

Dietary patterns during pregnancy and the association with sociodemographic characteristics among women attending general practices in southern Brazil: the ECCAGe Study

Padrões alimentares na gestação e associação com características sociodemográficas em mulheres atendidas em unidades básicas de saúde no Sul do Brasil: Estudo ECCAGe

Padrones alimentarios en la gestación y su asociación con características sociodemográficas en mujeres atendidas en unidades básicas de salud en el sur de Brasil: estudio ECCAGe

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Abstract

The assessment of the relationship between food intake and sociodemographic factors is crucial for developing effective public health policies. The present study aimed to examine dietary patterns in pregnant women and the association between these patterns and sociodemographic characteristics. Pregnant women attending general practices in southern Brazil (n = 712) answered a questionnaire and a food-frequency questionnaire with 88 items. Three dietary patterns were identified using cluster analysis. The association between the dietary patterns and sociodemographic variables was analyzed using the chi-square test and adjusted standardized residuals (p < 0,05). The restricted pattern was associated with lower maternal age, not living with a partner and being a non-working student. The varied pattern was associated with older maternal age, living with a partner, being employed and higher levels of education and income. The common-Brazilian dietary pattern included traditional Brazilian food items and was associated with lower levels of education and income, being unemployed and being a non-student.

Pregnant Women; Diet; Food Habits

Resumo

A avaliação do consumo alimentar e das condições sociodemográficas é crucial para o desenvolvimento de políticas públicas. Este estudo examinou os padrões alimentares em gestantes e sua associação com características sociodemográficas. Gestantes (n = 712) atendidas em unidades básicas de saúde no sul do Brasil, responderam a um questionário sobre as características sociodemográficas e a um outro de frequência alimentar. Foram identificados três padrões alimentares por análise de cluster. Utilizando-se o teste qui-quadrado com resíduos ajustado verificou-se a associação dos padrões alimentares com as variáveis sociodemográficas (p < 0,05). O padrão restrito foi associado com gestantes mais jovens, que não moram com o companheiro e só estudam; o padrão variado com mulheres mais velhas que moram com o companheiro, trabalham e têm níveis de escolaridade e renda mais altos. Mulheres que não trabalham nem estudam e possuem níveis de renda e escolaridade mais baixos estiveram associadas ao padrão comum-brasileiro, caracterizado por alimentos tradicionais da população brasileira.

Gestantes; Dieta; Hábitos Alimentares

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Introduction

The human diet involves the simultaneous intake of a variety of nutrients and foods that are highly correlated and may have synergistic and inhibitory properties^{1,2}. These interactions may hinder the detection of possible associations between specific foods and health outcomes^{2,3}. Dietary preferences are also influenced by cultural, social, economic and environmental determinants⁴.

Research has demonstrated that healthy eating habits during pregnancy affect fetal development and contribute to prevent pregnancy complications^{5,6} and the occurrence of diseases in adulthood⁷. An appropriate diet helps recovery from childbirth and favors breastfeeding⁸. Additionally, pregnant women pay more attention to diet and food choices than nonpregnant women⁹; thus pregnancy is an ideal time to make changes to dietary habits¹⁰. Dietary patterns during pregnancy have been associated with nutritional intake, sociodemographic characteristics and outcomes for babies^{8,11,12,13,14,15}. Dietary patterns rich in vitamins, minerals and proteins are associated with higher birth weight¹³. Older women with a higher level of education are more likely to follow a healthy diet and prevalence of pregestational overweight is lower in this group^{8,12,14}. It has also been shown that increased parity, prepregnancy maternal overweight, being single and unemployed and smoking are factors associated with unhealthy dietary patterns during pregnancy^{12,14}.

A study carried out in the Southern Region of Brazil also pointed to a positive association between diet and socioeconomic status, showing that women of higher socioeconomic status are more likely to follow a healthy diet¹⁶. However, a study of a cohort of young adults demonstrated that, although socioeconomic status affected dietary patterns, having a higher level of education or higher income was not a protective factor for healthy eating¹⁷.

