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ORIGINAL ARTICLE

Association between dietary patterns and mental disorders in pregnant women in Southern Brazil

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Objective: To evaluate the association between dietary patterns and mental disorders among pregnant women in southern Brazil.
Methods: Cross-sectional study with 712 pregnant women recruited from the Study of Food Intake and Eating Behaviors in Pregnancy (ECCAGe). Food intake assessment was performed using the Food Frequency Questionnaire. Dietary patterns were identified by cluster analysis. The Primary Care Evaluation of Mental Disorders (PRIME-MD) was used to evaluate participants' mental health. Poisson regression models with robust variance were fitted to estimate prevalence ratios (PR).
Results: In the adjusted models, there was a high prevalence of major depressive disorder among women with low fruit intake (43%, PR 1.43, 95%CI 1.04-1.95) and high sweets and sugars intake (91%, PR 1.91, 95%CI 1.19-3.07). Women with a common-Brazilian dietary pattern had higher prevalence of major depressive disorder compared to those with a varied consumption pattern (PR 1.43, 95%CI 1.01-2.02). Low intake of beans was significantly associated with generalized anxiety disorder (PR 1.40, 95%CI 1.01-1.93).
Conclusions: Low consumption of fruits and beans and intake of the common-Brazilian dietary pattern during pregnancy were associated with higher prevalence of mental disorders. These results reinforce the importance of an adequate dietary intake to ensure better mental health in pregnancy.

Keywords: Dietary patterns; food patterns; food intake; pregnancy; mental health

Introduction

In recent decades, noncommunicable diseases have become a major public health concern, with psychiatric disorders accounting for a large portion of the burden of these diseases.[1] The World Health Organization estimates that approximately 450 million people have at least one mental disorder, with depressive and anxiety disorders being most prevalent. Studies with lenient criteria for common mental disorders (mixed states of depression and anxiety) have demonstrated that approximately 30% of Brazilian adults exhibit these symptoms,[2] with women being the most affected.

According to the DSM-IV-TR, mental disorders are frequent in pregnancy and are important predictors of postpartum depression and anxiety, as well as adverse obstetric outcomes[3] capable of influencing child development. In a systematic review, Fisher et al. reported a weighted average prevalence of non-psychotic mental disorders of 15.6% during the prenatal period and 19.8% in the postpartum among women from low- and middle-income countries.[4] Biological factors (personal or family history of mood disorder), psychosocial factors (early pregnancy, substance abuse, low level of education, domestic violence), and lifestyle factors (such as diet and physical activity)[5] may modulate the risk for psychiatric disorders during pregnancy and affect mental health in offspring.[6]

Evidence shows that diet is related to inflammation, oxidative stress, and brain function and plasticity – factors potentially involved with mental disorders. Previous studies of the association between diet and depressive illness focused on individual nutrients or food groups.[7,8] However, nutrients and foods may have synergistic and inhibitory properties that may attenuate the relationship between isolated nutrients and health outcomes. Recently, research interest has shifted toward study of the potential interaction between mental disorders and dietary patterns,[8] which represent a broader framework of usual dietary habits. However, a literature review performed in the PubMed and SciELO databases, using the keywords food intake, pregnancy, mental health, and variations of dietary patterns and food patterns, retrieved only a few studies that evaluated the relationship between dietary patterns and mental health within the context of pregnancy.[9,10] The summary findings of a recent systematic review pointed to positive associations between poor-quality, unhealthy diets

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and antenatal depressive and stress symptoms, but the existing evidence base is limited.[11]

Within this context, the objective of this study is to evaluate the association of dietary patterns and consumption of specific food groups with mental disorders in pregnant women from southern Brazil.

