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Dietary patterns and their association with sociodemographic and behavioral factors: 2015 Women's Health Research, São Leopoldo (RS)

Padrões alimentares e sua associação com fatores sociodemográficos e comportamentais: Pesquisa Saúde da Mulher 2015, São Leopoldo (RS)

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ABSTRACT: ***Introduction:*** Dietary patterns may be more predictive of disease risk than individual nutrients or foods. ***Objective:*** To identify dietary patterns and associated factors among adult women. ***Method:*** Population-based cross-sectional study with 1,128 women, aged 20 to 69 years, living in São Leopoldo, Rio Grande do Sul. Food intake was assessed with a frequency questionnaire. The principal component analysis identified dietary patterns. We estimated crude and adjusted prevalence ratios using Poisson regression with robust variance. ***Results:*** Three dietary patterns – responsible for 25.8% of the total variance – were identified: healthy (fruits, vegetables, and whole foods); risk (ultra-processed foods); and Brazilian (rice and beans). The healthy pattern showed the largest percentage of explained variation (11.62%). The probability of adherence to the healthy pattern increased linearly with age and schooling and was higher among ex-smokers [prevalence ratio (PR) = 1.22; confidence interval of 95% (95%CI) 1.04 – 1.42]. Younger women and those with better schooling had more chances of adhering to the risk pattern. The probability of adherence to the Brazilian pattern increased as schooling decreased and was higher among non-white women (PR = 1.29; 95%CI 1.04 – 1.59). ***Conclusions:*** While adherence to healthy and risk patterns behaved differently according to women's age, it was similar regarding schooling. Socioeconomic conditions defined adherence to the Brazilian pattern.

Keywords: Food consumption. Women. Factor analysis, statistical. Principal component analysis. Cross-sectional studies.

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RESUMO: ***Introdução:*** Padrões alimentares parecem predizer melhor o risco de doenças do que nutrientes ou alimentos isoladamente. ***Objetivo:*** Identificar padrões alimentares e fatores associados em mulheres adultas. ***Método:*** Estudo transversal, de base populacional, com 1.128 mulheres, de 20 a 69 anos de idade, de São Leopoldo, Rio Grande do Sul. O consumo alimentar foi avaliado por meio de um questionário de frequência. Utilizou-se análise de componentes principais para identificação dos padrões alimentares. Razões de prevalências brutas e ajustadas foram estimadas por meio de regressão de Poisson com variância robusta. ***Resultados:*** Foram identificados três padrões alimentares que explicaram 25,8% da variância total: saudável (frutas, vegetais e alimentos integrais); de risco (alimentos ultraprocessados); e brasileiro (arroz e feijão). O padrão saudável apresentou o maior percentual de variância explicada (11,62%). A probabilidade de adesão ao padrão saudável aumentou linearmente com a idade e a escolaridade e foi maior em ex-fumantes (razão de prevalência — RP = 1,22; intervalo de 95% de confiança (IC95%) 1,04 – 1,42). Já mulheres mais jovens e com maior escolaridade tinham maior probabilidade de aderir ao padrão de risco. A probabilidade de adesão ao padrão brasileiro aumentou à medida que diminuiu a escolaridade e foi maior em mulheres de cor de pele não branca (RP = 1,29; IC95% 1,04 – 1,59). ***Conclusões:*** Enquanto a adesão aos padrões saudável e de risco comportou-se distintamente segundo a idade das mulheres, ela foi semelhante para a escolaridade. Já a adesão ao padrão brasileiro foi definida pelas condições socioeconômicas.

Palavras-chave: Consumo de alimentos. Mulheres. Análise fatorial. Análise de componente principal. Estudos transversais.

INTRODUCTION

Eating habits are among the leading causes of chronic non-communicable diseases (NCDs) and mortality[1,2], and the dietary pattern (DP) approach has been widely used to assess this relationship, given that it may be more predictive of disease risk than evaluating the intake of individual foods or nutrients[3,4]. More specifically, studies that investigated DPs in women revealed the association of some of these patterns with obesity[5-7], cardiovascular risk[8], hypertension[9], risk of fracture[10], cancer[11], and mortality[12].