Comprehensive nutritional assessment and guidance are not routine during prenatal care in Brazil and medical professionals often lack a comprehensive understanding of the sociodemographic factors that influence women's eating habits during pregnancy, thus leading to considerable variation in nutritional advice given to pregnant women.

The use of dietary patterns attempts to reduce the number of variables and provide a meaningful representation of the food nutrient combinations of total dietary intake. The analysis of dietary patterns is the ideal tool to identify nutritional risk and appropriate intervention³ and two methods have been used to

identify dietary patterns: a priori and a posteriori^{1,18,19}. The priori method scores dietary adequacy based on dietary guidelines, whereas the posteriori method uses a set of statistical techniques, such as principal component analysis and cluster analysis^{1,18,19}. Although studies of dietary patterns are becoming more and more common^{18,19,20,21,22,23,24} and include pregnant women's dietary patterns^{25,26,27}, we were unable to find any studies on dietary patterns in pregnant women in Brazil.

The objectives of the present study were therefore to identify dietary patterns of pregnant women attending prenatal care in southern Brazil and examine the association between these patterns and sociodemographic characteristics.

Methods

Study design

The ECCAGE (Study of Food Intake and Eating Behavior during Pregnancy) is a cohort study^{28,29,30,31,32} of 780 pregnant women based on data collected between June 2006 and February 2007. A total of 59 women (7.5%) refused to participate and nine (1.1%) interrupted the interview before completion, resulting in a final sample of 712 women (91.3%). Further details on the study protocol have been published elsewhere²⁹.

Study participants were consecutively recruited from public general practice outpatient clinics and a public maternal and infant health care center located in two cities in southern Brazil. The following inclusion criteria were used: receiving pre-natal care at one of the outpatient clinics included in the study; and gestational age between 16 and 36 weeks. No exclusion criteria were used.

The project was approved by the Research Ethics Committee of the Rio Grande do Sul Federal University and all study participants signed a written consent form.

Anthropometric and sociodemographic data

Nutritional status was assessed based on Body Mass Index (BMI). Pregestational weight was informed by study participants in response to the question "*How much did you weigh before you got pregnant?*". Height was measured following the guidelines of the Brazilian Ministry of Health technical manual with individuals wearing light clothing and barefoot³³. The U.S. Institute of Medicine (IoM) cutoff points³⁴ were used to categorize pregestational BMI as follows: "underweight" (BMI < 18.5kg/m²), "normal weight"

(18.5–25.0 kg/m²), “overweight” (25.0–30.0 kg/m²), and “obese” (BMI ≥ 30.0 kg/m²).

The following sociodemographic data were investigated: age (≤ 19 years; 20 to 29 years; ≥ 30 years); family income in number of minimum wages (MW) (≤ 1 MW; 1.01 to 3 MW; ≥ 3.01 MW), considering a MW of US\$ 250; cohabiting with a partner (Yes/No); occupational status (student and employed; student and unemployed; nonstudent and unemployed); years of schooling (≤ 4 years; 5 to 8 years; ≥ 9 years).

Dietary intake assessment

A semiquantitative *Food Frequency Questionnaire* (FFQ), validated for use with pregnant women was administered. A relative validation of the 24-hour dietary recall and the FFQ resulted in a Pearson correlation coefficient of 0.17 for energy intake ($p < 0,05$). The correlation coefficient ranged between 0.01 (vitamin E, $p > 0,05$) and 0.43 (vitamin C, $p < 0,01$)³⁵.

The FFQ assesses eating habits during pregnancy and includes eight different options of intake frequency which were converted into the following equivalent values of daily intake: “more than three times a day” = 3; “twice to three times a day” = 2; “once a day” = 1; “five to six times a week” = 0.79; “two to four times a week” = 0.43; “once a week” = 0.14; “once to three times a month” = 0.07; “never/almost never” = 0. The food list comprised 88 items, and standardized portions were provided for each item as an option to assess consumption. The home measures table³⁶ was used to define portion size in grams. The *Brazilian Food Composition Table* (TACO, acronym in Portuguese)³⁷ was used to calculate the calorie content of each food item; where the TACO did not provide data on a particular food item (14 items) the Tucunduva Table was used³⁸. In the item “other alcoholic beverages” all alcoholic beverages, except for wine and beer, were considered. Energy intake was categorized into the following quartile values: Q1 = 2,514Kcal, Q2 = 3,356Kcal, Q3 = 4,572Kcal.