Methods

Population and study design

This is a cross-sectional study with data obtained from the baseline of the Study of Food Intake and Eating Behaviors in Pregnancy (Estudo do Consumo e do Comportamento Alimentar em Gestantes, ECCAGe), a cohort study conducted in the primary healthcare network of southern Brazil. During 2006-2007, 780 pregnant women were enrolled in 18 primary healthcare units (PHU), 10 located in Porto Alegre and 8 located in Bento Gonçalves, both municipalities in the state of Rio Grande do Sul, Brazil. 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. Women between the 16th and 36th gestational weeks were enrolled consecutively, during operating hours, in the waiting room of the PHU before their prenatal appointments. In addition, follow-up contact was established once in the immediate postpartum period, once at 5 months postpartum, and once in the 5th year of life of the child. Quality control was conducted in 10% of the sample, by random selection, through telephone contact. Detailed descriptions of the study protocol are available elsewhere.[12-14] The study was approved by the ethics committee of Universidade Federal do Rio Grande do Sul (UFRGS), and all participants provided written informed consent.

Mental health assessment

The Primary Care Evaluation of Mental Disorders (PRIME-MD) was used to screen for mental disorders.[15] The PRIME-MD was developed in the United States to facilitate the diagnosis of mental disorders by primary care physicians, and has been translated and validated for use in Brazilian Portuguese.[16] The instrument covers the diagnoses of mood, anxiety, eating, and somatoform disorders, along with probable alcohol abuse or dependence, utilizing DSM-III-R diagnostic criteria. For the purposes of the ECCAGe, we chose to exclude the module for somatoform disorder due to the high frequency of physical complaints during pregnancy, which would act as a confounder for diagnosis and create the need for clinical confirmation. Trained interviewers administered the instrument; however, they were not qualified to perform clinical assessments of participant's mental states.

The PRIME-MD is divided into two parts: the Patient Health Questionnaire (PHQ) and the Clinician Evaluation Guide (CEG). The PHQ contains 12 questions (10 dichotomous yes/no responses, one item that measures the intensity of the symptom, and another that assesses overall health). The first 10 questions are organized into modules covering the diagnoses; in the case of an affirmative answer, the CEG is used to obtain additional information for each diagnosis.[14] In this study, the CEG was not used. Six diagnostic categories were identified from the collected data: major depressive disorder, major depressive disorder in partial remission, dysthymia, panic disorder, generalized anxiety disorder, and bulimia nervosa. The diagnoses of major depressive disorder and generalized anxiety disorder were our outcome variables, as they were the most prevalent. More details about the prevalence of the mental health diagnoses of the ECCAGe study have been published previously.[14]

Assessment of food consumption

Food consumption data were collected by the Food Frequency Questionnaire (FFQ) developed by Sichieri & Everhart[17] and validated for the study population.[13] The FFQ assesses food intake during pregnancy and presents eight options for frequency of consumption. To obtain an estimate of daily food consumption, the reported frequency was converted into a daily consumption equivalent, with the following respective categories[18]: more than three times a day = 3; two 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; one to three times a month = 0.07; and never/almost never = 0. The list of foods comprised 88 items, and quantity consumed was reported in relation to standardized serving sizes.[18] During analysis of FFQ results, the Standardized food serving size booklet was used to determine the quantity (in grams) of each portion.[19] The Brazilian Food Composition Table was used to calculate the caloric value of foods.[20]

Dietary patterns during pregnancy

The dietary patterns of the sample were determined by cluster analysis in a previous study.[18] We chose this method of identification *a posteriori* because it allows grouping of individuals with similar consumption patterns. The concept of clusters is also more intuitive than the concept of factor loadings,[21] facilitating the interpretation of dietary patterns and enabling association of respective patterns with other characteristics of the sample and outcomes of interest. Several variables derived from the FFQ were tested in the cluster analysis; of these, the ranking of the percentage of the total energy value presented the most consistent patterns and, therefore, demonstrated better interpretability. We identified three dietary patterns, which we named restricted, varied, and common-Brazilian.[18] The restricted dietary pattern was characterized by consumption of easy-to-prepare foods, including industrialized foods, consistent with contemporary eating patterns that feature limited food variability (fast food, sweets, desserts, high-fat products, and sweetened beverages). Food items mostly found in the restricted dietary pattern were cookies, French fries, snacks, soft drinks, natural juice, whole milk, cocoa powder, yogurt, and ice cream. A large part of the foods items present in FFQ (42.4%) were not consumed by at least half of the women in this group, revealing the restrictive nature of this pattern.[18] The varied pattern included a wide variety of items