Individual characteristics, such as sociodemographic, cultural, and behavioral aspects can determine the DP of individuals and are important factors to investigate[2]. In general, studies show that a healthy DP is more prevalent among women who are older, married, of a higher socioeconomic class, and with healthy behaviors (non-smokers, non-drinkers, physically active). Women who are younger, single, of low socioeconomic status, and with unhealthy behaviors tend to adhere to a risk DP[8,13-16].

The increase in intake of ultra-processed foods in Brazil[17,18] and the role of food in several health issues[2] justify the investigation of DPs in segments of the population. In addition to the rise in the female population and their greater life expectancy[19,20], data collected in the same city of the present study showed worrying prevalence rates of general obesity, abdominal obesity, and hypertension among women (18[21]; 23.3[5]; e 26.2%[22], respectively).

The objective of this study was to identify DPs and verify their association with sociodemographic and behavioral factors in adult women.

METHOD

This study is part of the research "Health and living conditions of adult women: A population-based study in Vale dos Sinos – Assessment after 10 years, RS", a population-based cross-sectional study, with a representative sample of adult women living in the urban area of São Leopoldo, Rio Grande do Sul.

The sample size was calculated based on several health outcomes, choosing the one that demanded the larger size (cytopathologic examination). Premises for the calculation were: risk ratio of 2.0, confidence level of 95%, statistical power of 80%, and non-exposed:exposed ratio of 1:2 for the variable schooling. The sample size had an increment of 10% for possible losses/refusals and 15% for control of confounding factors, resulting in 1,281 women, which would suffice for the Principal Components Analysis (PCA) since the recommendation is five observations (individuals) for each variable (food items). In the present study, the Food Frequency Questionnaire (FFQ) had 82 items, so the sample size required would be 410 (5×82) women.

Based on the average number of people per household (2.99), the proportion of women in the age group of interest (32.1%)[19], and the necessary sample size (1,281), the total of household visits estimated was 1,335. The study used a cluster sample, selected in two stages: the first selected census tracts and the second, households. To ensure greater representation, 45 of the 371 existing tracts of São Leopoldo were systematically selected, and in each sector, 36 households. The inclusion criteria for the study were: being 20 to 69 years old and living in the household selected. The study excluded women with physical and/or mental impairment that prevented data collection and pregnant women.

The characteristics of the sample were obtained in household visits, with pre-coded and pre-tested standardized questionnaires, applied by trained interviewers.

The sociodemographic variables of this study were: age (20–29, 30–39, 40–49, 50–59, 60–69); ethnicity (white/non-white); marital status (with/without partner); schooling (0–3, 4–7, 8–10, and ≥ 11 years of study); social class, defined in accordance with the Criteria for Economic Classification of the Brazilian Association of Research Companies (*Associação Brasileira de Empresas de Pesquisa* – ABEP) (classes A–E)[23]; and per capita household income (according to minimum wage and categorized into quartiles). The behavioral variables were: smoking (smoker/ex-smoker/non-smoker) and leisure-time physical activity based on the short and adapted version of the International Physical Activity Questionnaire (IPAQ)[24] (sufficiently active: ≥ 150 min/week of moderate/vigorous physical activity; insufficiently active: < 150 min/week of moderate/vigorous physical activity).

Food intake was assessed with a non-validated qualitative FFQ, with 82 food items, similar to the one used in the first research "Women's Health in São Leopoldo"[25], taking into

account customs and habits of the city, which had strong German immigration. The current FFQ included more items, such as olive oil, packaged snacks, and barbecue; disaggregated items that comprised a single group (the fish group originated four items – fried fish; cooked, baked, and grilled fish; sushi and sashimi; canned sardines and tuna); and presented more than one option for some foods – for instance, the old version of the FFQ only had the option cheese, while the new one had two, white and yellow. Another change was the reference period, from one to three months, to better gather the dietary pattern of women. For each food or food item, the interviewee reported if she had consumed it in the past three months and how many days per week or month it was consumed. This information was transformed into frequency-day.