Identification of dietary patterns

Twenty-six food items consumed by less than 25% of the sample considered low consumption items and excluded from the FFQ are presented as supplementary data (http://www.mat.ufrgs.br/~camey/dietary_patterns/items_excluded.pdf). Maintaining these items would have led to the creation of a group of “nonconsumers” which in turn could lead to a mischaracterization of dietary patterns. Cluster analysis was performed to identify dietary patterns using the

k-means cluster option of the SPSS software, version 13.0 (SPSS Inc., Chicago, USA). The k-means algorithm is the most common non-hierarchical cluster technique in which group homogeneity is measured using the Euclidean distance. Each element of the sample is grouped with the cluster of greatest similarity. To compare the different variables several attempts were made to define the number of groups a priori. The number of groups resulting from this process ranged from two to five and three groups were finally established as best representing the dietary patterns endorsed by the sample.

We decided to use cluster analysis because this method has an advantage over principal component analysis which allows the division of the sample into mutually exclusive characterizeable groups¹⁸. Furthermore, the concept of groups is more intuitive than the concept of factor loadings³⁹.

Variables included in the cluster analysis were measured as follows:

Crude variables were described using the traditional measure “consumption in grams per day” based on the number of portions consumed per day and the frequency of consumption and the weight (g) of each portion. The percentage of total energy intake (%TEI) for a particular food item is 100 times the ratio between energy intake (EI) of the food and the total energy intake.

Standardized variables consisted of the difference between the value of the crude variable and its mean divided by its standard deviation: i.e. “standardized consumption in grams/day” and “standardized %TEI”.

Ranking variables: “consumption ranking in grams/day” and “ranking of the percentage of total energy intake” (%TEI ranking). To define these variables for each of the food items cases were sorted in ascending order and each case was assigned a number that indicated its position in this order. The person with the lowest consumption was assigned value 1 and the person with the second lowest consumption was assigned value 2, and so on. Cases which had the same value were assigned the value of the mean order.

For all food items, except margarine, garlic and onion, standardization and ranking were used to screen crude and standardized variables for extreme values for consumption. The value was considered extreme when it was above a threshold of 1.5 times the interquartile range (IR) of consumption in grams per day. Cases were disregarded if over 30% of the food items showed extreme values, resulting in the exclusion of 65 cases.

Six cluster analyses were performed (one for each variable). The initial clustering criterion was

group size and those variables that produced patterns with groups with a very small number of individuals were disregarded. The criterion used for the remaining variables was interpretability of dietary patterns.

The distribution of the sample among the clusters according to city, occupational status, age, family income, cohabitation with a partner, level of education and pregestational BMI was compared using the chi-square test where adjusted standardized residuals greater than 1.96 ($\alpha = 0.05$) suggested a significantly higher than expected value, thus indicating a statistically significant positive association between variables ⁴⁰.

Results

A total of 401 women (56.3% of the total sample, $n = 712$) lived in the city of Porto Alegre, capital of the State of Rio Grande do Sul, and the majority of the sample (78.5%) were married or lived with a partner. Average age was 24.6 years ($SD = 6.4$) and the average number of years of schooling was 7.6 years ($SD = 2.7$). Average family income was 2.6 MW ($SD = 1.9$) and average pre-gestational BMI was 24.2kg/m² ($SD = 4.7$). The following three distinct dietary patterns were identified based on the data obtained using the FFQ: restricted, varied and common-Brazilian.