from the following groups: grains, cereals, and tubers; breads, cakes, and cookies; fruits; and vegetables. The common-Brazilian pattern was composed of foods popular in Brazilian culture, such as rice or noodles, French rolls, beans, boneless beef/chicken or eggs, coffee with sugar, margarine, and artificial juices.[18]

Food groups adequacy during pregnancy

The food items of the FFQ were separated into food groups as per the Food Guide for the Brazilian Population.[22] In accordance with Guide recommendations, the number of servings consumed of each food type was calculated by weight or volume. More details about the construction of the variable number of portions of each food group were published previously.[23]

The first edition of the Brazilian Food Guide establishes recommended portions for each food group on the basis of a 2000-kcal diet. Due to the 300-kcal increase in recommended daily energy intake during pregnancy,[24] the number of recommended servings from each food group was adjusted to compensate for this additional caloric intake. The adequacy adjustment resulted in 3.5 portions for the fruit, vegetables, and dairy groups; 1.2 portions for beans and meats; and 6.9 portions for the cereals, tubers, and roots group.

The variable recommended consumption of the food groups was composed of three categories: low, recommended, and high. Low consumption was defined using the cutoff point of the Food Guide recommendation, with portion sizes adapted for pregnancy. High consumption was determined by the upper quartile of number of servings per food group, since no specific cutoff for this purpose exists in the literature.

For the food groups sweets/sugars and fats, the lower quartile was considered low consumption and the upper quartile was defined as high consumption.

Potential confounders

We analyzed the following characteristics of participants: age (years); educational attainment ($\leqslant$ 4 years, 5-8 years and $\geqslant$ 9 years); marital status (lives vs. does not live with a partner or spouse), family income (expressed as a function of the Brazilian minimum wage, which is equivalent to US$ 175/month); occupation (working and/or studying vs. neither works nor studies); household occupancy (two people or fewer, three or four people, five people or more); number of children (no children, one child, two children or more); municipality in which the participant resides (Porto Alegre or Bento Gonçalves); cigarette smoking during pregnancy; alcohol consumption during pregnancy; whether pregnancy was planned; violence during pregnancy; presence of chronic disease; and pre-gestational body mass index (underweight, healthy weight, overweight, or obese).

Statistical analysis

Data were described as absolute and relative frequencies. Pearson's chi-square method was used to test for associations between categorical variables. Crude and adjusted analyses were performed using Poisson regression models with robust variance to estimate the prevalence ratio (PR) of the outcomes of interest.[25] The major depression and generalized anxiety outcomes were dichotomized into presence and absence of the respective disorder. For each mental health outcome, two regression models were fitted. In model 1, dietary patterns during pregnancy were considered, while in model 2, the consumption of the various food groups was considered. All variables with a p-value < 0.20 on univariate analysis, starting with those with the lowest p-value, were included in multivariate analysis in a stepwise manner. Only variables with a p-value < 0.05 (Wald test) were kept in the final model. Results were expressed as PRs and 95% confidence intervals (95%CI). The Wald test for heterogeneity and the linear trend test were performed to evaluate differences between groups.

All analyses were performed in PASW Statistics version 18, considering a significance level of 5%.

Results

The prevalence of major depression and generalized anxiety in the study population was 21.6% (95%CI 18.7-24.6) and 19.8% (95%CI 16.9-22.7), respectively. The prevalence of the three dietary patterns was similar, with 205 women (28.8%) following a restricted dietary pattern, 244 (34.3%) a varied pattern, and 263 (36.9%) the common-Brazilian pattern of eating.

