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Relationships between stress, demographics and dietary intake behaviours among low-income pregnant women with overweight or obesity

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Abstract
Objective: To identify demographic risk factors associated with high stress and examine the relationships between levels of stress, demographics and dietary fat, fruit and vegetable intakes in low-income pregnant women with overweight or obesity.
Design: A cross-sectional study.
Setting: Participants were recruited from the Special Supplemental Nutrition Program for Women, Infants, and Children in Michigan, USA.
Participants: Participants (*n* 353) were non-Hispanic Black (black) or White (white).
Results: Women aged 35 years or older (OR = 4·09; 95 % CI 1·45, 11·51) and who had high school or less education (OR = 1·88; 95 % CI 1·22, 2·89) or were unemployed (OR = 1·89; 95 % CI 1·15, 3·12) were significantly more likely to report high stress than women who were younger, had at least some college education or were employed/homemakers. However, race and smoking status were not associated with level of stress. Women with high stress reported significantly lower fruit and vegetable intakes but not fat intake than women with low stress. Women aged 35 years or older reported significantly higher vegetable but not fat or fruit intake than women who were 18–24 years old. Black women reported significantly higher fat but not fruit or vegetable intake than white women. Education, employment and smoking status were not significantly associated with dietary intake of fat, fruits and vegetables.
Conclusions: Nutrition counselling on reducing fat and increasing fruit and vegetable intakes may consider targeting women who are black or younger or who report high stress, respectively.

Keywords
Low-income
Pregnant women
Stress
Fat intake
Fruit and vegetable intake
Obesity

In the USA, the prevalence of overweight and obesity is high in low-income women at childbearing age (50 %)[1]. About 65–85 % of women with overweight or obesity, especially those with low income, experience excessive gestational weight gain[2,3], defined as greater than the Institute of Medicine recommendations for pregnancy weight gain[4]. Excessive gestational weight gain increases the risk of numerous adverse maternal (e.g. gestational hypertension and gestational diabetes)[5] and birth outcomes (e.g. large for gestational age)[6]. Excessive gestational weight gain is also associated with less healthy eating[7–9], which has been linked to high levels of perceived psychosocial stress (high stress) in non-pregnant women[10,11].

High prenatal maternal stress ('high stress' hereafter) is highly prevalent in low-income pregnant women[12,13] and has detrimental effects on health outcomes. High stress is strongly associated with reduced birth weight[14–16], small for gestational age[17], preterm birth[16,18,19] and a variety of negative effects on fetal and early childhood development[20,21]. Fortunately, high stress is a potentially modifiable risk factor for adverse birth and child health outcomes and may be reduced through stress management. Therefore, it is critically important to identify demographic risk factors related to high stress so that stress management interventions can focus on those at risk. To our knowledge, four studies of pregnant women with all body sizes and income levels have examined the relationships between stress and demographics (e.g. age, race, education). Results of these studies have been inconsistent[12,13,22–24]. Such relationships also remain a

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gap of knowledge in low-income pregnant women with overweight or obesity.

As with stress, dietary intake during pregnancy plays an important role in maternal health outcomes. Compared with pregnant women who did not follow a prudent diet (e.g. diet low in fat and high in fruits and vegetables), pregnant women who followed such a diet had a lower risk of gestational diabetes, especially for those with overweight or obesity before pregnancy[25,26]. Similarly, following a Dietary Approaches to Stop Hypertension (DASH) diet (diet low in fat and high in fruits, vegetables and whole grains) improved pregnant women's blood glucose tolerance and lipid profile[27]. When examining a specific food group in relation to maternal health outcomes, researchers found that higher fat intake was associated with increased risk of impaired glucose tolerance and gestational diabetes[28]. Also, increased vegetable intake was associated with reduced risk of gestational diabetes[29] and pre-eclampsia[30].

Prenatal maternal dietary intake affects birth and offspring's health outcomes. While some studies found that a Western diet (diet high in saturated fat and red meats but low in fruits and vegetables) increased the risk of small for gestational age, low birth weight[31] and preterm birth[32], other studies found that a Mediterranean diet (diet low in saturated fat and high in olive oil, fruits and vegetables) decreased risk of small for gestational age[33] and preterm birth, especially for women with overweight or obesity prior to pregnancy[34–36]. Instead of investigating a dietary pattern, many studies examined the relationships between specific food groups (fat, fruit and vegetable intakes) and birth outcomes. Studies found that high fat intake during pregnancy was associated with increased neonatal gut microbiome, which is associated with obesity[37] and increased BMI and waist circumferences in offspring[38]. Other studies reported that lower fruit and vegetable intake increased risk of small for gestational age[39] and having a child with sporadic retinoblastoma[40]. Increased fruit and vegetable intake, however, may reduce the risk of small for gestational age[41].

Our review of the literature has shown that stress[14–21] and maternal dietary intake during pregnancy[25–30] affect maternal, birth and subsequent child health outcomes[38,40]. A recent systematic review on the relationship between stress and nutrition during pregnancy concluded that high stress was associated with a less healthy dietary intake (e.g. eating foods high in fat and sugar), especially for those with overweight or obesity before pregnancy. The review also suggested that more research is needed to examine the relationship between stress and dietary intake in pregnant women, because of the paucity of research conducted[42]. Similarly, the relationships between demographics and dietary intake in pregnant women remain under investigation. To promote maternal, birth and child health outcomes, it is critically important to identify the relationships between stress, demographics and dietary intake behaviours so that clinicians and researchers can tailor stress and/or nutrition counselling to specific subgroups of women. We therefore conducted a secondary analysis to identify demographic risk factors associated with high stress. We also examined the relationships between level of stress, demographics and dietary fat, fruit and vegetable intakes in low-income pregnant women with overweight or obesity.