The restricted pattern was characterized by a higher consumption of cookies, whole milk, yogurt, chips, finger foods, soft drinks, natural juice, chocolate powder and ice-cream. A large part of the foods in this pattern (42.4%) were not consumed by at least half of the women in this group and 9.1% of the food items were not consumed

by over 75% of the subjects, thus revealing the restrictive nature of this pattern, hence the name restricted.

The varied pattern, as the name suggests, comprised a large variety of items, including "grains, cereals and tubercles", "bread, cakes and cookies", "fruits" and "vegetables". In addition, it contained cheese, pizza, mayonnaise, savory pastry, candies, chocolate bars, and sweet puddings.

With respect to the common-Brazilian pattern, most of the food items (60.6%) were not consumed by at least half of the participants and 12 foods were not consumed by at least 75% of the participants. These findings suggest that this group only consumes foods that are typical of the Brazilian pattern, hence the pattern's name.

Table 1 shows the number of women in each dietary pattern group based on the six different variables used in the cluster analysis. A table including the food items included in each dietary pattern identified by the cluster analyses is available as supplementary data (http://www.mat.ufrgs.br/~camey/dietary_patterns/cluster_analysis.pdf). The most homogeneous groups in terms of group size occurred in patterns generated by the %TEI ranking variable, resulting in more coherent dietary patterns and, therefore, better interpretability.

Table 2 shows the median, 25th and 75th percentiles (P25 and P75) for %TEI by food type and dietary pattern. Twenty-eight food items in the restricted pattern were not consumed by at least 50% of the participants and six of these foods were not consumed by at least 75% of the women in this group. With respect to the varied pattern, only nine food items were not consumed by at least

Table 1

Number and percentage of pregnant women in each dietary pattern group generated by the six different variables used in the cluster analysis.

Variable	Group					
	1		2		3	
	n	%	n	%	n	%
Consumption in grams *	591	91.34	2	0.31	54	8.35
Standardized consumption in grams *	5	0.77	103	15.92	539	83.31
Consumption ranking in grams	217	30.48	240	33.71	255	35.81
%TEI *	223	34.47	330	51.00	94	14.53
Standardized %TEI *	611	94.44	26	4.02	10	1.55
%TEI ranking	205	28.79	244	34.27	263	36.94

TEI: total energy intake.

* Subsample with the exclusion of 65 cases with extreme values in more than 30% of food items ($n = 647$).

Table 2

Description of the dietary patterns of pregnant women according to %TEI of each food item in TEI (n = 712).