Table 1 shows the demographic, social, and clinical characteristics of the study sample and the frequency of the two major mental disorders stratified by these characteristics. Women living in Porto Alegre and those with a greater number of people living in the same household reported a higher prevalence of depression. Those with two or more children endorsed a higher prevalence of generalized anxiety than those with one or no children. Pregnant women who had suffered some type of violence during pregnancy and those who had reported the presence of chronic disease had a higher prevalence of both depression and generalized anxiety compared with those with no history of violence or presence of chronic disease.

Analyses for the association between dietary patterns and mental disorders are presented in Table 2. The common-Brazilian pattern of eating was associated with a higher occurrence of major depressive disorder compared with the varied dietary pattern. Women who presented a common-Brazilian dietary pattern had a 62% higher prevalence of major depression (PR 1.62; 95%CI 1.15-2.30) when compared to those who presented a varied pattern of consumption. The association decreased slightly when adjusting for municipality of residence, violence during pregnancy, and monthly family income, but remained statistically significant (PR 1.43; 95%CI 1.01-2.02). On crude analysis, women who presented a restricted dietary pattern tended to have a lower prevalence of generalized anxiety than those who presented a varied pattern of eating, but the associations were not statistically significant.

Table 3 presents the associations between consumption of various food groups in terms of their recommended

Table 1 Basic characteristics of the study sample stratified by presence of mental disorders (PRIME-MD) among pregnant women attending primary healthcare units in Southern Brazil, 2007

Characteristics	Total sample (n=712)	Major depressive disorder (n=154)	p-value*	Generalized anxiety disorder (n=141)	p-value*
Age (years), mean (SD)	24.6 (6.4)	23.6 (6.1)	0.07	25.9 (6.2)	< 0.01
Monthly family income (× MW†), mean (SD)	2.55 (1.9)	2.4 (1.7)	0.41	2.8 (2.0)	0.85
Years of schooling			0.25		0.42
⩽ 4	98 (13.8)	24 (24.5)		24 (24.5)	
5-8	352 (49.4)	82 (23.3)		69 (19.6)	
⩾ 9	262 (36.8)	48 (18.3)		48 (18.3)	
Living with a partner			0.86		0.30
Yes	563 (79.1)	121 (21.5)		116 (20.6)	
No	149 (20.9)	33 (22.1)		25 (16.8)	
Work and/or study			0.34		0.09
Yes	292 (41.0)	58 (19.9)		49 (16.8)	
No	420 (59.0)	96 (22.9)		92 (21.9)	
Number of people in household			0.03		0.18
⩽ 2	171 (24.0)	33 (19.3)		27 (15.8)	
3-4	313 (44.0)	58 (18.5)		61 (19.5)	
⩾ 5	228 (32.0)	63 (27.6)		53 (23.2)	
Municipality of residence			< 0.01		0.79
Bento Gonçalves	311 (43.7)	47 (15.1)		63 (20.3)	
Porto Alegre	401 (56.3)	107 (26.7)		78 (19.5)	
Number of children			0.86		< 0.01
None	321 (45.1)	69 (21.5)		48 (15.0)	
1	194 (27.2)	40 (20.6)		37 (19.1)	
⩾ 2	197 (27.7)	45 (22.8)		56 (28.4)	
Pre-pregnancy BMI (kg/m^2)‡			0.48		0.39
< 18.5	28 (3.9)	6 (21.4)		2 (7.1)	
18.5-24.9	429 (60.3)	83 (19.3)		86 (20.0)	
25-29.9	152 (21.3)	38 (25.0)		32 (21.1)	
> 30	81 (11.4)	19 (23.5)		16 (19.8)	
Smoking during pregnancy			0.13		0.42
Yes	149 (20.9)	39 (26.2)		33 (22.1)	
No	563 (79.1)	115 (20.4)		108 (19.2)	
Alcohol use during pregnancy			0.11		0.70
Yes	118 (16.6)	32 (27.1)		25 (21.2)	
No	594 (83.4)	122 (20.5)		116 (19.5)	
Planned pregnancy			0.22		0.19
Yes	266 (37.4)	51 (19.2)		46 (17.3)	
No	446 (62.6)	103 (23.1)		95 (21.3)	
Chronic disease			0.08		0.02
Yes	115 (16.2)	32 (27.8)		32 (27.8)	
No	597 (83.8)	122 (20.4)		109 (18.3)	
Violence in pregnancy			< 0.01		< 0.01
Yes	124 (17.4)	44 (35.5)		56 (45.2)	
No	588 (82.6)	110 (18.7)		85 (14.5)	

