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Association between sociodemographics factors and dietary patterns during pregnancy

Associação entre fatores sociodemográficos e padrões de consumo alimentar durante a gestação

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ABSTRACT

Objective

To investigate the association between socio-demographic factors and dietary patterns in pregnancy.

Methods

Cross-sectional study with baseline data from a cohort of 421 postpartum women aged 18 and 45 years resident in *Rio de Janeiro,* Brazil. Dietary intake was evaluated with a validated food frequency questionnaire at 15 days following delivery, having as time frame the second and third pregnancy trimesters. Dietary patterns were identified using factor analysis for principal components analysis. The association between socio-demographic factors and the identified dietary patterns was assessed with multiple linear regression analysis.

Results

Two dietary patterns were identified: i) healthy: fruits; green vegetables; vegetables; fish; roots, corn and potato; milk and dairy and herbal tea mate, and negatively loadings for alcohol and coffee and ii) mixed: rice; bean;

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flour and pasta; breads; cake and cookies; soda and juice; sugar and sweets; fatty foods; meats; chicken; and eggs. The linear regression showed that the income (β=0.0002; 95%CI: 0.0002-0.0004) and schooling (β=0.0491; 95%CI: 0.0264-0.0718) were positively associated with healthy pattern, and parity (β=-0.1044; 95%CI: -0.1665- -0.0423) and skin color (β=-0.3102; 95%CI: -0.5256- -0.0947) were negatively associated. Skin color (β=0.1647; 95%CI: 0.0378- 0.2916) and marital status (β=0.1065; 95%CI: 0.0062- 0.2067) were positively associated with mixed pattern and income (β=-0.0001; 95%CI:-0.0002- -0.0001) and schooling (β=-0.0281; 95%CI: -0.0417- -0.0146) were negatively associated.

Conclusion

Socio-demographic factors such as income, schooling, skin color, marital status and parity were associated with dietary patterns in this sample of postpartum women residents in *Rio de Janeiro*.

Indexing terms: Demographic data. Factor analysis. Food consumption. Pregnant women. Socioeconomic factors.

RESUMO

Objetivo

Investigar a associação entre fatores sociodemográficos e padrões de consumo alimentar gestacional.

Métodos

Estudo transversal, com dados da linha de base de uma coorte com 421 puérperas entre 18 e 45 anos, residentes no Rio de Janeiro. O consumo alimentar foi avaliado com um questionário de frequência alimentar validado, aplicado aos 15 dias do pós-parto, e teve como referência o segundo e o terceiro trimestres gestacionais. Os padrões alimentares foram identificados a partir da análise fatorial por meio de análise de componentes principais. A associação entre os fatores sociodemográficos e os padrões alimentares foi avaliada com regressão linear múltipla.

Resultados

Foram identificados dois padrões alimentares: i) saudável: frutas; folhosos; hortaliças; peixe; raízes, milho e batata; leite e derivados e mate, e, negativamente para o consumo de álcool e café; e ii) misto: arroz; feijão; farinhas e macarrão; pães; bolo e biscoito; refrigerante e suco; açúcares e doces; alimentos gordurosos; carnes; frango e ovos. Na regressão linear, a renda (β=0,0002, IC95%: 0,0002-0,0004) e a escolaridade (β=0,0491, IC95%: 0,0264-0,0718) associaram-se positivamente ao padrão saudável, e a paridade (β=-0,1044, IC95%: -0,1665- -0,0423) e a cor da pele (β=-0,3102, IC95%: -0,5256- -0,0947) associaram-se negativamente. A cor da pele (β=0,1647, IC95%: 0,0378-0,2916) e o estado marital (β=0,1065, IC95%: 0,0062-0,2067) associaram positivamente ao padrão misto; e a renda (β=-0,0001, IC95%: -0,0002- -0,0001) e a escolaridade (β=-0,0281, IC95%: -0,0417- -0,0146) associaram-se negativamente.