Food groups/Foods	Dietary pattern *								
	Restricted (n = 205)			Varied (n = 244)			Common-Brazilian (n = 263)		
	Median	P25	P75	Median	P25	P75	Median	P25	P75
Grains, cereals and tubercles									
Cassava	0.00	0.00	0.51	0.88 **	0.37	1.61	0.00	0.00	1.00
Rice	3.57	2.23	5.84	4.55	2.58	6.95	6.33 **	4.14	9.29
Boiled potato	0.14	0.00	0.72	0.71 **	0.29	1.49	0.48	0.00	1.27
Beans	3.67	1.28	6.98	3.91	1.44	7.69	5.89 **	2.73	10.49
Lentil	0.00	0.00	0.19	0.16 **	0.00	0.34	0.00	0.00	0.22
Pasta	1.15	0.41	2.73	1.69	0.72	3.00	1.96 **	0.87	3.43
Corn	0.00	0.00	0.22	0.00 **	0.00	0.33	0.00	0.00	0.00
Popcorn	0.00	0.00	0.76	0.67 **	0.00	1.69	0.00	0.00	1.06
Polenta	0.00	0.00	0.28	0.51 **	0.18	1.01	0.00	0.00	0.70
Bread, cakes and cookies									
Cookie	0.73 *	0.00	3.37	0.33	0.00	1.57	0.00	0.00	1.33
Salty pastry	0.26	0.00	2.31	0.49 **	0.00	2.29	0.00	0.00	1.35
Cake	1.27	0.00	2.51	1.42 **	0.00	2.74	0.00	0.00	1.98
French roll	12.51	6.12	18.16	8.18	1.71	15.70	13.63 **	5.13	22.41
Homemade bread	0.66	0.00	4.16	1.68 **	0.00	7.35	0.94	0.00	4.63
Fruits									
Pineapple	0.00	0.00	0.11	0.00 **	0.00	0.29	0.00	0.00	0.00
Banana	1.57	0.42	3.39	1.66 **	0.63	3.40	1.40	0.00	3.15
Orange	1.27	0.16	4.16	2.31 **	0.78	5.42	1.13	0.00	4.42
Lemon	0.00	0.00	0.00	0.00 **	0.00	0.01	0.00	0.00	0.01
Apple	0.51	0.00	1.77	1.17 **	0.38	2.52	0.31	0.00	1.40
Papaya	0.16	0.00	0.88	0.52 **	0.00	1.79	0.00	0.00	0.00
Mango	0.16	0.00	0.52	0.18 **	0.00	0.45	0.00	0.00	0.00
Watermelon	0.00	0.00	0.28	0.10 **	0.00	0.60	0.00	0.00	0.00
Grape	0.00	0.00	0.94	0.00 **	0.00	1.17	0.00	0.00	0.00
Vegetables									
Lettuce	0.07	0.00	0.19	0.14 **	0.06	0.27	0.09	0.01	0.26
Garlic	0.00	0.00	0.01	0.03 **	0.00	0.06	0.03	0.00	0.06
Beet	0.02	0.00	0.12	0.10 **	0.03	0.30	0.00	0.00	0.11
Onion	0.00	0.00	0.07	0.08 **	0.04	0.13	0.10	0.02	0.14
Carrot	0.00	0.00	0.05	0.08 **	0.02	0.21	0.00	0.00	0.06
Chayote	0.00	0.00	0.00	0.00 **	0.00	0.04	0.00	0.00	0.00
Kale	0.00	0.00	0.00	0.13 **	0.00	0.39	0.00	0.00	0.11
Cauliflower	0.00	0.00	0.00	0.09 **	0.00	0.26	0.00	0.00	0.00
Cucumber	0.00	0.00	0.00	0.00 **	0.00	0.01	0.00	0.00	0.00
Green pepper	0.00	0.00	0.01	0.01 **	0.00	0.05	0.00	0.00	0.04
Cabbage	0.00	0.00	0.03	0.03 **	0.01	0.08	0.00	0.00	0.04
Tomato	0.13	0.01	0.38	0.26 **	0.11	0.48	0.24	0.08	0.59
Milk and dairy									
Yogurt	1.14 **	0.32	2.16	0.53	0.00	1.29	0.00	0.00	0.63
Whole milk	6.40 **	1.60	10.42	5.18	0.38	8.78	3.61	0.00	8.40
Cheese	0.09	0.00	1.31	0.62 **	0.11	1.47	0.00	0.00	0.40

(continues)

Table 2 (continued)

