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Dietary patterns are associated to pre-gestational obesity in pregnant women

Padrões alimentares estão associados à obesidade pré-gravídica em gestantes

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ABSTRACT: This study aimed to evaluate the association between the eating patterns and the pre gestational obesity in pregnant women from Fortaleza, Ceará. The method used was a cross-sectional study with 401 pregnant women between 19 and 45 years old, treated in a hospital that is a reference in the care of risk pregnancy and in eight health units in Fortaleza, Ceará. Food consumption was investigated using a validated food frequency questionnaire, and the eating patterns were identified using factor analysis for main components, followed by Varimax orthogonal rotation. Obesity was measured according to the body mass index (BMI). Poisson Regression with robust estimation of variance was used to estimate the prevalence ratio of eating patterns in relation to pre gestational obesity, adjusted by sociodemographic variables. Four main eating patterns were identified: "healthy cearense", "rich in protein", "snacks" and "popular". A higher adherence to the "healthy cearense" pattern was associated to a higher prevalence of pre gestational obesity (PR: 1,33; CI 95% 1,01-1,77), the greater adherence to the "popular" pattern was related to the lower prevalence of pre-pregnancy obesity (PR: 0.69; 95% CI 0.51-0.92). It was concluded that there are four main food consumption patterns in the pregnant women from Fortaleza that were studied and the associations between the "healthy cearense" and "popular" patterns and pre gestational obesity were shown.

Keywords: Food consumption. Pregnant. Obesity.

RESUMO
Esta pesquisa teve o objetivo de avaliar a associação entre os padrões alimentares e a obesidade pré-gravídica em gestantes do município de Fortaleza, Ceará. Trata-se de um estudo transversal com 401 gestantes entre 19 e 45 anos, atendidas em um hospital referência para a gestação de risco e em oito unidades de saúde nesse município. O consumo alimentar foi avaliado com um questionário de frequência alimentar validado, e os padrões alimentares identificados por análise fatorial por componentes principais, seguida de rotação ortogonal Varimax. A obesidade foi medida pelo Índice de Massa Corporal (IMC). Utilizou-se Regressão de Poisson com estimativa robusta da variância para estimar as razões de prevalências dos padrões alimentares em relação à obesidade pré-gravídica, ajustado por variáveis sociodemográficas. Quatro principais padrões alimentares foram identificados: "saudável cearense" ;"denso em proteína"; "lanches"; e "popular" . Maior adesão ao padrão "saudável cearense" esteve associada a maior prevalência de obesidade pré-gravídica (RP: 1,33; IC 95% 1,01-1,77); já a maior adesão ao padrão "popular" se relacionou a menor prevalência de obesidade pré-gravídica (RP: 0,69; IC 95% 0,51-0,92). Concluiu-se que há quatro principais padrões de consumo alimentar nas gestantes de Fortaleza estudadas, e evidenciaram-se associações entre os padrões "saudável cearense" e "popular" com a obesidade pré-gestacional.

Palavras-chave: Consumo de alimentos. Gestante. Obesidade.

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INTRODUCTION

Obesity represents an important public health problem due to its increasing prevalence and the risk of associated diseases. Its etiology is multifactorial and involves biological, emotional, socioeconomic and cultural aspects[1].

The frequency of overweight and obese adult women in the 27 Brazilian State Capitals was 53.9% and 20.7%, respectively. Obesity increased with age and decreased with higher levels of education among women[2]. According to data from the 2006 National Survey on Demography and Child and Women's Health, both the frequency of overweight and obesity tended to increase with maternal age and the number of children[3], highlighting the possible influence of pregnancy on the increase of female obesity.

Overweight as well as malnutrition during pregnancy may alter fetal gene expression resulting in permanent adaptations in fetal structure, physiology and metabolism, with consequences not only for the newborn but also throughout adult life, especially related to endocrine metabolism and cardiovascular diseases[4].

Excessive weight gain during pregnancy can be considered a risk for the onset of gestational diabetes, elevation of blood pressure, among other problems in the circulatory system, prematurity, defects in the nervous system of the child and increased number of caesarean sections[5].

Nutrition is essential for the prognosis of pregnancy as it is a phase in which nutritional needs are high. Thus, any change in maternal nutritional status has an important impact on fetal growth[5].

However, the evaluation of food intake becomes a challenge due to the complexity of the human diet, by the interaction of chemical compounds that may be antagonistic, compete or alter the bioavailability of nutrients[6].

