


Perceived Stress and Depressive Symptoms Are Associated With Emotional Eating but Not Nutritional Intake During Pregnancy: A Prospective Cohort Study

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Introduction: Pregnancy is a major life event during which women may experience increased psychological distress and changes in eating behaviors. However, few studies have investigated the influence of psychological distress on pregnant women's eating behaviors. The primary objective of this prospective study was to examine the associations of changes in perceived stress and depressive symptoms with emotional eating and nutritional intake during pregnancy. In addition, we examined the direct and moderating effects of perceived social support.

Methods: Participants were racially diverse pregnant women (14-42 years) from 4 clinical sites in Detroit, MI, and Nashville, TN (N = 678). We used multiple linear and logistic regression models to determine if changes in stress and depressive symptoms across pregnancy were associated with changes in emotional eating and nutritional intake. We examined residualized change in stress and depressive symptoms from second to third trimester of pregnancy; positive residualized change scores indicated increased stress and depressive symptoms.

Results: Participants showed significant improvement in emotional eating and nutritional intake from second to third trimester of pregnancy ($P < .001$ for both). At second trimester, higher depressive symptoms were associated with a greater likelihood of emotional eating ($P < .001$) and worse nutritional intake ($P = .044$) at third trimester. Increased stress and depressive symptoms during pregnancy were both associated with increased risk, whereas increased perceived social support reduced risk of emotional eating at third trimester (stress: adjusted odds ratio [AOR], 1.17; 95% CI, 1.08-1.26; depressive symptoms: AOR, 1.05; 95% CI, 1.01-1.08; social support: AOR, 0.93; 95% CI, 0.88-0.99). None were associated with changes in nutritional intake. Perceived social support did not show any moderating effects.

Discussion: Increased psychological distress during pregnancy may increase emotional eating. Efforts to promote healthy eating behaviors among pregnant women should consider and address mental health.

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Keywords: cohort studies, depressive symptoms, emotional eating, nutritional intake, pregnancy, stress

INTRODUCTION

Pregnancy is a major life event during which women may experience increased psychological distress. Prenatal maternal stress and depression affect as many as 52.9% and 25.0% of pregnant women, respectively.^{1,2} Some women experience their first depressive episode during pregnancy, whereas those with a history of clinical depression are more likely to experience recurrence, continuation, or exacerbation.^{3,4} Levels of psychological distress can also fluctuate over the

course of a woman's pregnancy. Previous studies indicate that women in their third trimester were less likely to report perceived stress than those in their second trimester⁵ and that depressive symptoms decreased throughout pregnancy.⁶ Psychological distress has been associated with a variety of adverse pregnancy outcomes, such as preeclampsia, spontaneous preterm birth, low birth weight, and neonatal morbidity.^{7,8}

In addition to fluctuations in mood throughout pregnancy, eating challenges may present themselves. Many pregnant women struggle to adhere to recommended guidelines and present with nutritional deficits^{9,10} and excessive gestational weight gain.^{11,12} Studies have shown that perceived stress and depressive symptoms are associated with poor nutritional intake during pregnancy.^{13,14} Emotional eating is characterized by excessive eating in response to negative emotions, such as anxiety, fear, and anger.¹⁵ It often manifests as a craving for high-calorie or high-carbohydrate foods with minimal nutritional value. This could lead to excess gestational weight gain or disruption of weight-loss efforts.^{16,17} In addition, major life events can trigger negative emotions that lead to emotional eating. One cross-sectional study conducted among pregnant women in China during the COVID-19 pandemic found that those on lockdown tended to snack more and consumed higher amounts of grains and fats, leading to excess gestational weight gain.¹⁸ It is possible that these

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Quick Points

- ◆ Higher depressive symptoms at second trimester were associated with a greater likelihood of emotional eating and worse nutritional intake at third trimester.
- ◆ Increased perceived stress and depressive symptoms predict an increased likelihood of emotional eating at third trimester of pregnancy but not worsening of nutritional intake between second and third trimesters.
- ◆ Increased perceived social support reduced the risk of emotional eating at third trimester but did not buffer the adverse effects of increased psychological distress on emotional eating during pregnancy.
- ◆ Interventions to improve eating behaviors during pregnancy may benefit from addressing mental health.

pregnant women may have experienced psychological distress attributed to the pandemic lockdown and that emotional eating may have been their coping response. Emotional eating is well characterized among the general population¹⁹ but is an understudied eating phenotype among pregnant women.