Food groups/Foods	Dietary pattern *								
	Restricted (n = 205)			Varied (n = 244)			Common-Brazilian (n = 263)		
	Median	P25	P75	Median	P25	P75	Median	P25	P75
Meat, fish and eggs									
Bone beef	0.00	0.00	0.32	0.00 **	0.00	1.60	0.00	0.00	0.95
Boneless beef	3.02	0.97	6.02	3.30	1.48	6.00	3.56 **	1.59	6.63
Pork	0.00	0.00	0.81	0.42 **	0.00	1.06	0.00	0.00	0.53
Chicken	1.78	0.64	3.81	2.11	0.90	3.65	2.44 **	1.00	4.51
Eggs	0.24	0.00	0.89	0.41	0.16	1.08	0.57 **	0.00	1.32
Fish	0.00	0.00	0.00	0.31 **	0.00	0.95	0.00	0.00	0.00
Sausage	0.00	0.00	0.19	0.23 **	0.00	0.52	0.00	0.00	0.61
Offal	0.00	0.00	0.37	0.19 **	0.00	0.72	0.00	0.00	0.32
Fatty food									
Chips	1.48 **	0.00	4.00	1.37	0.00	4.07	0.00	0.00	2.94
Mayonnaise	0.00	0.00	0.14	0.08 **	0.00	0.22	0.00	0.00	0.16
Margarine	0.36	0.00	0.92	0.55	0.00	1.02	0.75 **	0.00	1.20
Pizza	0.00	0.00	1.74	0.89 **	0.00	1.87	0.00	0.00	0.00
Finger food	1.00 **	0.00	3.88	0.00	0.00	1.32	0.00	0.00	1.58
Salty pastry	0.53	0.00	1.49	0.62 **	0.00	1.31	0.00	0.00	0.82
Beverages									
Coffee	0.12	0.00	0.63	0.54	0.06	0.89	0.75 **	0.26	1.30
Soft drink	1.12*	0.00	3.42	0.68	0.00	1.77	1.31	0.00	3.77
Artificial juice	0.00	0.00	1.10	0.47	0.00	1.56	0.96 **	0.00	2.94
Natural juice	1.60*	0.00	4.18	1.44	0.27	2.90	0.00	0.00	1.88
Sweets									
Sugar	5.19	1.83	8.66	5.89	3.04	9.28	7.27 **	4.02	10.79
Candy	0.00	0.00	0.18	0.00 **	0.00	0.25	0.00	0.00	0.07
Chocolate bar	0.34	0.00	1.76	0.37 **	0.00	1.22	0.00	0.00	0.32
Powder chocolate	0.99 **	0.00	3.20	0.12	0.00	1.19	0.00	0.00	0.51
Sweet pudding	0.00	0.00	0.70	0.34 **	0.00	1.13	0.00	0.00	0.00
Ice-cream	0.57 **	0.00	2.19	0.36	0.00	1.15	0.00	0.00	0.37

P25: 25th percentile; P75: 75th percentile; TEI: total energy intake.

* Groups resulting from cluster analysis using the %TEI ranking variable;

** Foods with higher mean %TEI ranking among the three dietary patterns.

50% of the women, and all foods were consumed by at least 25% of the participants. With regard to the common-Brazilian pattern, 40 foods were not consumed by at least 50% of the women, and 12 of these items were not consumed by at least 75% of the participants.

Table 3 shows the characteristics of the sample and the association between sociodemographic characteristics, energy intake and pregestational BMI and dietary patterns. The restricted pattern is associated with not living with a partner, younger age, being a nonworking student and high energy intake (above the 75th percentile). The varied pattern is associated with older age, cohabiting with a partner, being employed and having a higher family income and educational level. The common-Brazilian pattern is associated with lower

family income and educational level, being unemployed, being a nonstudent and low energy intake (below the 25th percentile).

Discussion

The following three dietary patterns were identified: restricted, varied and common-Brazilian. There was a significant association between the sociodemographic characteristics of study participants and dietary patterns.

The restricted pattern was characterized by higher consumption of easily available and more expensive items, such as cookies, whole milk, yogurt, chips, finger foods, soft drinks, natural juice, chocolate powder, and ice-cream.

Table 3

Sociodemographic characteristics and pregestational BMI by dietary pattern identified using the %TEI ranking variable (n = 712).