An alternative to overcome these limitations, food-based dietary guidelines are recommendations for healthy eating. They are primarily intended for consumer information and education and should be appropriate for each region or country, culturally acceptable and practical to implement. The development of food-based dietary guidelines consists of integrating scientific knowledge on nutrients, foods and health in order to identify dietary patterns that facilitate the attainment of desirable amounts of food and nutrients[7].

Brazilian literature investigates eating patterns mainly in adult populations[8,9] Dietary patterns during pregnancy have been associated with sociodemographic characteristics of pregnant women[10,11], and the association with pregestational obesity is poorly explored. The knowledge of the profile of pregestational obesity gains relevance due to the fact that women who start pregnancy with an above normal BMI have higher risks for several complications. Thus, the aim of the present study was to evaluate

the association of dietary patterns with pregestational obesity in pregnant women in Fortaleza, state of Ceará. The existence of factors monitoring food consumption and the local nutritional situation is important because their results constitute scientific evidence for the definition of priorities in the area of nutrition and public health, in order to provide a better quality of life for these women, supporting health policies and care actions for pregnant women.

METHODS

This is a cross-sectional study, performed with low-risk and high-risk pregnant women, carried out in a reference hospital for risk pregnancy and in primary health care units in the city of Fortaleza, state of Ceará. It is part of a larger research entitled "The maternal and child health care network: caring for pregnant women, nursing mothers and children under two years old" (Universal Call 14/2013 – CNPq. 484077/2013-9). The purpose of this larger research was to analyze the maternal and child health care network in Fortaleza, with an emphasis on nutritional care and for that, socioeconomic, health, anthropometric and food consumption data were collected from low-risk and high-risk pregnant women monitored during prenatal care.

At the time of the study, Fortaleza had 92 primary health care units, distributed among six Regional Executive Health Secretariats and a tertiary care level referral hospital for high-risk pregnant women, which was appointed in 2013 by the Ministry of Health to be one of the support centers installation of the Rede Cegonha in the state of Ceará. This fact justified the choice of this hospital to represent pregnant women at risk.

To obtain a homogeneous sample of low-risk pregnant women, one or two primary health care units were drawn from each Regional Executive Health Secretariat, depending on the number of units they had, totaling eight primary health care units.

Participants were selected, for convenience, in a non-probabilistic manner, from January to November 2014. Hospitalized pregnant women, as well as those who attended primary health care units for prenatal care were evaluated. Women under 19 years of age and/or presenting twin or ectopic pregnancy or diagnosed with hydatidiform mole were excluded.

Low-risk pregnant women were invited to participate in the study on the days of prenatal appointment at the respective health units, by the nutrition undergraduate students, properly trained to do so. Such students also invited high-risk pregnant women to participate during their hospital internment. There were no refusals by pregnant women. The study included 401 pregnant women of different gestational ages, 200 from the hospital unit and 201 from the primary health care units.

For the present research, the following socio-demographic variables were considered: age of pregnant women in years ("≤ 35 years"; "> 35 years"), marital status (living with a partner; not living with a partner), education in years of

study ("≤ 9 years" incomplete primary education; "> 9 years" complete primary education), household income in multiples of minimum wages received by all household residents (MW = R $ 724.00 in 2014) ("≤ 3 MW ; "> 3 MW") and parity ("nulliparous" had no children; "multiparous" with one or more children).

Nutritional status was assessed by the Body Mass Index (BMI), based on anthropometric measurements of weight and height prior to pregnancy, obtained from the prenatal card or medical record. Women were classified as non-obese (BMI <30kg/m^2) and obese (BMI> 30kg/m^2)[5] prior to pregnancy.

To obtain dietary data, we used a Quantitative Food Frequency Questionnaire (FFQQ), developed for pregnant women from Ribeirão Preto-SP, by Oliveira et al.[12]. This instrument was chosen because it is validated for pregnant women in Brazil.

The instrument contains 91 food items and refers to food during pregnancy. For high-risk pregnant women, the instrument was collected with data referring to the period prior to hospitalization. It consists of the columns of consumption frequency, unit of time and portion size, and also presents an average reference serving, in home measurements and in grams or milliliters. In addition, the FFQQ contains space to include foods that are consumed by individuals and not on the food list[12].