Quality control was performed in 10% of the sample under study with the application of a questionnaire with 10 questions from the original instrument, including variables that did not change over a short period.

The Research Ethics Committee of Universidade do Vale do Rio dos Sinos approved the project. All participants read and signed the informed consent form prior to the interview.

DATA ANALYSIS

The software EpiData® version 3.1 recorded the data, with double entry, to correct such potential errors. The statistical package IBM SPSS® version 22.0 (IBM Corp., Armonk, United States) performed the analysis of inconsistencies in the database, descriptive analysis, and PCA. The statistical package Stata MP® version 14.0 (StataCorp, College Station, United States) tested the associations between independent variables and each DP. Since this study uses a cluster sample, we used the Stata command "svy."

Continuous variables were expressed as mean (± standard deviation – SD) or median (interquartile range). Before identifying the DPs, we checked the frequency of consumption of each food item, and excluded those with intake below 20%, as this value represents a low consumption of these food items[26]. Next, to reduce intra-individual variability, the food items were distributed into 39 groups, based on nutritional composition, culinary use, seasonality, the frequency of consumption, and how they were grouped in the FFQ (fast foods). Some foods were not aggregated either because grouping them did not make sense (popcorn) or because they could be indicative of a particular dietary pattern, such as rice and beans[27]. (Table 1).

DP derivation was performed by PCA, considering the theoretical requirements for its execution. Thus, we estimated the Kaiser-Meyer-Olkin (KMO) coefficient to check the applicability of the method. The measure of this test indicates the strength of the relationship between variables, with values ≥ 0.60 being considered adequate. In addition, we conducted Bartlett's test of sphericity to test the null hypothesis, that is, the lack of relationship between variables. P-value < 0.05 indicates suitability for data analysis.

We performed an orthogonal varimax rotation to examine the exploratory factorial structure of the FFQ. The number of factors to extract was defined according to the variance graph (Scree Plot), in which the points of greatest slope indicate the appropriate number of components to retain. Food items that presented absolute factor loading ≥ 0.30 were considered significant contributors to a certain factor. We classified the DPs according to cultural aspects or the impact of the foods on health. Factor scores, that is, individual values of factors, were saved for each participant in the study. The scores of each DP were divided into quartiles[13,25] and categorized into low adherence (1st, 2nd, and 3rd quartiles) and high adherence (4th quartile), given that the higher the score, the greater the adherence to the pattern[28]. We estimated crude and adjusted prevalence ratios for all DPs and independent variables using Poisson regression with robust variance. Variables with p-value < 0.20 in the crude analysis underwent an adjusted analysis based on a conceptual model of determination, with three levels[29]. The 1st level included

Table 1. Foods/food groups used in the principal component analysis.