Characteristic	Total sample		Dietary pattern						p-value
	n	%	Restricted		Varied		Common-Brazilian		
			n	%	n	%	n	%	
Co-habiting with a partner									
No	149	20.9	53 *	35.6	35	23.5	61	40.9	0.006
Yes	563	79.1	152	27.0	209 *	37.1	202	35.9	
Family income (minimum wage = US\$ 250)									
≤ 1	127	17.8	32	25.2	37	29.1	58 *	45.7	< 0.001
1.01-3	370	52.0	105	28.4	111	30.0	154 *	41.6	
≥ 3.01	215	30.2	68	31.6	96 *	44.7	51	23.7	
Age (years)									
≤ 19	181	25.4	85*	47.0	26	14.4	70	38.7	< 0.001
20 to 29	364	51.1	100	27.5	124	34.1	140	38.5	
≥ 30	167	23.5	20	12.0	94 *	56.3	53	31.7	
Level of education (years)									
≤ 4	98	13.8	16	16.3	32	32.7	50*	51.0	< 0.001
5 to 8	352	49.4	104	29.6	110	31.3	138	39.2	
≥ 9	262	36.8	85	32.4	102 *	38.9	75	28.6	
Occupational status									
Student	57	8.0	27 *	47.4	7	12.3	23	40.4	< 0.001
Employed	215	30.2	58	27.0	95 *	44.2	62	28.8	
Student and employed	20	2.8	7	35.0	8	40.0	5	25.0	
Non-student and unemployed	420	59.0	113	26.9	134	31.9	173 *	41.2	
Energy Intake (Kcal) **									
< 2,514	178	25.0	39	21.9	59	33.1	80 *	44.9	< 0.001
2,514 – 3,356	178	25.0	40	22.5	71	39.9	67	37.6	
3,356 – 4,572	178	25.0	45	25.3	65	36.5	68	38.2	
> 4,572	178	25.0	81 *	45.5	49	27.5	48	27.0	
Pregestational BMI ***									
Underweight	29	4.1	12	41.4	5	17.2	12	41.4	0.058
Normal weight	441	62.4	141	32	148	33.6	152	34.5	
Overweight	154	21.8	34	22.1	60	39.0	60	39.0	
Obese	83	11.7	18	21.7	30	36.1	35	42.2	

BMI: body mass index; TEI: total energy intake.

* Significantly (p < 0.05) adjusted standardized residuals (positive);

** Energy intake was classified into four categories, according to quartile values: Q1 = 2,514Kcal; Q2 = 3,356Kcal; Q3 = 4,572Kcal;

*** Pregestational BMI classified according to the Institute of Medicine ³⁴.

A similar “high risk-high cost diet” pattern was observed by another study involving women in southern Brazil ²⁴. Elsewhere in Brazil two studies involving a sample of inpatients and a sample of women have also identified similar patterns ^{22,23}.

The varied pattern includes the greatest variety of items and this was the only pattern in which all foods were consumed by at least 25% of women. In Brazil, other studies involving samples of different population groups have found similar

“healthy” ^{23,24} or “cautious” ²² patterns. Research with pregnant women from Finland and England also identified “healthy” and “health conscious” varied patterns ^{1,2,3,4,5,6,8,9,10,11,19,41,42}.

Most of the items in the common-Brazilian pattern are typical Brazilian foods. For example, the main meals (lunch and dinner) usually contain rice or pasta and beans with beef, chicken or eggs, together with artificial juice. Snacks usually include French rolls with margarine and sweetened coffee. Other studies have also iden-

tified this traditional pattern in the Brazilian population^{17,20,21}.

This study found no association between dietary patterns and pregestational BMI. Other variables, such as previous pregnancy and age may have influenced this association. The restricted pattern is associated with younger pregnant women who do not live with a partner, and are nonworking students. This group reported higher energy intake and higher consumption of sweets and fatty foods, suggesting that little attention is given to eating habits, probably due to a lack of nutritional education. Other research conducted with women in southern Brazil has also indicated a trend of high risk-high cost dietary patterns among younger women¹⁶.

The varied pattern is characterized by older women who cohabit with a partner, are employed and have a higher income and educational level, suggesting a more stable lifestyle and higher socioeconomic status. These findings are in agreement with other studies regarding pregnant women and other population groups^{8,12,16}. Health-related concerns also seem to be more prevalent in this group, since dietary intake included a large variety of healthy food items.

The common-Brazilian pattern was associated with women who are non-students and unemployed and have a lower energy intake and lower income and educational level. Items such as rice and beans are inexpensive and are part of the basic food basket in Brazil. This explains the high intake of these items in low-income groups, corroborated by the fact that this pattern can be detected in all regions of the country regardless of cultural differences.