Conclusão

Fatores sociodemográficos como a renda, a escolaridade, a cor da pele, o estado marital e a paridade influenciaram os padrões alimentares nessa amostra de puérperas residentes no Rio de Janeiro.

Termos de indexação: *Dados demográficos. Análise fatorial. Consumo de alimentos. Gestantes. Fatores socioeconômicos.*

INTRODUCTION

Dietary nutrient adequacy during pregnancy is usually assessed by estimating the intake of specific macro and micronutrients, foods, and food groups[1-4]. Although these studies are important, diet consists of a combination of meals, nutrients, and foods[5], and is determined by social, cultural[6,7], physiologic, genetic[8], and demographic[9] factors.

Studies on nutritional epidemiology have analyzed the diet of populations using their dietary patterns[6,10] and associating these patterns with sociodemographic determinants during pregnancy[9,11-13]. Principal Component Analysis (PCA) is one of the methods used for assessing

dietary patterns[14]. This analytical procedure allows assessing a diet within a multidimensional context of exposure[6,10] by reducing the number of dietary variables, which are grouped into factors composed of correlated foods. Analysis of dietary patterns assesses the global effect of diet on health and identifies population groups at the greatest risk of diet-related morbidities[15,16].

Northstone *et al*.[9] used a Food Frequency Questionnaire (FFQ) to assess the food intake of 12,053 pregnant women on the third trimester of pregnancy and found five distinct dietary patterns. These authors found a positive association between schooling and the pattern called "health conscious". Arkkola *et al*.[12] found that the mother's age and schooling were positively associated with "healthy" and "low-fat foods" patterns when they studied 3,730 Finnish women. To date, only one study about the dietary patterns of pregnant women was published in Brazil[17].

Food intake during pregnancy varies greatly[18]. The analysis of dietary patterns can be a guide for specific groups of women according to their demographic and socioeconomic determinants, promoting a healthier diet during pregnancy. Hence, the aim of the present study was to investigate if demographic and socioeconomic factors are associated with dietary patterns during pregnancy.

METHODS

Study design and population

This cross-sectional study used the baseline data of a prospective cohort of 479 women aged 18 to 45 years. The study was conducted from May 1999 to April 2001. The prospective cohort design included 15 months of recruitment and 9 months of follow-up, and collected data on the following occasions: 15 days after delivery (baseline), and 2, 6, and 9 months postpartum. The participants were recruited for the cohort during prenatal and newborn Bacillus Calmette-Guérin (BCG) immunization visits, performed at the Municipal Health Center Marcolino Candau, and immediately after delivery at the maternity hospital of the *Praça* XV, both located in the municipality of *Rio de Janeiro*, Brazil.

The present study analyzed only the baseline data. Forty-seven women aged less than 18 years and two with a daily total energy intake in excess of 6,000kcal were excluded. Of the 430 (100.0%) eligible women, 421 (97.9%) answered the FFQ.

Dependent variable

A total of 421 *postpartum* women answered the FFQ approximately 15 days after delivery. The FFQ, previously validated by Sichieri & Everhart[19], was administered to collect food intake data during the second and third trimesters of pregnancy[1]. This instrument was validated to investigate food intake during the six months prior to its administration[19].

The dietary patterns were obtained by grouping the 81 food items and beverages listed in the FFQ into 19 food groups: 1) rice; 2) bean; 3) breads; 4) flours and pasta; 5) roots, corn and potato (cassava, yam, corn, and potatoes); 6) meats (steak, oxtail, pork, and giblets); 7) chicken; 8) eggs; 9) fish; 10) green vegetables (lettuce, kale, cabbage, and chicory); 11) vegetables (okra, chayote, cucumber, onion, squash, zucchini, carrots, pea pods, beets, cauliflower, red/green/yellow peppers, and tomatoes); 12) fruits (orange, banana, papaya, apple, melon, avocado, pineapple, mango, grapes, guava, and pear); 13) milk and dairy products (whole milk, skim milk, yogurt, cheese, and cream cheese); 14) sugar and sweets; 15) cakes and cookies-crackers (cookies and savory biscuits); 16) soda and juices; 17) fatty foods (butter/margarine, bacon, mayonnaise, pizza, savory snacks, french fries, popcorn, patty, and sausage; 18) alcoholic beverages and coffee (wine, beer, and other alcoholic beverages); and 19) herbal mate tea. Some foods like rice, bean,