Foods or food groups	
Oilseeds	Barbecue
Vegetable oil | Soybean, canola, corn, and olive oil	Common fruits | Banana, papaya, apple
High-fat creams | Margarine, cream, heavy cream, requeijão (Brazilian cream-cheese), cream-cheese, cottage cheese	Seasonal fruits | Guava, persimmon, strawberry, kiwi, grapes, mango, pear, peach, melon, watermelon, avocado
Mayonnaise | Processed and homemade mayonnaise	Citrus fruits | Pineapple, orange, mandarin orange, lime, passion fruit
High-fat dairy products | Whole milk, yellow cheese, yogurt, whole milk beverage	Vegetables | Beetroot, tomato, squash, pumpkin, carrot, zucchini, eggplant, cucumber, cabbage, cauliflower, garlic, onion
Low-fat dairy products | Skimmed milk, white cheese	Roots/tubers/corn | Boiled/baked potatoes, cassava, sweet potato, corn
White rice	Leafy vegetables | Lettuce, watercress, arugula, broccoli, spinach, collard green, other vegetables
Pasta	Beer/Draft beer
Refined grains | White bread, cracker	Wine
Whole grains | Brown rice, whole bread, oat, wheat bran, granola, whole-wheat cracker	Fresh juice
Sweet baked goods | Cookie, *kuchen*, cake, sweet bread	Farofa (toasted cassava flour mixture) | Cassava flour, farofa
Popcorn	Beans
Chocolate and ice cream	Lentil
Sugary foods | *Schmier* (jam), fruit jam, white sugar, hard candy, dessert, sweets, brown sugar, honey	Fried meat | Fried meat, fried fish, breaded meat, nuggets
Processed foods | Packaged snacks, sandwich cookie	Red meat | Cooked, grilled, ground, and baked beef, steak, stew, pork
Baked snacks	Chicken | Grilled, baked, ground
Fast foods | McDonald's, hot-dog, cheese-burger, ham and cheese sandwich, pizza	Fish | Cooked, baked, grilled, canned sardine or tuna
Soft drinks and processed juices	Offal | Fried beef liver
Egg	Cold cuts | Ham, mortadella, salami, pork sausage, Vienna sausage
Fried foods | Fried foods, French fries/ fried cassava	

demographic variables, mutually adjusted; the 2nd comprised socioeconomic variables, mutually adjusted and adjusted for variables of the 1st level with $p < 0.20$; and the 3rd consisted of behavioral variables, mutually adjusted and adjusted for variables of the previous levels with $p < 0.20$. After adjustment, the variables with $p \leq 0.05$ were considered associated with DPs.

RESULTS

Out of the expected sample, 153 (11.9%) women did not provide data for the study, resulting in 1,128 interviewees. The mean age was 43.4 years (SD ± 13.9). Most participants were white (74.5%) and lived with a partner (63.8%). The mean schooling was 8.7 years of study (SD ± 3.9). More than half of the women belonged to social class C (52.8%). The median per capita household income was R$ 869 (interquartile range: R$ 525–1,547). Approximately 60% of the women were non-smokers, and 85.6% were insufficiently active (data not shown in table).

Regarding the PCA, both the KMO coefficient (0.807) and Bartlett's test of sphericity (p-value < 0.001) indicated that correlations between items were sufficient and suitable for analysis. According to Scree Plot results, three factors were extracted: healthy, risk, and Brazilian, which explained 25.8% of the total variance. Among the 39 food groups, 32 saturated and no item saturated in more than one factor, that is, pure saturation, revealing that these DPs are typical of women from São Leopoldo. Healthy DP showed the highest percentage of explained variation (11.6%), i.e., the best representation of consumption in this population (Table 2).

Table 3 describes the prevalence of high adherence to each DP, according to the characteristics of women. High adherence to the healthy DP was more prevalent in women who were older, white, more educated, and ex-smokers. Risk DP had a greater prevalence of high adherence among young women, those with higher schooling, and in smokers. Brazilian DP was more prevalent in women with low schooling, of social class C, in the 2nd quartile of per capita household income, and among smokers.

Table 4 shows the crude and adjusted prevalence ratios for high adherence to DPs according to the characteristics of the study participants. Women who were older ($p < 0.001$), white ($p < 0.040$), more educated ($p < 0.001$), and never smoked ($p < 0.001$) had a greater probability of high adherence to the healthy DP. After adjustment, this probability rose with increasing age and schooling. With respect to smoking, the chance of high adherence was 22% higher among ex-smokers and 40% lower in smokers when compared to non-smokers.

After adjustment, the probability of high adherence to the risk DP decreased as age increased, that is, it was 32% lower in women aged 30 to 39 years, and 74% among those aged 60 to 69 years. Concerning schooling, the probability increased with the years of study (Table 4).