The use of the %TEI ranking variable enabled the identification of clearer patterns with greater coherence and avoided the need to exclude cases. Although not widely used in studies of dietary patterns, the use of this strategy by the present study proved to be effective. However, the most commonly used variable to describe consumption is %TEI and we therefore opted to present the medians of this variable to facilitate the understanding and comparison of results with other studies.

The use of standardized variables did not provide satisfactory results. The use of this type of variable has been subject to discussion and it has been suggested that nonstandardized variables provide more realistic groups because standardization may result in a false influence from smaller food groups¹⁹.

Different methods have been used for a posteriori dietary pattern analysis, such as cluster analysis or principal component analysis. Although both methods include subjective decisions inherent to each researcher, studies have shown that results are similar^{18,43}. It is noticeable that the patterns identified in the present study concur with published data. While some patterns may be replicated in different populations, others are specific to given cultures and ethnical and geographical differences, food preferences and availability lead to a diversity of dietary patterns. Such diversity may hinder the replication of results but does not impair the validity of the methods used⁴¹.

Few studies have assessed the replicability and validity of principal component analysis and cluster analysis¹⁹. In the present study, most of the food items with higher median %TEI corresponded to those identified using the %TEI ranking variable, suggesting that the observed patterns are valid.

One of limitations of this study is the use of the FFQ. Despite being previously validated for use in pregnant women, the Pearson correlation coefficient was low, suggesting that it may not have provided an accurate reflection of food intake.

Another limitation is that the study sample was not designed to be representative of pregnant women in the cities studied. However, the sociodemographic characteristics of the study sample are comparable to those of the population of pregnant women seeking medical care in the Brazilian national public health system⁴⁴.

This is the first investigation of dietary patterns among pregnant women in Brazil. We observed that higher socioeconomic status is associated with a healthier diet in this group of women. Furthermore, if we look at the results of this study within the context of previously published data, it could be speculated that the patterns observed here are not specifically related to pregnancy, but rather to general eating behavior developed throughout life. Therefore, there is enough evidence to support nutritional interventions and related public policies, especially in more vulnerable populations. Studies of the association between dietary patterns and maternal and infant outcomes are needed to identify the possible health consequences of inappropriate eating habits.

Resumen

La evaluación del consumo alimentario y de las condiciones sociodemográficas es crucial para el desarrollo de políticas públicas. Este estudio examinó padrones alimentarios en gestantes y su asociación con características sociodemográficas. Las gestantes (n = 712) atendidas en unidades básicas de salud en el sur de Brasil, respondieron a un cuestionario sobre características sociodemográficas y a un cuestionario de frecuencia alimentaria. Se identificaron tres padrones alimentarios por análisis de clúster. A través del test chi-cuadrado ajustado con residuos se verificó la asociación de los padrones alimentarios con las variables sociodemográficas ($p < 0,05$). El padrón restringido fue asociado con gestantes más jóvenes, que no viven con un compañero y sólo estudian; el padrón variado con mujeres más viejas, que viven con compañero, trabajan y tienen niveles de escolaridad y renta más altos. Mujeres que no trabajan ni estudian, y poseen niveles de renta y escolaridad más bajos, estuvieron asociadas al padrón común-brasileño, caracterizado por alimentos tradicionales de la población brasileña.

Mujeres Embarazadas; Dieta; Hábitos Alimenticios

Contributors

J. F. Hoffmann participated in data collection, analysis and interpretation, drafting of this article, critical revision of the manuscript for important intellectual content and in the final approval of the published version of this article. S. Camey contributed to in data analysis and interpretation, drafting of this article, critical revision of the manuscript for important intellectual content and in the final approval of the published version of this article. M. T. A. Olinto participated in study conception and data interpretation, critical revision of the manuscript for important intellectual content and in the final approval of the published version of this article. M. I. Schmidt, S. G. I. Ozcariz, C. Melere, C. Buss, M. Drhemer, P. Manzolli, R. M. Soares, M. A. A. Nunes, e A. P. Pinheiro participated in study conception, critical revision of the manuscript for important intellectual content and in the final approval of the published version of this article.

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