Sex				
Female	1	1	1	1
Male	0.66 (0.45 – 0.97)*	1.69 (1.15 – 2.49)*	0.47 (0.32 – 0.70)*	0.62 (0.41 – 0.95)*
Age (years)				
≤ 44	1	1	1	1
45–49	1.31 (0.70 – 2.46)	0.63 (0.35 – 1.15)	1.08 (0.59 – 1.99)	0.82 (0.46 – 147)
50–54	1.38 (0.75 – 2.54)	1.02 (0.57 – 1.81)	1.37 (0.76 – 2.47)	0.64 (0.35 – 1.16)
55–59	2.00 (1.02 – 3.93)*	0.62 (0.32 – 1.23)	1.23 (0.64 – 2.38)	0.75 (0.38 – 1.47)
≥ 60	2.79 (1.47 – 5.29)*	0.37 (0.18 – 0.76)*	1.81 (0.96 – 3.39)	0.36 (0.17 – 0.79)*
Race				
Non whites				1
Whites				1.75 (1.14 - 2.67) *
Marital status				
Married/Civil Union			1	1
Single			1.21 (0.70 - 2.08)	1.33 (0.74 - 2.40)
Separated/ Widowed			0.67 (0.41 – 1.12)	1.26 (0.74 – 2.14)
Education level				
Higher education or more		1		1
Completed elementary education		1.94 (0.89 - 4.20)		0.18 (0.05 - 0.65) *
Completed high school education		1.78 (1.15 – 2.73)*		0.58 (0.37 – 0.91)*
Per capita income				
< 3	1	1		1
3-6	1.13 (0.72 – 1.77)	0.72 (0.45 – 1.16)		1.55 (0.98 – 2.46)
> 6	1.50 (0.61 – 3.68)	0.34 (0.09 – 1.22)		0.86 (0.31 – 2.38)

*p ≤ 0.05; OR: odds ratio; 95%CI: 95% confidence interval.

For the "traditional Brazilian foods" pattern, the chances of adherence were reduced for men, individuals aged ≥ 60 years and those with lower levels of education, and they were increased among white participants.

DISCUSSION

The present study showed a global view of food consumption patterns and its socio-demographic determinants among workers at a university in Rio de Janeiro. Four dietary patterns were identified:

- "processed and ultra-processed products";
- "fresh food";
- "meats and alcoholic beverages";
- "traditional Brazilian foods".

Only marital status and income were not associated with food consumption patterns. Men were associated with the "fresh food" pattern and women with the "processed and ultra-processed products", "meat and alcoholic drinks" and "traditional Brazilian foods" patterns. Individuals aged 60 years old or over were positively associated with the "processed and ultra-processed products" pattern and negatively with the "fresh food" and "traditional Brazilian food" patterns. White individuals preferred the "traditional Brazilian food" pattern, and those with a medium level of education consumed more of the "fresh food" pattern and less of the "traditional Brazilian food" pattern.

EPS food consumption patterns were similar to studies in the United States[12], China[13], Iran[14], Korea[15] and France[16]. Although dietary patterns are not the same between different cultures, generally the ones called "processed" or "western" are energy-dense, with a greater amount of sugar, sodium, total and saturated fat[17], and are associated with a worse quality of life[18]. The "healthy" or "prudent" patterns are commonly composed of cereals, fruits, vegetables and associated with a better quality of life, while the "traditional" patterns are characterized by foods that represent the food base of the population[19,20].

The "processed and ultra-processed products" pattern was similar to those described in other studies[21-23] and its consumption has been common in around 80 countries[24]. The set of products that are characteristic of this pattern, such as crackers, ice cream, candies, cakes, snacks, soft drinks, pizzas, among others, has been widely described in the latest edition of the *Food Guide for the Brazilian population*[25]. Besides its negative effects on health due to high caloric density, unbalanced nutritional composition and increased risk of developing obesity and other chronic non-communicable diseases (NCDs), these foods affect cultural identity, since the product presentation pattern is identical around the whole world. They also negatively impact social life, as they limit meal preparation, due to its ease and speed of preparation. Lastly, they impact the environment by affecting the planet's sustainability, through the use of non-biodegradable packaging[26].

When assessing the food environment at UERJ, Franco[27] found that cost and accessibility of establishments that provide meals were higher within the campus compared to the university surroundings, although the nutritional quality of the products offered at the university was inferior, with a low offering of complete meals, fruits and vegetables. The dietary patterns found in this research do not reflect only food choices in the workplace. Thus, possibly the healthy pattern found in the present study could reflect food choices and the availability of food outside the university environment.

Demographic and socioeconomic differences determined adherence to food consumption patterns in the present study. In developed countries, the literature lists higher consumption of fruits and vegetables with better socioeconomic status[16,18,29]. This tendency is justified because financial access allows for the purchase of healthy foods[30] and because income is often associated with a better level of education, which facilitates access to information related to behaviors that are considered protective of health[19,31]. However, some Latin American studies[21,32] revealed lower consumption of traditional foods and higher consumption of industrialized foods also among individuals with a better socioeconomic status. Interestingly, in the present study, there was no association between income and eating patterns, probably because of the economic homogeneity and the high level of education of the EPS participants.