Data presented as n (%), unless otherwise specified.
BMI = body mass index; MW = minimum wage; PRIME-MD = Primary Care Evaluation of Mental Disorders; SD = standard deviation.
* Pearson's χ^2 test.
† Minimum wage approximately equivalent to US$ 175/month.
‡ According to the U.S. Institute of Medicine (2009) classification.

intake and two mental disorders. With respect to major depressive disorder, low consumption of fruits and high consumption of sweets/sugars were associated with higher prevalence. After adjusting for age, municipality of residence, and violence in pregnancy, associations remained statistically significant, with PR 1.43 (95%CI 1.04-1.95) and 1.91 (95%CI 1.19-3.07), respectively. With respect to anxiety, no associations were found for low

Table 2 Association between dietary patterns and mental disorders (PRIME-MD) in pregnant women attending primary healthcare units in Southern Brazil, 2007

	Crude			Adjusted*		
	PR	95%CI	p-value	PR	95%CI	p-value
Major depressive disorder (n=154)						
Dietary pattern						
Varied	1.00			1.00		
Restricted	1.31	0.89-1.93	0.17	1.25	0.86-1.84	0.24
Common-Brazilian	1.62	1.15-2.30	< 0.01	1.43	1.01-2.02	0.04
Generalized anxiety disorder (n=141)						
Dietary pattern						
Varied	1.00			1.00		
Restricted	0.67	0.44-1.02	0.06	1.10	0.66-1.88	0.70
Common-Brazilian	1.17	0.84-1.62	0.35	1.24	0.85-1.81	0.25

95%CI = 95% confidence interval; PR = prevalence ratio; PRIME-MD = Primary Care Evaluation of Mental Disorders.
* Major depressive disorder: adjusted for municipality of residence, violence in pregnancy, and monthly family income. Generalized anxiety disorder: adjusted for age and violence in pregnancy.

Table 3 Association between food intake groups and mental disorders (PRIME-MD) in pregnant women attending primary healthcare units in Southern Brazil, 2007

	Crude			Adjusted*		
	PR	95%CI	p-value	PR	95%CI	p-value
Major depressive disorder (n=154)						
Fruits						
Low consumption	1.56	1.13-2.16	< 0.01	1.43	1.04-1.95	0.03
High consumption	1.32	0.93-1.89	0.12	1.36	0.95-1.94	0.08
Recommended consumption	1.00			1.00		
Beans						
Low consumption	1.35	0.97-1.88	0.07	0.95	0.67-1.36	0.79
High consumption	0.95	0.64-1.41	0.81	0.73	0.52-1.03	0.07
Recommended consumption	1.00					
Sweets and sugars						
High consumption	2.19	1.37-3.51	< 0.01	1.91	1.19-3.07	0.01
Low consumption	1.00			1.00		
Generalized anxiety disorder (n=141)						
Fruits						
Low consumption	1.08	0.75-1.54	0.68	0.92	0.67-1.29	0.65
High consumption	1.31	0.91-1.89	0.15	1.13	0.79-1.60	0.50
Recommended consumption	1.00			1.00		
Beans						
Low consumption	1.35	0.97-1.89	0.07	1.40	1.01-1.93	0.04
High consumption	0.95	0.64-1.41	0.81	0.86	0.59-1.25	0.42
Recommended consumption	1.00			1.00		
Sweets and sugars						
High consumption	1.37	0.90-2.08	0.15	1.17	0.68-1.67	0.76
Low consumption	1.00			1.00		

95%CI = 95% confidence interval; PR = prevalence ratio; PRIME-MD = Primary Care Evaluation of Mental Disorders.
* Major depressive disorder: adjusted for age, municipality of residence, and violence in pregnancy. Generalized anxiety disorder: adjusted for age and violence in pregnancy.

consumption of fruits and high intake of sweets/sugars in both crude and adjusted analyses. We found that low consumption of beans, in adjusted analysis, was associated with a 40% higher prevalence of anxiety when compared to recommended consumption (PR 1.40; 95% CI 1.01-1.93).