In relation to the Brazilian DP, the variables that remained associated with high adherence after adjustment were ethnicity and schooling. Non-white women showed a 29% greater probability of high adherence compared to white participants. The probability of high adherence to the Brazilian DP was 21% lower in women with 4 to 7 years of schooling and 69% among those with ≥ 11 years of schooling (Table 4).

DISCUSSION

The present study identified three DPs based on PCA: healthy, risk, and Brazilian. The variables that remained associated with DPs after adjustment were age, ethnicity, schooling, and smoking.

Regarding food composition, the patterns found were similar to those identified in other studies, although some of them had different names. The names found for the healthy DP were more healthy DP[7], vegetable DP[8,14], fruit, vegetables, and soybean DP [11],

Table 2. Dietary patterns and their components, factor loading, and percentage of explained variation in adult women. São Leopoldo, RS, 2015 (n = 1,128).

Healthy DP	Factor loading	Risk DP	Factor loading	Brazilian DP	Factor loading
Leafy vegetables	0.696	Fried foods	0.597	White rice	0.587
Citrus fruits	0.647	Fast food	0.549	Beans	0.550
Vegetables	0.634	Sweet baked goods	0.525	Refined grains	0.482
Common fruits	0.621	Chocolate and ice cream	0.514	Pasta	0.410
Seasonal fruits	0.613	Mayonnaise	0.482	Fried meat	0.372
Vegetable oil	0.591	Cold cuts	0.480	Farofa	0.350
Whole grains	0.590	Processed food	0.446	Red meat	0.339
Fresh juice	0.466	Baked snacks	0.434	Whole grains	-0.459
Low-fat dairy products	0.422	Barbecue	0.384	Oilseeds	-0.353
Fish	0.412	High-fat creams	0.379		
Oilseeds	0.405	Soft drinks and processed juices	0.335		
Lentil	0.324	Eggs	0.327		
% of explained variation*	11.6		9.4		4.8

DP: dietary pattern; *the total explained variation by all factors is 25.8%.

Table 3. Prevalence of high adherence to dietary patterns in adult women. São Leopoldo, RS, 2015 (n = 1,128).

Variables	Healthy DP %	Risk DP %	Brazilian DP %
Age (years)			
20–29	13.4	48.6	20.8
30–39	17.6	32.8	23.8
40–49	23.9	19.9	28.6
50–59	35.1	11.0	23.2
60–69	39.0	10.4	28.7
Ethnicity			
White	26.5	24.9	23.3
Non-white	20.5	25.3	29.9
Marital status			
With partner	25.0	25.1	26.4
Without partner	25.0	24.8	22.5
Schooling (years)[a]			
0–3	21.6	11.8	41.2
4–7	19.5	17.7	34.2
8–10	22.1	26.1	25.1
≥ 11	31.1	33.0	13.6
Social class[a]			
Classes A and B	26.2	25.9	21.5
Class C	25.0	25.3	27.3
Classes D and E	22.1	20.6	24.3
Per capita household income[a,b]			
1st quartile (0.0–0.67)	22.0	22.3	23.4
2nd quartile (0.68–1.10)	27.1	26.7	30.4
3rd quartile (1.11–1.96)	26.0	26.7	23.1
4th quartile (1.97–15.80)	25.4	25.0	22.4
Smoking			
Never smoked	25.3	24.8	21.3
Ex-smoker	33.2	22.4	27.0
Smoker	13.9	28.8	34.1
Physical activity			
Sufficient	25.9	23.5	26.5
Insufficient	24.8	25.3	24.7

DP: dietary pattern; [a]missing data: per capita household income: 37; social class: 6; schooling: 18; [b]according to minimum wage (value in January 2015 – R$ 788).

Table 4. Crude and adjusted prevalence ratio and confidence interval of 95% for high adherence to the dietary pattern according to demographic, socioeconomic, and behavioral variables in adult women. São Leopoldo, RS, 2015 (n = 1,128).