Thus, for the present study, 20 foods (couscous, tapioca, "rapadura", kiwi, powder soup, cooked lamb, oatmeal, flaxseed, sushi, "bruaca", "baião-de-dois", eggplant, manioc flour, granola, cashew, beetroot juice, shoyu sauce, fruit salad, coconut water and "pamonha") were cited as consumed by the pregnant women evaluated and included in the FFQQ.

The dietary variable used in the dietary pattern derivation analysis was the daily frequency of consumption of each food. To identify dietary patterns, the 111 food items were grouped according to similarity in nutritional composition. Sushi, Bruaca, Baião-de-dois and shoyu sauce were consumed by 0.5% of the sample, being excluded. In this way, the 107 food items were grouped into 24 predefined food groups based on nutritional profiles similarity and comparable use (Chart 1).

Chart 1. Food groups used in the analysis of dietary patterns identified among the pregnant women studied in Fortaleza, 2015

Food Groups	Food Items
1. Refined Breads	White bread and sweet bread
2. Cookies	Salted crackers and unstuffed sweet crackers
3. Risotto and Pasta	Risotto, stuffed pasta and unstuffed pasta
4. Rice	White rice
5. Beans	Boiled beans and seasoned beans (feijoada, with sausage or bacon)
6. Whole Grains	Brown bread, brown rice, oats, linseed and granola
7. Tubers	Cassava/Potatoes/Mashed Potatoes or Boiled Cassava and Manioc/Potatoes/Mashed Potatoes or Fried Manioc
8. Regional Foods	Couscous, tapioca, pamonha, corn and manioc flour
9. Fat	Butter/Margarine
10. Dairy Products and Derivatives	Whole milk, creamy cheese, yellow cheese, whole yogurt, porridge, smoothie, skim milk, white cheese and nonfat yogurt
11. Savory	Snacks, pizza, fried snacks, roasted snacks, xilitos and chips / popcorn
12. Fruits and fruit juices	Banana, citrus fruits (orange, tangerine), guava, mango / persimmon, apple / pear, melon / watermelon, papaya / formosa papaya, strawberry, peach, avocado/avocado smoothie, grape, pineapple, kiwi, orange juice, other juice coconut water and fruits
13. Oilseeds	Cashews/Walnuts/Peanuts
14. Vegetables	Raw or cooked chard/lettuce/cabbage, cabbage/watercress/almond/arugula Carrot (raw or cooked), pumpkin, beetroot (raw or cooked), beetroot juice, cucumber, tomato, zucchini, broccoli, vegetables (green beans, chayote, cauliflower), eggplant, green corn and vegetable soup
15. Soda	Soft drink/artificial juice
16. Coffee	Coffee
17. Red Meat	Fried Beef, Grilled Steak, Ground Beef, Vegetable Meat/Beef Steak/Beef Stroganoff, Kidneys (Liver or Gizzard), Double Pork, Pork and Mutton
18. Chicken	Roast Chicken, Checkered Chicken/Chicken Stroganoff/Fried Chicken, Fried Chicken and Boiled Chicken
19. Fish	Boiled fish, fried fish, tuna, sardines and
20. Seafood	Seafood
21. Processed Meat	Sausages (mortadella, salami, ham, turkey breast, sausage), sausage and bacon/pork rinds
22. Eggs	Boiled egg, fried egg and omelet
23. Sweets	Honey/jelly/molasses, sweet with fruit/popsicle, sweet with milk, ice cream, chocolate, sweet with peanuts (paçoca, peanut butter), chocolate, sugar added in beverages, rapadura, sweet biscuits with filling and cake
24. Processed Soups	Noodles and powder soup

For the identification of eating patterns, the principal component analysis (PCA) was used, followed by varimax orthogonal rotation.

The adequacy of the data to the factor analysis was confirmed by the Kaiser-Meyer-Olkin coefficient (KMO), using cutoff values ≥ 0.6, and Bartlett's sphericity test, with a p value ≤ 0.05.

The number of factors to be extracted was defined according to three criteria: eigenvalues, where components

with eigenvalues greater than 1.0 indicate that the factor explains more of the total variance than the original variable; Cattel (scree plot), where the points on the highest slope indicate the appropriate number of components to retain; and the conceptual meaning of the identified patterns[13].

Factors with a factor load greater than ≥ 0.3 or ≤ -0.3 were kept in the factors (patterns), and negative loads indicate an inverse association of the food item and positive loads indicate a direct association[13].