The level of education, an important proxy of socioeconomic status, is often related to specific dietary characteristics. A French study found a greater chance of achieving a "prudent" pattern of food consumption and a lesser chance of achieving a meat pattern consumption among individuals with a high level of education[33]. In contrast, our study observed that the chance of adhering to a dietary pattern composed of fresh foods that are considered healthy was higher among participants with a medium level of education, whereas those who declared at least a complete higher education had a greater chance of adhering to a food pattern composed of traditional Brazilian cuisine, revealing schooling as a major constraint on food consumption compared to income.

Sex was associated with adherence to the four patterns of food consumption, although the results have diverged from the literature. In general, women tend to consume foods of better nutritional quality, while men prefer processed foods and alcoholic beverages, characteristics of a stereotype of strength and masculinity[34,35]. EPS men were more likely to achieve a "fresh food" pattern, and women the "processed and ultra-processed products", "meat and alcoholic beverages" and "traditional Brazilian foods" patterns. This difference can be attributed to the level of education of the participants, regardless of gender, or to the uptake of a specific dietary tendency among the men in the study, reflecting more attention to habits considered to be protective of health.

Several studies indicate better dietary quality with ageing, with greater consumption of traditional foods, fruits, vegetables, and lean meats[22,28,36,37]. In Brazil, the National Food Survey 2008–2009 revealed a high consumption of sweetened beverages, fried foods and crackers among young people, while older people opted for traditional foods such as rice, beans, coffee, bread and meat[3]. Among EPS participants, being 55 years old or over was negatively

associated with dietary quality, with higher consumption of ultra-processed products, similar to other studies[38,39]. Since the population of this study is composed of individuals who eat at least one meal outside the home, this finding may be due to the low availability/access to food or meals with better nutritional quality[27] or it may reflect an accelerated pace of life, with a preference for fast food and snacks[1].

International studies attribute racial differences in dietary patterns to socioeconomic inequalities. Some research shows that there is a higher cost of healthy foods (fruits, vegetables, poultry and nuts) and, therefore, a greater chance of consumption by individuals with better social status, generally observed among white people, while other ethnic groups consume food that are more linked to their cultural identity, such as rice and bread[39]. As the majority of the EPS population has a certain socioeconomic homogeneity and belongs to a lower income stratum, there was a greater chance of achieving a pattern composed of traditional Brazilian cuisine items, such as rice, beans and flours[40].

There are two national studies that investigate food consumption patterns among civil servants[1,5]. Both identified four food patterns, with the labels "fruits and vegetables", "common Brazilian fast food", "common Brazilian meal" and "diet and light food and drinks" for one and "traditional", "fruits and vegetables", "pastries" and "diet/light" for the other study. Similar to the EPS, these studies identified trends in the consumption of ultra-processed, traditional and healthy foods. However, it is expected that there are differences due to the methodologies and tools used, besides the subjectivity involved in the techniques for identifying dietary patterns, limiting comparisons between results[41].

Some limitations must be mentioned. Epidemiological studies with this approach measure dietary quality based on a single moment, although eating habits vary with time. This is a sectional study, which makes it difficult to make causal inference. There are flaws inherent to the food collection instrument (semi-quantitative FFQ) itself, related to cognition, memory and individual food preferences[42]. Despite the wide use of the PCA technique, the criteria for retaining the number of factors, type of matrix rotation and pattern labeling are considered limitations of this tool, as these decisions involve researcher's subjectivity and makes comparison difficult between different studies[33]. Additionally, the low data variability found (37,3%) may indicate the presence of other dietary patterns not identified through this technique. The homogeneity in the socioeconomic profile of this population may have influenced our findings, such as the lack of a relationship between income and food consumption patterns. On the other hand, besides the FFQ having been validated for the Brazilian population, guaranteeing the reliability of the data collected, studies of this nature are widely used to explore eating habits between populations and allow for the outline of a panorama, even if it is subject to errors[21,22,43,44]. Furthermore, this is the first survey that contributes to speculating real food consumption among this population. Although the results do not allow for generalization for the Brazilian population, they possibly reflect food consumption patterns in populations with similar social and demographic characteristics and that those are economically active and regularly employed.

CONCLUSION

Four patterns of food consumption were identified among EPS participants, two consist of fresh foods and traditional Brazilian cuisine and two of meat and alcoholic drinks and processed and ultra-processed products. Adherence among them varied mainly between sexes and more advanced age groups, diverging from the literature, which reflects the complexity involved in food consumption and some of its conditioning factors.

The identification of a dietary pattern composed exclusively of products of lower nutritional value, rich in fats and sugars, with adherence among women and older individuals, indicating worse quality of diet, given its harm and potential risk for health, indicates the mass creation of a globalized food pattern and reinforces the need to prioritize the transformation of dietary practices and to implement actions to discourage consumption, either by limiting publicity and advertising, or by raising the taxes on products and providing nutritional education measures to raise awareness.

This study empirically analyzed how the combination of foods occurs among this population of public university employees and contributes positively to the area of nutritional epidemiology, since it identifies individuals who do not eat well and are at risk for nutritional imbalances.

ACKNOWLEDGMENTS

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