Social support may be a key buffer of potential links between psychosocial stressors and concerning eating behaviors during pregnancy. Social support is a multidimensional construct, encompassing emotional, instrumental, and informational assistance received from others, and may protect mental health both directly through the benefits of social relationships and indirectly as a buffer against stressful circumstances.²⁰ Research has highlighted the importance of social support from significant others, family members, and friends to improve dietary quality among adolescents and adults in the general population,^{21,22} as well as pregnant women.^{23–25} Among pregnant women with low income, those with high levels of perceived social support had a healthier diet during the first trimester of pregnancy than those with lower levels of support,²³ and those who received more partner support consumed more vegetables than those with little partner support.²⁴ Likewise, emotional support from partners and female relatives has been shown to be important for Latina women to maintain a healthy diet during pregnancy.²⁵ No studies have assessed the influence of social support on emotional eating during pregnancy.

Most research on the impacts of psychological distress on eating behavior has focused on the general population. The few studies conducted among pregnant women are predominantly descriptive and cross-sectional in nature. We found only one prospective study, which suggests that greater depressive symptoms and perceived stress as well as poorer sleep quality are associated with greater self-reported reward-related eating such as addictive-like eating, hedonic hunger (psychological appetitive response to environmental food cues), and cravings during pregnancy and postpartum.²⁶ Although social support can have salutary influences on mental health and eating behaviors, it is not typically included in studies assessing these associations.

To address the gaps in the literature, we aimed to prospectively examine (1) the association between changes in psychological distress (ie, perceived stress and depressive symptoms) and eating behaviors (ie, emotional eating and nutritional intake) among a diverse sample of pregnant women enrolled in group prenatal care and (2) whether perceived social support moderates these associations. We hypothesized that increases

in perceived stress and depressive symptoms would be associated with greater risk of emotional eating and worsening nutritional intake during pregnancy and that increases in perceived social support would buffer the adverse effects of psychological distress on emotional eating and nutritional intake among pregnant women.

METHODS

Procedure

We analyzed data from a prospective cohort study of Expect With Me, an innovative model of group prenatal care aimed to improve perinatal outcomes.²⁷ Between 2014 and 2017, women attending prenatal care at 4 clinical sites in Detroit, MI, and Nashville, TN, were referred by either research staff or health care providers to participate in the study. We selected the clinical sites through convenience sampling using the following criteria: sufficient number of persons from diverse populations who are at risk for adverse birth outcomes, commitment to integrating group prenatal care into practice, and willingness to offer Expect With Me. We conducted site capacity building by providing training for group facilitation and curriculum development. We equipped each site with tools such as a field guide, a facilitation guide, and information technology platform access.

We recruited women prospectively from 14 weeks' gestation (after initial individual assessment) and followed them until one year postpartum. Inclusion criteria were less than 24 weeks' gestation at baseline, absence of serious health condition requiring individualized care, English- or Spanish-speaking ability, and voluntary participation. We categorized women as having received group prenatal care if they attended at least one group prenatal care visit.

We conducted a baseline survey during women's second trimester of pregnancy (14–24 weeks' gestation) and follow-up surveys during their third trimester (32–42 weeks' gestation), at childbirth, and about 6 and 12 months postpartum (5–8 months and 11–14 months, respectively). We collected data on women's sociodemographic characteristics as part of the baseline survey and data on various psychosocial factors and health behaviors at multiple time points. Women completed the surveys online in either English or Spanish. We obtained research ethics approval from institutional review boards at Yale, Vanderbilt, and Wayne State Universities. Women gave their written informed consent before data collection and were compensated \$20 for each interview.

Analyses for this article used data collected during the second and third trimesters of pregnancy. The cohort is limited to women with complete data for the exposure and outcome variables of interest, resulting in a sample size of 678. Compared with women included in this analytic sample, those excluded were more likely to be Black, to be younger, and to have had higher levels of depressive symptoms ($P < .05$). There were no other significant sociodemographic or clinical differences.