A descriptive analysis of the main characteristics of interest of the sample was performed, being the numerical variables presented as means (standard deviation) or medians (interquartile range) and categorical variables as simple frequencies and percentages. Shapiro-wilk test was used to test the normality of numerical variables. To assess the association of dietary intake patterns with pre-gestational obesity, Poisson regression was used with robust estimation of variance in bivariate and multivariate analysis to estimate the prevalence ratio (PR) of independent variables (dietary patterns) in relation to the outcome (pre-pregnancy obesity). Food intake patterns were also classified as dichotomous variables: low adherence to the pattern (1st, 2nd and 3rd quartiles) and high adherence to the pattern (4th quartile).

Multivariate analysis sought to associate dietary patterns with pre-gestational BMI, adjusted for sociodemographic variables (age, education, marital status, and family income). As the independent variables were categorized into quartiles, the p trend value was calculated. Estimates were calculated by points and 95% confidence intervals, with a significance level of 5%. Statistical analyses were run using Stata Software, 10.0 version.

The study was approved by the Research Ethics Committee of the State University of Ceará (CAEE 14911313.0.0000.5534), following Resolution 466/12 of the National Health Council. All pregnant women authorized their participation in the research by signing the informed consent form.

RESULTS

The median age of the group was 25 (21; 31) years. Most (89.5%) pregnant women were 35 years old or younger, lived with a partner (76.6%), had more than one child (78.8%), had a family income of three or less wages wages (91.3%) and had completed elementary school (61.2%) (Table 1).

The median pregestational BMI was 26 (22.2; 29.0) kg/m², and 20.0% pregnant women had pre-pregnancy obesity (Table 1).

Table 1. Socioeconomic and demographic characteristics of the pregnant women studied. Fortaleza, 2015

Variables	N	%
Age (years)	(n = 401)	(n = 401)
≤ 35	359	89.5
> 35	42	10.5
Education (years)	(n = 397)*	(n = 397)*
≤ 9	154	38.8
> 9	243	61.2
Conjugal situation	(n = 401)	(n = 401)
With companion	307	76.6
No companion	94	23.4
Family income (MW)	(n = 367)*	(n = 367)*
≤ 3	335	91.3
> 3	32	8.7
Number of children	(n = 401)	(n = 401)
Nulliparous	85	21.2
Multiparous	316	78.8
Pre-pregnancy BMI	(n = 325)*	(n = 325)*
<19 Kg/m²	13	4.0
≥19 ≤30 Kg/m²	247	76.0
>30Kg/m²	65	20.0

MW = minimum wages: R $ 724.00 (2014).
* n Variation due to lack of information from some pregnant women (could not inform).

The KMO coefficient (0.7061) and Bartlett's sphericity test (p <0.001) indicated the adequacy of data for the factor analysis. Ten factors with eigenvalues ≥ 1.0 were retained. The inflection of the Cattell graph (scree plot) pointed to four factors, which defined, together with the analysis of the conceptual significance of these factors, the number of four main eating patterns in the group, explaining 42.5% total variance. The four extracted patterns, and only these, presented eigenvalues ≥ 1.5 (Table 2).

Dietary patterns identified were named: healthy cearense (regional foods, oilseeds, red meat, vegetables, fruits and fruit juices, tubers and whole grains. "Cearense" means someone or something that comes from the state of Ceará, Brazil); protein-rich (fish, chicken, processed meat, eggs, seafood and beans); snacks (sweet, savory, risotto and pasta and dairy products); popular (fats, refined breads, coffee and rice). Healthy cearense and protein-rich patterns explained the largest proportion of total variance (17.9% and 10.3%, respectively) (Table 2).

Table 2. Factorial load distribution of the main dietary patterns identified among the pregnant women studied. Fortaleza, 2015

Food Groups	Dietary Patterns			
	Healthy Cearense	***Protein-dense***	***Snacks***	***Popular***
Regional Foods	0.782			
Oilseeds	0.756			
Red meat	0.714			
Vegetables	0.709			
Fruits and Fruit Juices	0.687			
Tubers	0.647			
Whole Grains	0.599			
Fish		0.690		
Chicken		0.683		
Processed Meat		0.579		
eggs		0.575		
Seafood		0.544		
Bean		0.523		
Sweets			0.751	
Savory			0.750	
Risotto and Pasta			0.588	
Dairy Products and Derivatives			0.421	
Fats				0.707
Refined Breads				0.650
Coffee				0.457
Rice				0.350
Explained variance (%)	17.93	10.32	7.98	6.32
Eigenvalues	4.30	2.47	1.91	1.51