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breads, and herbal mate tea were not grouped because they were consumed frequently. Other foods such as chicken, eggs, and fish were placed in individual groups because they have a unique nutritional composition. Alcoholic beverages and coffee were kept in the same group because they were consumed only occasionally during pregnancy, and also because they should be avoided during this time.

The factor analysis for PCA determined the dietary patterns of the women during pregnancy. Commonalities greater than 0.30 determined whether the groups were correctly correlated. The following criteria established the number of factors (patterns): (1) eigenvalues >1.50 and (2) the Scree test plots. After varimax orthogonal rotation, factor loadings above 0.20 limited the intercorrelation between the dietary variables given by the factors[10,20]. The internal consistency of dietary pattern identified was given by Cronbach's alpha. Next, the factors were labeled according to the most prevalent foods[14-16].

Independent variables

The following sociodemographic and obstetric variables were selected as independent: family income (*reais*), schooling (years), skin color (white or brown/black), marital status (married/living together or single/other) and parity (number of deliveries). Pregnancy-related information was collected at baseline using a structured questionnaire.

Covariates

Information about total energy intake (calories), pre-pregnancy Body Mass Index (BMI) [pre-pregnancy weight (kg)/height^2 (meters), and age (years) were used as adjustment variables in data analysis.

Total energy intake was determined by a program developed by Sichieri[21] in the statistical package Statistical Analysis System (SAS) version 8.2. The usual food intake was converted into daily total energy intake by multiplying each food consumed in standardized portions[22] by the daily intake frequency: more than 3 times a day; 2 to 3 times a day; once a day; 5 to 6 times a week; 2 to 4 times a week; once a week; 1 to 3 times a month; never or hardly ever. The energy content of the foods was given by the nutrient composition database from *Escola Paulista de Medicina*[23]. If a food was not listed in the aforementioned database, the food composition table of the National Household Expenditure Study was used[24].

The pre-pregnancy BMI was obtained by pre-pregnancy weight reported by women and their height was measured by a stadiometer of the brand Holtain-Harpeden (Crymych, United Kingdom) with an accuracy of 0.1 cm. The women were measured barefoot.

Statistical analysis

The Student's *t* test and the Chi-square test compared the independent variables and covariates according to the forth quartile of identified dietary patterns. Bivariate linear regression analysis considered the dietary pattern scores as the outcome variable. Age and total energy intake were used as adjustment variables. Although the pre-pregnancy BMI of women with healthy and mixed dietary patterns were not different distributed, this covariate was used as an adjustment variable because its p-value was <0.20 in the bivariate linear regression analysis. The dependent variable of the final multiple linear regression model was the score of each dietary pattern, and the model was adjusted for age, total energy intake, and pre-pregnancy BMI. The significance level was set at $p<0.05$.

Ethical aspects

The study was approved by the Research Ethics Committee of the *Núcleo de Estudos em Saúde Coletiva* (NESC) of the *Universidade Federal*

do Rio de Janeiro (UFRJ) under Protocol number 041/98. All participants signed an Informed Consent Form before they joined the study. More information about the study design and population can be found elsewhere[4,25].

RESULTS

Two dietary patterns were identified and labeled healthy and mixed. Their eigenvalues were 2.24% and 2.22%, respectively. The accumulated variance was 23.48%. The healthy pattern explained 11.79% of the total variance and consisted of fruits; green vegetables; vegetables; fish; roots, corn and potato; milk and dairy products; and herbal mate tea; and inversely with alcohol and coffee intake. The mixed pattern explained 11.69% of the total variance and consisted of rice; bean; flours and pasta; breads; cake and cookies-crackers; soda and juices; sugar and sweets; fatty foods; meats; chicken, and eggs (Table 1).