Variables and Measurements

Outcome Variables: Emotional Eating and Nutritional Intake

We measured emotional eating by asking women, "How often do you eat to forget your worries or to cheer yourself up when you are in a bad mood?" with responses ranging from 1 (never) to 5 (always). Women who answered "sometimes," "often," or "always" were categorized as having engaged in emotional eating, whereas those who answered "rarely" or "never" were categorized as eating in response to physical hunger.

We measured nutritional intake using the 8-item Starting the Conversation food frequency instrument. This is a simplified screening scale designed for nondietitians in clinical practices for assessment and counseling.²⁸ The scale was derived from a validated 54-item scale²⁹ and identifies dietary patterns. Items include, for example, "During the past few months, how many times a week did you eat fast food meals or snacks?" We added item scores to create a summary score (range 0-16), with lower scores reflecting a healthier diet and higher scores reflecting worse nutritional intake. The scale is robust across various participant characteristics, stable over time, and sensitive to treatment.²⁸ Reliability was acceptable: Cronbach's alpha in this study was .72.

Exposure Variables: Psychosocial Factors

The Perceived Stress Scale was designed to measure the degree to which situations in one's life are appraised as stressful.³⁰ We used the abridged 4-item version of the original 14-item scale. This version makes repeated measures of perceived stress feasible in large samples. Scores range from 4 to 20, with higher scores indicating higher levels of perceived stress. Cronbach's alpha for the abridged version of the scale in this study was .65, indicating acceptable reliability.

The 20-item Center for Epidemiologic Studies Depression Scale assesses the current depressive symptomatology among the general population.³¹ Consistent with previous studies targeting pregnant women,^{32,33} we dropped 5 somatic items influenced by pregnancy (eg, poor appetite, trouble concentrating, low effort, poor sleep, lack of motivation). Women rated how often during the past week they experienced affective components of depressed mood (eg, feelings of loneliness, failure, hopelessness) on a 4-point Likert scale, ranging from none of the time (0) to all of the time (3). We calculated summary scores (range 0-45), with higher scores indicating greater depressive symptoms. Reliability was good: Cronbach's alpha in this study was 0.87.

We used the abridged version of the Multidimensional Scale of Perceived Social Support³⁴ to measure women's per-

ceived social support. We used 4 items and a 5-point Likert scale, ranging from strongly disagree (1) to strongly agree (5). We calculated summary scores (range 4-20), with higher scores indicating greater perceived social support. Cronbach's alpha in this study was .88, indicating good reliability.

Control Variables: Participant Characteristics, Group Prenatal Care Session Attendance, and Study Site

We controlled for variables hypothesized to be causally related to the exposures and outcomes of interest and considered them as potential confounders based on previous research.³⁵ We also controlled for women's self-reported sociodemographic information, including age, race, education, employment, relationship status, and insurance status. We treated women's age as a continuous variable. Race was categorized as Black, White, and other. We grouped educational attainment into less than high school, high school graduate or equivalent, and some college or higher education. Employment was dichotomized as either employed or unemployed. Relationship status was classified as committed (ie, married or not married, but living with a partner) or noncommitted (ie, single, never married, separated, or divorced). Insurance status was categorized as private, public or Medicaid, and no insurance. We calculated women's body mass index (BMI) based on self-reported weight and height prior to pregnancy. We also controlled for study site and group prenatal care session attendance to account for potential confounding bias and the presence of effect modification or interaction.

Data Analysis

Using descriptive statistics, we summarized participants' characteristics. We used paired *t* tests and chi-square tests to compare data from the second and third trimesters of pregnancy. We performed multiple linear and logistic regression models to examine the associations between exposure and outcome variables. We created separate models to assess associations of psychosocial factors during the second and third trimesters with third-trimester outcomes. We also created models to assess associations between the residualized change scores in psychosocial factors from second to third trimester and third-trimester outcomes. The residualized change scores represent increases in perceived stress, depressive symptoms, and social support from second to third trimester. We computed unstandardized residuals by regressing third-trimester perceived stress, depressive symptoms, and social support on their second-trimester data. Positive residualized change scores denote increased perceived stress, depressive symptoms, and social support from second to third trimester. Calculating residual scores is a more appropriate method of measuring change in constructs over time than post-pre change scores.³⁶ Residual score models assume that posttest scores are a linear function of pretest scores and that this function is not necessarily one.^{36,37} All models controlled for second-trimester outcome data, participant characteristics, group prenatal care session attendance, and study site. We also added separate models for interaction effects to explore the moderating role of social support between perceived stress/depressive symptoms and emotional eating/nutritional intake. We conducted