Discussion

In our sample, consumption of the common-Brazilian eating pattern was associated with the highest prevalence of depression. Higher intake of sweets and sugars and low intake of fruit were also associated with depression, even after adjustment in the multivariate model. Generalized anxiety was not associated with any of the three dietary patterns, but was associated with low intake of beans.

Foods such as rice, pasta, French bread, beans, boneless beef or chicken, eggs, margarine, coffee with sugar, and artificial juices constitute the common-Brazilian dietary pattern. In a previous study with the same sample of the ECCAGe,[18] this pattern was observed in women with lower income and less education. We also found that 84.3% of women with this dietary pattern were overweight. These characteristics indicated that such women

may be at greater risk of depressive disorder when compared to those with a higher level of education, adequate weight, and healthier dietary pattern.

The common-Brazilian dietary pattern, as well as the high-glycemic load western pattern reported in other studies,[6,26] are substantially composed of foods rich in refined carbohydrates. An association between these types of foods and higher levels of C-reactive protein, a sensitive biomarker of inflammation, has been suggested.[27] Moreover, experimental studies show that a typical western diet could influence brain structure and function, deregulating the expression of a factor responsible for promoting neurogenesis and protecting neurons from oxidative stress.[28] It is believed that this factor, BDNF (brain-derived neurotrophic factor), plays a central role in depressive illness.[28] An animal study showed that mice fed a diet rich in saturated fat and refined sugar developed a rapid decline in BDNF expression, with an independent effect of obesity and nutritional deficit.[29] Ongoing research into the hypothesis of diet being an influential determinant of psychiatric status, by modulating the expression of BDNF,[28,29] may help elucidate the role of this pathway.

Inflammatory processes also seem to play a role in the etiology of depressive disorders,[30] just as elevated levels of proinflammatory cytokines are of central importance in other highly prevalent chronic diseases, such as cardiovascular disease, diabetes, and cancer.[30] Nowlin et al. showed that adherence to a Mediterranean diet rich in vegetables, fruits, beans, whole grains, low-fat foods, and low refined carbohydrates correlated with low levels of inflammatory markers.[31] Other evidence suggests that high adherence to a Mediterranean diet may prevent the development of depressive disorders in adults.[32] Although studies have suggested that heart disease and inflammation are involved in the pathogenesis of depression,[33] more research is needed to improve understanding of the mechanisms linking diet, inflammation, and mental disorders.

We also need to consider the possibility that the common-Brazilian dietary pattern represents a risk marker, being associated with an increase in the occurrence of disease, but not necessarily a causal factor. Under this hypothesis, the common-Brazilian pattern could represent one of the components (low-cost diet) of an unfavorable socioeconomic context that determines the occurrence of mental disorders.

We also observed that pregnant women who reported low consumption of fruit and high consumption of sweets and sugars had a higher prevalence of depression. The associations remained significant after adjustment for potential confounding variables such as demographic, socioeconomic, and health parameters. Regarding fruit intake by pregnant women, a similar finding was reported in a Canadian study, which showed that adequate fruit consumption was significantly associated with lower odds of depression, anguish, and distress in adults.[34] The literature has shown that a diet rich in antioxidant compounds derived from fruits and vegetables seems to be effective in the reduction or prevention of pathophysiological and cognitive alterations.[34] Compounds such as vitamin C, vitamin E, carotenoids, flavonoids, zinc, magnesium, iron, and folic acid have been reported by many authors as dietary factors that may modulate the risk of neural-structural and cognitive alterations in the brain, showing strong biological plausibility in affecting the brain function and modulation of the mood. Recent findings suggest that a lack of dietary fiber, important in modulating gut microbiota, leads to a substantial loss of diversity in this microbial community and influences the ability of gut bacteria to be transferred from parents to their offspring. New evidence suggests that the microbiome-gut-brain axis can modulate mood and behavior, so it is possible that gut microbiota mediates the link between diet and depressive illness.[35]