Women who adhered more to the healthy pattern were older (28.4x24.7 years, $p<0.001$), had higher income (R$1.038,00xR$569,00 *reais*, $p<0.001$), and higher schooling (8.1x6 years, $p<0.001$) than those who adhered more the mixed pattern. White and married women or those living with a partner also preferred the healthy pattern as opposed to the brown/black women who were single/other (Table 2).

The bivariate linear regression model showed that income and schooling were positively associated with the healthy pattern. Brown or black skin color was positively associated with the mixed pattern and negatively associated with

Table 1. Distribution of factor loadings and communalities (h2) of the two dietary patterns identified in the gestational period[1] in a cohort with 421 postpartum women. *Rio de Janeiro*, Brazil, 1999-2001.

Foods and food groups	Dietary pattern		
	Factor loadings[2]		h_2
	Healthy	Mixed	
Fruits	0.537	0.175	0.71
Green vegetables	0.455	-0.073	0.72
Vegetables	0.439	0.039	0.73
Fish	0.261	0.034	0.60
Roots, corn, and potato	0.296	0.083	0.68
Milk and dairy products	0.443	-0.049	0.74
Alcoholic beverages and coffee	-0.210	0.096	0.59
Herbal mate tea	0.283	-0.070	0.64
Rice	-0.306	0.355	0.59
Bean	-0.201	0.332	0.55
Flours and pasta	0.029	0.260	0.59
Breads	-0.056	0.555	0.69
Cakes and cookies-crackers	0.101	0.266	0.60
Soda and juices	0.130	0.307	0.74
Sugar and sweets	-0.034	0.257	0.54
Fatty foods	0.075	0.516	0.66
Meats	0.291	0.328	0.66
Chicken	-0.029	0.250	0.70
Eggs	-0.095	0.271	0.62
Number of items	8	11	
Eigenvalues	2.24	2.22	
Final communalities	1.43	1.41	
% of variance explained	11.79	11.69	
% of cumulative variance explained	11.79	23.48	

Note: [1] Food intake refers to second and third gestational trimester; [2] Factor analysis for principal component analysis.

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Table 2. Mean values and proportions of selected variables from the dietary patterns identified in the gestational period[1] in a cohort with 421 postpartum women. *Rio de Janeiro*, Brazil, 1999-2001.

Variables	Dietary pattern				*p* value*
	Healthy		Mixed		
	Mean	SD	Mean	SD	
Age (years)	28.4	5.79	24.7	5.76	<0.001
Total energy intake (kcal)	2.867	653	3.874	666	<0.001
Pre-pregnancy BMI (kg/m²)	22.6	3.24	22.5	4.05	0.889
Income (*reais*)	1.038	995	569	414	<0.001
Schooling (years)	8.1	3.45	6.0	2.75	<0.001
	N	%	N	%	*p* value*
Parity					0.746
<1	22	38.6	29	41.4	
≥2	35	61.4	41	58.6	
Skin color					<0.001
White	38	54.3	26	24.5	
Brown/Black	32	45.7	80	75.5	
Marital status					0.029
Married or stable partnership	59	84.3	74	69.8	
Single/Other	11	15.7	32	30.2	

Note: *The *p* value refers to the Student's *t* test or Chi-square test. [1]Food intake refers to second and third gestational trimester.
SD: Standard Deviation; BMI: Body Mass Index.

Table 3. Bivariate linear regression and multiple linear regression of selected variables from the dietary patterns identified in the gestational period in a cohort with 421 postpartum women. *Rio de Janeiro*, Brazil, 1999-2001.