Table 1. Characteristics of Pregnant Women (N = 678)	
Characteristics	Value
Age, mean (SD), y	24.9 (5.3)
Age, range, y	14-42
Race n (%)	
White	162 (23.9)
Black	441 (65.0)
Other ^a	75 (11.1)
Education n (%)	
Less than high school	98 (14.4)
High school graduate/GED	273 (40.3)
Some college or higher education	307 (45.3)
Employment n (%)	
Employed	361 (53.2)
Unemployed	317 (46.8)
Relationship status n (%)	
Single, never married/separated/divorced	425 (62.7)
Married/not married, but living with partner	253 (37.3)
Insurance status n (%)	
Private	197 (29.1)
Public/Medicaid	455 (67.1)
No insurance	26 (3.8)
Prepregnancy BMI n (%)	
Underweight	25 (3.7)
Healthy	261 (38.5)
Overweight	155 (22.9)
Obese	237 (34.9)

Abbreviations: BMI, body mass index; GED, General Educational Development. ^aIncluded Asian, Native American, and multiple races, among others.

all statistical analyses using Stata 17.0 (StataCorp, College Station, TX) and set the significance level to .05 (2-tailed).

RESULTS

Characteristics of Participants

Table 1 shows the participants' characteristics. At second trimester, women had a mean (SD) age of 24.9 (5.3) years. Of 678 women, 441 (65.0%) self-identified as Black, 162 (23.9%) as White, and 75 (11.1%) as another race. Nearly half (45.3%)

attended some college or higher education, and more than half (53.2%) were employed. Most (62.7%) were in noncommitted relationships and used public insurance or Medicaid as insurance (67.1%). A little over one-third (34.9%) and nearly a quarter (22.9%) of participants had an obese or overweight BMI prior to pregnancy, respectively.

Table 2 compares exposure and outcome variables at the second and third trimesters of pregnancy. Women showed significant improvement in emotional eating (170 vs 150; $P < .001$) and nutritional intake (8.18 vs 7.76; $P < .001$) from second to third trimester. On the other hand, perceived stress, depressive symptoms, and perceived social support did not show statistically significant differences from second to third trimester.

Association of Psychosocial Factors With Emotional Eating and Nutritional Intake

Table 3 shows regression models predicting pregnant women's emotional eating and nutritional intake at third trimester. After controlling for covariates and potential confounders, depressive symptoms during the second trimester of pregnancy were associated with worse nutritional intake at third trimester (unstandardized coefficient, 0.02; 95% CI, 0.00-0.05). Both perceived stress (second-trimester adjusted odds ratio [AOR], 1.15; 95% CI, 1.07-1.25; third-trimester AOR, 1.21; 95% CI, 1.12-1.30) and depressive symptoms (second-trimester AOR, 1.06; 95% CI, 1.04-1.09; third-trimester AOR, 1.07; 95% CI, 1.04-1.10) were associated with higher odds of emotional eating at third trimester. When psychological distress increased from second to third trimester, there was greater likelihood of emotional eating at third trimester (greater perceived stress: AOR, 1.17; 95% CI, 1.08-1.26; greater depressive symptoms: AOR, 1.05; 95% CI, 1.01-1.08) but no greater likelihood of worsening of nutritional intake. Perceived social support at third trimester was associated with lower odds of emotional eating at third trimester (AOR, 0.93; 95% CI, 0.88-0.99), as was residualized change in perceived social support from second to third trimester (AOR, 0.93; 95% CI, 0.88-0.99). Perceived social support did not moderate the associations between psychological distress and emotional eating or nutritional intake.

DISCUSSION

Women who participated in Expect With Me group prenatal care showed significant improvement in emotional eating and

Table 2. Comparison of Exposure and Outcome Variables at Second and Third Trimesters of Pregnancy (N = 678)

Measures	Second Trimester	Third Trimester	P Value
Exposure variables			
Depressive symptoms, mean (SD)	9.24 (7.72)	8.74 (7.65)	.061
Perceived stress, mean (SD)	8.85 (2.78)	8.66 (2.99)	.099
Perceived social support, mean (SD)	17.72 (2.96)	17.58 (3.32)	.298
Outcome variables			
Nutritional intake, mean (SD) ^a	8.18 (2.68)	7.76 (2.66)	<.001
Emotional eating, n (%)	170 (25.1)	150 (22.1)	<.001

^aHigher scores in nutritional intake reflect a less healthy diet.