Foods with factor loadings ≥ 0.3 or ≤ - 0.3; total variance = 42.5%

After adjusting for sociodemographic variables, higher adherence (Q4) to the *healthy cearense* pattern was associated with a higher prevalence of pre-pregnancy obesity (PR: 1.33; 95% CI 1.01-1.77), while higher adherence to the *popular* pattern was associated with a lower prevalence of pre-pregnancy obesity (PR: 0.69; 95% CI 0.51-0.92). For the *protein-rich* and *snacks* patterns, there was no significant association with pre-pregnancy obesity among the pregnant women studied (Table 3). There were no statistically significant differences between low-risk and high-risk pregnant women attended in prenatal care (data not shown p> 0.01).

Table 3. Unadjusted and adjusted prevalence ratios (PR) and confidence intervals (95% CI) for the association of pre-pregnancy obesity with the patterns identified among pregnant women. Fortaleza, 2015

Dietary Pattern	Pre-pregnancy obesity (Body Mass Index ≥30kg/m²)		
	%	Non-adjusted PR (CI 95%)	Adjusted PR (CI 95%)
Healthy Cearense		*p* = 0.191	*p* = 0.213
Q1	14.3	Reference	Reference
Q2	20.6	1.16 (0.86-1.56)	1.15 (0.85-1.57)
Q3	20.7	1.16 (0.88-1.55)	1.07 (0.79-1.44)
Q4	29.0	1.37 (1.04-1.82)	1.33 (1.01-1.77)
Protein-dense		*p* = 0.478	*p* = 0.462
Q1	24.6	Reference	Reference
Q2	18.2	0.87 (0.65-1.16)	0.82 (0.61-1.09)
Q3	25.3	1.01 (0.77-1.34)	1.01 (0.77-1.32)
Q4	16.9	0.84 (0,63-1.13)	0.92 (0.68-1.24)
Snacks		*p* = 0.242	*p* = 0.279
Q1	25.7	Reference	Reference
Q2	24.7	0.98 (0.74-1.30)	1.00 (0.76-1.32)
Q3	13.3	0.76 (0.57-1.00)	0.78 (0.58-1.06)
Q4	21.6	0.92 (0.69-1.22)	0.94 (0.70-1.27)
Popular		*p* = 0.004	*p* = 0.001
Q1	22.4	Reference	Reference
Q2	29.3	1.15 (0.86-1.52)	1.21 (0.90-1.63)
Q3	26.7	1.09 (0.82-1.45)	1.05 (0.78-1.42)
Q4	7.60	0.69 (0.52-0.91)	0.69 (0.51-0.92)

* The p value obtained by Poison Regression (p trend value) ** Data were adjusted for the variables maternal age, education, marital status and family income *** Patterns were categorized into quartiles - Q1 (the lowest quartile). represents the lowest adherence to the standard), Q2, Q3 and Q4 (the largest quartile of the distribution represents the highest adherence to the standard).

DISCUSSION

Four main dietary patterns were identified among the 401 pregnant women from Fortaleza, Ceará, named *healthy cearense*, *protein-rich*, *snacks*, and *popular*. The *healthy cearense* pattern was associated with a higher prevalence of pre-pregnancy obesity, while the *popular* pattern was associated with a lower prevalence. *Protein-rich* and *snacks* patterns were not associated with obesity.

Pattern of food consumption entitled *healthy cearense* explained the largest percentage of variance, being characterized by the presence of foods rich in vitamins, minerals, fiber, low in sugars and trans fats, similar to eating patterns called "healthy", commonly identified in other studies[9,11,14,15], but marked by the presence of foods typically consumed in

the state of Ceará (couscous, tapioca, pamonha, corn and cassava flour). In a study conducted with postpartum women, 18 and 45 years old, residing in Rio de Janeiro, the "healthy" dietary pattern was also identified in the studied population[15]. Other denominations of patterns with similar composition are found in the literature, the main one being "prudent"[12,16], that is, a more beneficial and healthy diet for proper fetal development. As the pattern found in the present study presents some foods that do not fit the Brazilian healthy diet, representing a regional diet of the state, *healthy cearense* was considered the most appropriate denomination.

The pattern identified as *protein-rich* was named for protein-rich foods such as white meats, processed meats, eggs, seafood and beans. Although no pattern was detected in the literature with exactly the same denomination, several studies have identified factors with protein-rich foods in their composition[10,15,17].