Westover & Marangell conducted a cross-sectional study in six countries that demonstrated a positive correlation between sugar intake and annual rate of depression.[36] These results corroborate our findings, in that women who reported a high consumption of sweets and sugars had a higher prevalence of major depression. Our results are also consistent with previous studies that demonstrated an apparent association between a diet high in sugar-rich desserts, chocolates, and refined grains and depressive disorders. Similar results were also observed in non-pregnant Australian women following a western dietary pattern.[11,37] Conversely, some authors propose that the desire for these specific foods (sweets, refined food products, and those high in fat) would be associated with improved mood, i.e., women with mental disorders could experience extreme episodes of craving for sugary foods and those that are high in fats as a means of achieving relief from unpleasant affective states.[38]

Regarding the outcome of generalized anxiety disorder, there was no association with the dietary patterns; however, we observed that women who reported below-recommended intake of beans had a higher prevalence of anxiety compared to those who had adequate consumption of this food group. Our results are in accordance with a study that showed that moderate consumption of beans by women in the perimenopausal period was a protective factor against mental disorders.[39] The 2008/2009 Household Budget Survey indicated a decrease in consumption of foods that are considered healthy and popular in Brazilian culture, such as beans, fruits and vegetables, in parallel with an increase in consumption of processed foods, sausages, soft drinks, and sweets. These findings reveal an inadequate dietary pattern, low in essential micronutrients and high in energy density.[40] In addition, a plausible mechanism that may elucidate our findings is that beans are an important source of iron; when stores of this mineral are depleted, the activity of the enzymes required for synthesis, function, and degradation of dopamine, serotonin, and norepinephrine – neurotransmitters that modulate mood – can be impaired.[41]

The limitations of the present study include its cross-sectional design, which prevents conclusive inferences about the direction of the relationship between diet and mental health. Changes in appetite are common characteristics of depressive illness. Therefore, a low-quality diet can be the result of the depressive disorder rather than a causal factor. We cannot disregard the possibility

of type I error, i.e., in association of age, pre-pregnancy body mass index, city of residence, and violence in pregnancy; however, other significant associations are plausible.

Another limitation is that PRIME-MD was applied by interviewers who were trained to do so, but were not qualified to carry out clinical assessment of participants' mental state. This may have resulted in overestimation of the prevalence of the outcomes of interest.

Regarding assessment of food consumption, the poor capability of the FFQ to estimate the actual ingestion is one of the inherent limitations of the instrument. Another limiting factor is the lack of information on women's physical activity, considering that physical exercise may be related with mental health improvement.[5] Despite the attempt to adjust for potential confounding variables, residual effects cannot be discarded.

Our results cannot be generalized to the entire universe of Brazilian pregnant women. However, our sample was representative of the population of pregnant women seeking prenatal care in the Brazilian Unified Health System.

The maintenance of healthy eating habits, including intake of fruits, vegetables, and beans, can be associated with a lower prevalence of common mental disorders during pregnancy. If not identified and treated, these disorders can lead to psychiatric issues in the postpartum period, impairing the quality of life of the mother and the maintenance of breastfeeding. Pregnancy is a crucial moment for identification of high-risk groups and an ideal period for nutritional counseling, since changes in diet, eating behavior, and lifestyle are usually better accepted at this time. The promotion of healthier living habits among pregnant women may be passed on to the child, with positive consequences potentially persisting into adulthood.

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Disclosure

The authors report no conflicts of interest.

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