Variables	Healthy DP		Risk DP		Brazilian DP	
	Crude PR (95%CI)	Adjusted[c] PR (95%CI)	Crude PR (95%CI)	Adjusted[c] PR (95%CI)	Crude PR (95%CI)	Adjusted[c] PR (95%CI)
1st LEVEL						
Age (years)	p = 0.000*	p = 0.000*	p = 0.000*	p = 0.000*	p = 0.159*	p = 0.133*
20–29	1.00	1.00	1.00	1.00	1.00	1.00
30–39	1.31 (0.82 – 2.11)	1.30 (0.81 – 2.08)	0.67 (0.54 – 0.85)	0.68 (0.54 – 0.85)	1.14 (0.82 – 1.59)	1.13 (0.80 – 1.58)
40–49	1.78 (1.22 – 2.60)	1.78 (1.22 – 2.61)	0.41 (0.29 – 0.58)	0.45 (0.31 – 0.65)	1.37 (0.95 – 1.98)	1.34 (0.92 – 1.96)
50–59	2.61 (1.84 – 3.72)	2.58 (1.81 – 3.67)	0.23 (0.13 – 0.38)	0.25 (0.15 – 0.44)	1.12 (0.75 – 1.67)	1.13 (0.76 – 1.67)
60–69	2.91 (1.99 – 4.24)	2.88 (1.97 – 4.20)	0.21 (0.12 – 0.37)	0.26 (0.16 – 0.44)	1.38 (0.94 – 2.01)	1.38 (0.95 – 2.02)
Ethnicity	p = 0.074**	p = 0.126**	p = 0.848**		p = 0.022**	p = 0.019**
White	1.00	1.00	1.00	-	1.00	1.00
Non-white	0.77 (0.58 – 1.03)	0.80 (0.59 – 1.07)	1.02 (0.84 – 1.24)		1.28 (1.04 – 1.59)	1.29 (1.04 – 1.59)
Marital status	p = 1.000**		p = 0.895**		p = 0.148**	p = 0.147**
With partner	1.00	-	1.00	-	1.00	1.00
Without partner	1.00 (0.81 – 1.24)		0.98 (0.78 – 1.24)		0.85 (0.69 – 1.06)	0.85 (0.69 – 1.06)
2nd LEVEL						
Schooling (years)[a]	p = 0.003*	p = 0.000*	p = 0.000*	p = 0.012*	p = 0.000*	p = 0.000*
0–3	1.00	1.00	1.00	1.00	1.00	1.00
4–7	0.90 (0.55 – 1.49)	1.07 (0.66 – 1.75)	1.50 (0.82 – 2.77)	1.16 (0.65 – 2.04)	0.83 (0.65 – 1.06)	0.79 (0.63 – 1.00)
8–10	1.03 (0.57 – 1.85)	1.50 (0.84 – 2.70)	2.22 (1.15 – 4.28)	1.31 (0.71 – 2.41)	0.61 (0.42 – 0.88)	0.56 (0.38 – 0.81)
≥ 11	1.44 (0.87 – 2.39)	2.23 (1.33 – 3.76)	2.80 (1.61 – 4.89)	1.59 (0.92 – 2.73)	0.33 (0.23 – 0.48)	0.31 (0.21 – 0.47)
Social class[a]	p = 0.383*		p = 0.317*		p = 0.159*	p = 0.181*
Classes A and B	1.00		1.00		1.00	1.00
Class C	0.96 (0.79 – 1.16)	-	0.98 (0.78 – 1.22)	-	1.27 (1.01 – 1.60)	1.25 (0.98 – 1.59)
Classes D and E	0.84 (0.59 – 1.20)		0.79 (0.53 – 1.18)		1.13 (0.82 – 1.55)	1.13 (0.83 – 1.55)

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Table 4. Continuation.