On the other hand, the *snacks* pattern, formed by foods usually consumed as snacks and characterized by being of low nutritional value and dense in calories, sugars, fats, carbohydrates and sodium, was similar to the pattern found in another study[6]. A study of elderly people in Botucatu, São Paulo[18] also found a "snack" pattern with a high variety of foods, such as yellow cheeses; pizza/pancake; savory; bacon/dried meat; hamburger/nuggets/meatballs; soda; French bread; pasta with meat; mayonnaise salad; desserts/sweets; potato/cassava chips; some of these being similar to those in the present study. Other patterns, such as "obesogenic"[14] and "energy-dense"[19], with similar compositions to the snack pattern and in adult populations, were evidenced.

The fourth pattern identified was called *popular*, composed of butter/margarine, white bread, coffee and rice, which represent lower cost foods and popular in the Brazilian diet. A Brazilian study with adults aged 30 years and older from the urban area of Ribeirão Preto, São Paulo, also identified a pattern with the same nomenclature, although it had in its composition the following foods: beans, cereals and vegetable fat[14]. A research on pregnant women from Ribeirão Preto, São Paulo, the main foods found in the popular pattern of the current study were distributed between two patterns; in the pattern called "snacks" (breads, butter and margarine; cold cuts; milk and yogurt; cheese and creamy cheese; sweets; chocolate and cappuccino) and in the "coffee" (coffee, sugar, butter and margarine)[20].

The *healthy cearense* pattern was associated with pre-gestational obesity, where women who began pregnancy with obesity showed greater adherence to this pattern. Thus, it is hypothesized that most women neglect their diet until they suffer visible consequences of this choice, but when they become visible, they start to adopt healthier habits[17]. Women who began their pregnancy already obese possibly had a greater concern to consume a healthier diet during the gestational period. However, these results cannot be explained in the literature, as studies like

the ones of Zuccolloto et al [20] and Wall et al[21], showed that women with a higher adherence to the "healthy" patterns presented a lower pre-pregnancy BMI or lower chance of obesity. Hoffamann et al.[10], in turn, found no association between adherence to established standards with nutritional status in a study conducted with pregnant women.

In addition, pregnant women pay more attention to diet and food choices than non-pregnant women, which is an ideal time to make changes in eating habits[16]. Healthy eating that enables the consumption of a wide variety of foods, the non-use of alcohol and other drugs, as well as the safe handling of food combined with physical activity, are fundamental for good fetal development and reduction of risks of developing chronic health problems for mother and child[22].

Wesołowska et al.[16] found that the women who were overweight/obese before pregnancy indicated a healthier dietary pattern during the pregnancy period. In that perspective, it could be suspected that they changed their nutritional behavior in the entire pregnancy (for their and newborn's health).

The *popular* dietary pattern was inversely associated with pre-pregnancy obesity among the pregnant women studied. Gimeno et al.[20,14] found no association between the "popular Brazilian" pattern of adults in Ribeirão Preto and anthropometric indicators of obesity. Similarly, in the cohort with pregnant women from southern Brazil, no association was found between the "common Brazilian" pattern and gestational BMI[16,10]. Cunha et al.[23] observed among adults living in Duque de Caxias, Rio de Janeiro, that the "traditional" pattern of composition (rice, beans, bread, sugar, fats and salad dressings) had a protective effect on BMI in the female population studied. However, it is noteworthy that the *popular* pattern of the present study does not have the combination of rice and beans, as evidenced in the study cited, with a "traditional" pattern.

Among the limitations of this study, the cross-sectional approach, the subjectivity of the principal component analysis, which involves some decisions of the researcher, such as the grouping of food items, the number of patterns to be extracted, the rotation method, and the denomination of dietary patterns found[24].

As in other researches with approach to dietary patterns, the comparison of the results of the present study with other investigations should be done with caution, because there are methodological differences, and the dietary choices depend on the socioeconomic and cultural factors of each population and especially during pregnancy[25].

Thus, the results of the present study are not generalizable and represent the dietary patterns of the studied sample, but not the pregnant population of Fortaleza, Ceará.

CONCLUSION

This study identified four main patterns of food consumption (*healthy cearense*, *protein-rich*, *snacks* and

popular) among the pregnant women studied and showed associations of the healthy cearense pattern with the highest prevalence of pre-gestational obesity and the popular with a lower prevalence. These results add more knowledge to those that already exist about diet during pregnancy and can help prenatal nutrition education.

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