Variables	Healthy pattern					
	Bivariate linear regression			Multiple linear regression		
	β	*p* value*	95%CI	β	*p* value**	95%CI
Age (years)	0.0184	0.005	[0.0056] - [0.0312]	-	-	-
Total energy intake (kcal)	0.0003	<0.001	[0.0002] - [0.0004]	-	-	-
Pre-pregnancy BMI (kg/m²)†	-0.0068	0.514	[-0.0274] - [0.0137]	-	-	-
Income (*reais*)	0.0003	<0.001	[0.0002] - [0.0004]	0.0002	<0.001	[0.0001] - [0.0004]
Schooling (years)	0.0493	<0.001	[0.0256] - [0.0729]	0.0491	<0.001	[0.0264] - [0.0718]
Parity (*n*)	-0.0321	0.271	[-0.0893] - [-0.0252]	-0.1044	0.001	[-0.1665] - [-0.0423]
Skin color††	-0.2062	0.063	[-0.4238] - [0.0114]	-0.3102	0.005	[-0.5256] - [-0.0947]
Marital status†††	-0.1464	0.108	[-0.3249] - [-0.0321]	-0.1384	0.112	[-0.3094] - [0.0326]
Variables	Mixed pattern					
	Bivariate regression			Multiple regression		
	β	*p* value*	95%CI	β	*p* value**	95%CI
Age (years)	-0.0128	0.050	[-0.0256] - [-0.00001]	-	-	-
Total energy intake (kcal)	0.0008	<0.001	[0.0007] - [0.0008]	-	-	-
Pre-pregnancy BMI (kg/m²)†	-0.0160	0.124	[-0.0363] - [-0.0044]	-	-	-
Income (*reais*)	-0.0001	0.1363	[-0.0002] - [-0.00003]	-0.0001	<0.001	[-0.0002] - [-0.0001]
Schooling (years)	-0.0336	0.006	[-0.0572] - [-0.0099]	-0.0281	<0.001	[-0.0417] - [-0.0146]
Parity (*n*)	0.0230	0.415	[-0.0324] - [0.0784]	0.0328	0.083	[-0.0043] - [0.0698]
Skin color††	0.4242	<0.001	[0.2091] - [0.6393]	0.1647	0.011	[0.0378] - [0.2916]
Marital status†††	0.1213	0.182	[0.0570] - [0.2997]	0.1065	0.038	[0.0062] - [0.2067]

Note: **p* value refers to bivariate linear regression; ***p* value refers to multiple linear regression; The final multiple linear regression model was adjusted for age, total energy intake, and pre-pregnancy BMI. †Pre-pregnancy Body Mass Index (BMI): [Pre-pregnancy weight (kg)/height ² (meters)] was obtained by pre-pregnancy weight reported by women and their height was measured; ††White or Brown/Black; †††Married or stable partnership or single/other.

schooling. The multiple linear regression model found that income and schooling were positively associated with the healthy pattern and negatively associated with parity and skin color. Income and schooling were negatively associated with the mixed pattern, and marital status and skin color were positively associated with it. The multiple regression model was adjusted for age, total energy intake, and pre-pregnancy BMI (Table 3).

DISCUSSION

Two dietary patterns were identified, a healthy pattern that explained most of the dietary variance and was characterized by fruits; green vegetables; vegetables; roots, corn and potato; milk and dairy products; fish; and herbal mate tea; and inversely with alcoholic beverages and coffee; and a mixed pattern characterized by rice; bean; breads; cakes and cookies-crackers; sodas and juices; fatty foods; meats, chicken, and eggs. Older women with higher schooling, higher income, lower parity, married or living with a partner, and white were more likely to adhere to the healthy pattern. The results of the multiple regression analysis model showed that higher income and schooling were positively associated with the healthy pattern, and higher parity and brown or black skin color were negatively associated with it. Married women or those living with their partners and those with brown or black skin color were positively associated with the mixed pattern, while income and schooling were negatively associated with it. Women who adhered more to the mixed pattern were more likely to be younger and have higher parity.