Variables	Healthy DP		Risk DP		Brazilian DP	
	Crude PR (95%CI)	Adjusted[c] PR (95%CI)	Crude PR (95%CI)	Adjusted[c] PR (95%CI)	Crude PR (95%CI)	Adjusted[c] PR (95%CI)
Per capita household income[a,b]	p = 0.349*		p = 0.457*		p = 0.403*	
1st quartile (0.0–0.67)	1.00		1.00		1.00	
2nd quartile (0.68–1.10)	1.23 (0.87 – 1.75)	-	1.20 (0.91 – 1.58)	-	1.30 (1.00 – 1.68)	-
3rd quartile (1.11–1.96)	1.18 (0.89 – 1.58)		1.20 (0.90 – 1.59)		0.98 (0.73 – 1.34)	
4th quartile (1.97–15.80)	1.15 (0.88 – 1.52)		1.12 (0.84 – 1.49)		0.96 (0.68 – 1.35)	
3rd LEVEL						
Smoking	p = 0.000**	p = 0.003**	p = 0.391**		p = 0.004**	p = 0.249**
Never smoked	1.00	1.00	1.00		1.00	1.00
Ex-smoker	1.31 (1.09 – 1.58)	1.22 (1.04 – 1.42)	0.90 (0.69 – 1.18)	-	1.27 (0.95 – 1.69)	1.14 (0.84 – 1.53)
Smoker	0.55 (0.38 – 0.79)	0.60 (0.42 – 0.86)	1.16 (0.91 – 1.48)		1.60 (1.23 – 2.09)	1.25 (0.96 – 1.63)
Physical activity	p = 0.755**		p = 0.621**		p = 0.641**	
Sufficient	1.00	-	1.00	-	1.00	-
Insufficient	0.96 (0.73 – 1.26)		1.08 (0.79 – 1.46)		0.93 (0.69 – 1.26)	

DP: dietary pattern; *Wald test for linear trend; **Wald test for heterogeneity of proportions; [a]missing data: per capita household income: 37; social class: 6; schooling: 18; [b]according to minimum wage (value in January 2015 – R$ 788.00); [c]each variable is adjusted for those of the same level and the levels above. Only variables with p-value <0.20 were included.

and healthy DP[10,30]. Risk DP resembled the western DP[10], less healthy DP[7], and unhealthy DP[30]. With respect to the Brazilian DP, patterns characterized by the presence of rice and beans, but with a slightly different composition, were denominated Brazilian DP[26] or low cost higher-risk DP[13].

Despite the similarities found in some DPs, they do not have the same foods, or the foods contribute with different loads to constitute it. Thus, some authors criticize DP comparison, suggesting that this would only be possible if the foods or food groups significantly contributing to the factors were equivalent and the loads had the same magnitude[31]. However, the similarities observed indicate that the factors extracted in this study consisted of foods identified in other populations.

After the adjusted analysis, we found a positive association between age and adherence to the healthy DP. This result is similar to that found in other studies, in which older individuals demonstrated high adherence to healthy DPs[8,13,14,16,26,30,32]. This finding could indicate

that, with age, women become more aware of the benefits of healthy eating habits for their health, which would influence their food choices. In addition, culturally, they are responsible for preparing the meals[33,34]. Another hypothesis is that, with increasing age, the prevalence of chronic NCDs and the demand for health services are higher; therefore, these women would have more chances of receiving guidance on health care and diet, which would lead to healthier eating habits[35].

Age was inversely related to the risk DP, a result consistent with both international and national studies[8,13,14,16,30,32]. This finding could be explained by the presence of young women in the labor market, which would contribute to changes in eating habits, the time devoted to food preparation, and food purchase behavior, often causing widespread consumption of processed foods, fast food, pre-prepared foods, or foods consumed outside the home[36]. We can also underline the influence of nutritional transition, that is, changes in Brazilian dietary patterns during the construction of the eating habits of these young women, making these foods common in their daily lives, as data collected from Household Budget Surveys (2002/03 and 2008/09) show. Purchase of ready-made meals and processed products increased by 40% while for fresh foods it decreased or did not change during the two pieces of research. Although part of the population still consumes a combination of rice and beans, national data reveal that Brazilian households have bought less fruit and vegetables and more sweetened drinks, sweets, frozen pizzas, cookies, processed snacks, and processed meats. All these foods are rich in sodium and saturated fat and low in fiber, which can be considered a high-risk DP[17].