Table 3. Multiple Linear and Logistic Regression Models Predicting Nutritional Intake and Emotional Eating of Pregnant Women in the Third Trimester (N = 678)

Models ^a	Exposure Variable	Nutritional Intake		Emotional Eating	
		B (95% CI)	P Value	AOR (95% CI)	P Value
Model 1	Second-trimester perceived stress	0.05 (−0.01, 0.11)	.109	1.15 (1.07, 1.25)	<.001
Model 2	Third-trimester perceived stress	0.06 (−0.00, 0.12)	.052	1.21 (1.12, 1.30)	<.001
Model 3	Residualized change in perceived stress	0.05 (−0.02, 0.11)	.166	1.17 (1.08, 1.26)	<.001
Model 4	Second-trimester depressive symptoms	0.02 (0.00, 0.05)	.044	1.06 (1.04, 1.09)	<.001
Model 5	Third-trimester depressive symptoms	0.02 (−0.00, 0.05)	.061	1.07 (1.04, 1.10)	<.001
Model 6	Residualized change in depressive symptoms	0.01 (−0.01, 0.04)	.329	1.05 (1.01, 1.08)	.005
Model 7	Second-trimester perceived social support	0.01 (−0.04, 0.07)	.612	0.98 (0.91, 1.05)	.493
Model 8	Third-trimester perceived social support	0.01 (−0.04, 0.06)	.704	0.93 (0.88, 0.99)	.016
Model 9	Residualized change in perceived social support	0.01 (−0.05, 0.06)	.844	0.93 (0.88, 0.99)	.023
Model 10	Residualized change in perceived stress × residualized change in perceived social support	0.00 (−0.01, 0.02)	.619	1.00 (0.98, 1.02)	.804
Model 11	Residualized change in depressive symptoms × residualized change in perceived social support	0.00 (−0.00, 0.01)	.349	0.99 (0.99, 1.00)	.129

Abbreviations: AOR, adjusted odds ratio; B, unstandardized coefficients.

^aAll models predicted third trimester outcomes and adjusted for second-trimester nutritional intake and emotional eating, age, race, education, employment, relationship status, insurance status, body mass index group, group prenatal care session attendance, and study site.

nutritional intake from second trimester to third trimester of pregnancy. Higher depressive symptoms at second trimester were associated with a greater likelihood of emotional eating and worse nutritional intake at third trimester. From second to third trimester, increase in psychological distress (greater perceived stress and depressive symptoms) was associated with higher odds of emotional eating but not with worse nutritional intake at third trimester. Perceived social support was associated with lower odds of emotional eating at third trimester, but no moderating effect on the association between greater perceived stress and depressive symptoms and higher odds of emotional eating was observed in this study.

Our finding that psychological distress predicted emotional eating but not necessarily worsening nutritional intake from second to third trimester is consistent with a systematic review of the psychological determinants of emotional eating behaviors among Black women in the United States.³⁸ However, this review included only 2 prospective studies^{39,40} and focused mainly on the impact of perceived stress on emotional eating. A population-based prospective study conducted in Finland likewise showed a positive association between depressive symptoms and emotional eating.³⁵ Our study is the first to demonstrate this among pregnant women and suggests that efforts to promote healthy eating behaviors during pregnancy would benefit from addressing mental health.

At second trimester, higher depressive symptoms were associated with worse nutritional intake, which is consistent with the literature.^{13,14} The lack of association between residualized change in depressive symptoms and nutritional intake suggests potential confounding. In this study, more than half of the women (57.8%) had an overweight or obese BMI. It is possible that women with higher BMIs might have received more individual counseling sessions at the beginning of pregnancy to monitor their health and food intake than those whose BMIs fall within the healthy weight range. However,

these data are unavailable, and we were only able to control for group prenatal care session attendance in our analyses.