Among the study limitations, it is important to emphasize that even though the broader study comprises a prospective cohort of postpartum women, the analyses were based exclusively on baseline data, therefore the study has a cross-sectional design. Other limitations include the potential memory bias associated with the FFQ; the arbitrary decisions taken by the researchers, such as food grouping; number of extracted factors; and naming of the retained factors[20]. However, these decisions are inherent to PCA, which is being widely used in epidemiological studies on the dietary patterns of pregnant women[9,11,12,26].

Women with higher schooling, higher income, lower parity, and white were more likely to adhere to the healthy dietary pattern, a finding corroborated by other studies. Northstone *et al.*[9] studied a cohort of pregnant women in the Southeast region of England and found a pattern that they called "health conscious", characterized by the intake of salads, fruits, rice, pasta, oat, breakfast cereals, fish, fruit juices, and whole bread. Low schooling and multiple parities were negatively associated with this pattern. Arkkola *et al.*[12] studied the dietary patterns of a cohort of pregnant Finnish women and found that higher schooling was associated with the healthy pattern. In a population-based, cross-sectional study of 1,026 women aged 20 to 60 years living in the Brazilian South region, Alves *et al.*[27] found that those with higher schooling and socioeconomic status adhered more frequently to the healthy pattern. The first Brazilian study to assess the dietary patterns of pregnant women included women attended in health care facilities located in the Brazilian South; this study found that high family income and schooling were positively associated with a healthy dietary pattern[17].

In general, higher socioeconomic status and age tend to be associated with healthier food choices[13,28]. These results are expected since these factors are related to access to health services and consequently, to health-related information, and additionally, higher income grants better access to healthier foods[29] since these are usually more expensive[30]. The study women had low income and schooling. Yet, it was possible to detect a positive association between income and schooling and healthier food choices. This is probably because women tend to prefer healthier foods when they are pregnant to promote better fetal development, even when these foods are nutrient poor[31].

The mixed pattern consisted of foods with high energy and lipid contents, but also included items like rice and beans, considered commom

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in the Brazilian diet[32,33]. The women who adhered to this pattern were married or lived with a partner, had brown or black skin, and had lower income and schooling. Thompson *et al.*[26] found that the women who adhered to the "junk and fusion pattern", consisting of foods similar to those of the mixed pattern of the present study, were from middle and low socioeconomic levels. Olinto *et al*.[32] studied 4,202 adults from a birth cohort from *Pelotas* (RS), a city in the Brazilian South region, and found that low schooling and income were associated with the common Brazilian pattern, which consisted of rice, beans, sugar, bread, coffee, butter/margarine.

In the present study, pregnant women with lower schooling and income and brown or black skin were more likely to prefer high-energy, refined carbohydrates, and high-fat foods, characteristic of the mixed pattern. Black women of low socioeconomic level usually do not begin prenatal care during the first trimester of pregnancy[34], that may compromise the information they receive about a healthy pregnancy and consequently, proper diet during pregnancy. The changes in Brazilian eating habits seen in the last years included the replacement of healthier foods by high-fat, high-carbohydrate foods, especially those with sugar, although many people still consume the traditional diet[35,36]. Most of these foods are inexpensive and available everywhere, good reasons for women of low income and schooling to adhere more of these foods during pregnancy.

In summary, this study has shown that sociodemographic factors such as income, schooling, skin color, marital status, and parity were associated with the dietary patterns of pregnant women. These sociodemographic factors influenced the dietary patterns of a sample of pregnant women from *Rio de Janeiro* (RJ), emphasizing that women with higher schooling and income preferred the healthy pattern.

CONTRIBUTORS

MBT CASTRO contributed to the data analysis, interpretation of data, and drafting of the manuscript; RAG SOUZA and AAF VILELA contributed in the interpretation of data, and drafting of the manuscript; and G KAC participated in the design and coordination of the study, interpretation of data, and drafting the manuscript. All authors read, revised, and approved the final manuscript.

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