Non-white women presented a higher probability of adherence to the Brazilian DP. These data corroborate other Brazilian studies that investigated both genders[37,38]. According to Arruda et al.[37], what could explain this result is the fact that beans, the most characteristic food of these patterns, were the main components of the diet of people of low socioeconomic status in the colonial period in Brazil.

The present study found a positive association between schooling and greater adherence to healthy and risk DPs and a negative one to the Brazilian DP. These findings are consistent with the literature[13-16,30,32]. Higher schooling can influence healthy eating habits, for its relationship to greater access to information[39]. For Popkin et al.[40], more educated individuals tend to have more knowledge about food acquisition, increasing the variety consumed, especially of fruits and vegetables. On the other hand, higher schooling can also be related to unhealthy patterns as a reflection of the development level of countries and the process of nutritional transition. According to Vinholes et al.[41], wealthy nations have a higher prevalence of obesity and unhealthy eating habits among poorer and less educated individuals. In low- and middle-income countries, as is the case of Brazil, obesity and unhealthy eating habits are still greater among individuals of higher socioeconomic status. Less educated women adhere more often to the Brazilian DP due to the greater availability and lower cost of foods such as rice and beans[34]. In this case, schooling would be a better indicator of socioeconomic conditions.

With respect to smoking, ex-smoker women had a higher probability of adhering to the healthy DP. Data from the literature show that non-smoker women are more likely to adhere to a healthy DP[15,16]. According to Sanchez-Villegas et al.[42], this result suggests that non-smoker and ex-smoker women have a higher chance of making positive decisions concerning their health, including by choosing healthy foods. On the other hand, the outcome that smoker women adhere more often to the risk DP is also consistent. This finding is similar to a study with both genders conducted by Olinto et al.[43], which identified a cluster of risk behaviors, such as smoking, and greater adherence to a processed food DP.

Comparing the results of the present study with the 2003 Women's Health Research, in the same city, we found a difference in the number of extracted factors and their characteristics[25]. While the present study extracted three patterns, the authors of the research found three healthy patterns of distinct costs (low, medium, and high), two risk patterns, one of low and another of high cost, and did not identify a pattern with rice and beans, foods of the Brazilian DP. These differences can be explained by the FFQ used – which underwent some modifications compared to the previous study –, the dietary changes in recent years, and the use of PCA for dietary pattern derivation, in which researchers need to make decisions from how to group the foods to determining the number of factors to extract. Regarding associated factors, we found similar results concerning age, schooling, and smoking. The other independent variables studied did not show significant associations as those observed in the study by Lenz et al.[13] – for example, income, social class, and physical activity.

One of the limitations of this study was the use of a retrospective method to collect data on food consumption, depending on memory, which could lead to recall error and make the participants show greater adherence to a different pattern than the one identified. We tried to minimize this error by using a shorter reference time (past three months). Another aspect was the use of a qualitative FFQ, which did not allow us to calculate the amount of food consumed. However, frequency has shown that it can indicate the intake pattern[4]. Also, we cannot dismiss the bias of convenience (not wanting to receive criticism) or social approval (need for praise), given that women could have misreported the consumption of some foods, due to them knowing their beneficial or harmful effects, increasingly widespread in means of communication. This could explain why the healthy DP had the highest percentage of variance in the sample. As this is a cross-sectional study, we cannot rule out reverse causality; nevertheless, the study had the purpose of investigating association rather than causality.

CONCLUSION

While adherence to healthy and risk DPs behaved differently according to women's age, it was similar regarding schooling. Socioeconomic conditions defined adherence to the Brazilian DP.

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