The association between perceived stress, depressive symptoms, and emotional eating may be attributed to biological and social mechanisms. Emotion dysregulation and increased neuropeptide Y, an anxiolytic peptide that increases in response to stress, are both associated with greater emotional eating.^{41,42} When experiencing stress, people are more likely to eat highly palatable food, which has properties that promote dependence because it can activate the brain reward system through increased blood glucose and adiposity and possibly gut signals.^{41,43} In addition, based on affect regulation theories, people tend to eat more when depressed to alleviate negative feelings.^{44,45} Thus, emotional eating is an attempt to reduce awareness of distress; this method may help in dealing with stressful events but may become a maladaptive coping response in the long run. Another possible mechanism is the association between depression and alexithymia. Alexithymia is the inability to recognize or describe feelings, which may affect emotional eating.^{46,47} Individuals with eating disorders have elevated levels of alexithymia.⁴⁷ A number of theoretical models have suggested that these individuals may find emotions unacceptable and/or frightening and may use their eating disorder symptoms (ie, bingeing, restricting food intake, purging) as a way to avoid or cope with their feelings.⁴⁷ A study among nonpregnant Dutch women found that alexithymia mediates the positive association between depression and emotional eating.⁴⁶ In the United States, women at high risk for depression during pregnancy had higher levels of alexithymia than those at low risk.⁴⁸ However, the association between alexithymia and emotional eating has not yet been examined during pregnancy.

Women who had greater perceived social support had a lower risk for emotional eating. In the Expect With Me group prenatal care setting, women received support from their

significant others, health care providers, and peers. For instance, facilitated discussions allowed women to provide and receive peer support while gaining knowledge and skills for pregnancy, childbirth, and parenting.²⁷ They may also bring their partner, family member, or another support person to accompany them in their pregnancy journey.²⁷ Our finding highlights the importance of social support networks in promoting healthy behaviors in pregnancy, including reduced emotional eating. According to previous studies, other positive effects of perceived social support on pregnancy were reduced smoking, improved prenatal care, and higher maternal quality of life.^{49,50} We further explored its moderating effect; however, perceived social support did not buffer the negative influence of psychological distress on emotional eating and nutritional intake over time among pregnant women in this study.

This study has several limitations. First, the measures used are subject to self-report bias. Emotional eating was assessed using a single-item question, which could limit variability in women's responses. The use of a validated emotional eating scale is suggested for future studies. In addition, nutritional intake was based on self-report, and the scale used did not assess amount or nutritional composition of food consumed. Second, data were unavailable regarding the prior history of depression, eating disorder, alexithymia, or other sociocultural factors that may increase the risk for emotional eating or affect nutritional intake. Third, missing data and nonresponse could lead to information bias. Women excluded from this study had significantly higher levels of depressive symptoms; hence, our findings are likely conservative estimates. Fourth, women self-selected to participate in the group rather than traditional prenatal care; thus, the sample may not represent all pregnant women at risk for psychological distress and unhealthy eating behaviors. There may be an inherent social support system among women who chose group prenatal care. The lack of a control group limited our analyses to only those who attended the group prenatal care sessions. Finally, our findings may not reflect clinical significance due to small treatment effect values.

Despite these limitations, this study has several strengths. The prospective design examined changes in exposures and outcomes across the prenatal period. Thus, it provides evidence for a temporal relationship between the variables of interest. This is the first prospective cohort study that examined the effect of psychological distress on emotional eating and nutritional intake during pregnancy and investigated the moderating role of perceived social support. Furthermore, we used a large, diverse sample of women, measured and controlled for covariates and confounders, and used validated measures of perceived stress, depressive symptoms, and nutritional intake. All of these strengthen the internal validity of our findings.

CONCLUSIONS

Higher depressive symptoms at second trimester were associated with less healthy eating behaviors. Increases in perceived stress and depressive symptoms between second and third trimesters predicted a greater likelihood of emotional eating during pregnancy but were not associated with worse

nutritional intake. Greater perceived social support was associated with reduced odds of emotional eating but did not buffer the adverse effects of psychological distress on emotional eating and nutritional intake during pregnancy. Understanding the impact of psychological distress on eating behaviors will broaden the clinical conversation about the benefits of screening and monitoring mental health symptoms across the prenatal period. Future research to promote healthy eating behaviors among pregnant women should focus on development of interventions that also aim to reduce psychological distress.

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CONFLICT OF INTEREST

The authors have no conflicts of interest to disclose.

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