Methods

Setting and participants

Participants were low-income pregnant women with pre-pregnancy BMI $\geq 25{\cdot}0\,kg/m^2$ calculated using self-reported height and weight. Also, participants were non-Hispanic Black ('black' hereafter) or non-Hispanic White ('white' hereafter), aged 18 years or older, and English speakers. Women were recruited via in-person invitation from four local Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) agencies in Michigan, USA. A detailed description of study participants and settings has been published elsewhere[43]. This study was conducted according to the guidelines laid down in the Declaration of Helsinki, and all procedures involving human subjects were approved by Michigan State University's Institutional Review Board. Written informed consent was obtained from all participants.

Measures

Demographics

Participants completed a pencil-and-paper survey while waiting for their WIC appointments. Demographic information included age, previous pregnancies (gravidity), race/ethnicity, education, employment and smoking status. Participants were also asked about their gestational age calculated using self-reported last menstrual period and due date.

Stress

The Perceived Stress Scale (nine items) with established validity and reliability was used to measure stress[44]. Participants were asked about their perception of stressful life situations in the past month. Responses to each item were rated on a 4-point scale (1 = 'rarely or never', 2 = 'sometimes', 3 = 'often' and 4 = 'usually or always'). Responses to the nine items were averaged to create a stress score with a higher score indicating perceived higher stress. We used a mean value of 3 as a cut-off value for high *v.* low stress.

Fat, fruit and vegetable intakes

A Rapid Food Screener was used to measure frequency of fat (seventeen items), fruit (two items) and vegetable intake (five items)[45]. This survey has established

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predictive validity assessed by comparison to a full FFQ (Spearman correlation coefficient (r) = 0·69 for total fat intake, r = 0·72 for saturated fat, r = 0·71 for fruit and vegetable servings, r = 0·62 for dietary fibre). Participants were asked about frequency of fat intake (e.g. hamburgers, fried chicken, hot dogs, pizza, French fries, ice cream) and frequency of fruit (e.g. fruit juice) and vegetable (e.g. vegetable soup, salad) intake in the past month. Responses to each fat intake item were rated on a 5-point scale that ranged from 0 ('one time per month or less') to 4 ('five or more times per week'). We summed seventeen items to create a fat intake score that ranged from 0 to 68 with a higher score indicating higher frequency of fat intake. Responses to each fruit and vegetable intake item were rated on a 6-point scale that ranged from 0 ('less than one time per week') to 5 ('two or more times a day'). Responses to fruit intake items were summed to create a score that ranged from 0 to 10 with a higher score indicating higher frequency of fruit intake. Responses to vegetable intake items were summed to create a score that ranged from 0 to 25 with a higher score indicating higher frequency of vegetable intake. For brevity, in the remainder of the paper we refer to frequency of fat intake as 'fat intake' and frequency of fruit and vegetable intake as 'fruit and vegetable intake'.

Table 1 Characteristics of the sample of low-income pregnant women with overweight or obesity (*n* 353) recruited from four local Special Supplemental Nutrition Program for Women, Infants, and Children agencies in Michigan, USA, May–August 2010

Characteristic	*n*	%
Trimester		
1st	124	35·1
2nd	121	34·3
Primigravida		
Yes	114	32·3
No	239	67·7
Age (years)		
18–24	173	49·0
25–34	157	44·5
35–46	23	6·5
Race/ethnicity		
Non-Hispanic White	203	57·5
Non-Hispanic Black	150	42·5
Education		
8th grade or less	5	1·4
Some high school	46	13·0
High-school graduate	87	24·6
Some college or technical school	176	49·9
College graduate or higher	39	11·0
Employment status		
Full-time	57	16·1
Part-time	71	20·1
Unemployed	117	33·1
Homemaker	43	12·2
Self-employed	11	3·1
Student	43	12·2
Other	11	3·1
Smoking status		
Never smoked	168	47·6
Smoked, but quit	136	38·5
Smoker	49	13·9
BMI		
Overweight (25·0–29·9 kg/m^2)	151	42·8
Mild obese (30·0–34·9 kg/m^2)	109	30·9
Moderate obese (35·0–39·9 kg/m^2)	50	14·2
Severe obese (≥40·0 kg/m^2)	43	12·2

Descriptive analysis was performed.

Statistical analysis

Descriptive statistics were performed to summarize the sample characteristics as well as the proportion of women reporting high stress and the distribution (mean and SD) of measures on fat, fruit and vegetable intakes, stratified by sample characteristics. The χ^2 test was used to examine the bivariate associations of sample characteristics with prevalence of high stress. ANOVA was used to examine the bivariate associations of sample characteristics with fat, fruit and vegetable intakes. In addition to statistical significance, we reported effect sizes of *post hoc* between-group comparisons from the bivariate tests using OR for the binary outcome (stress, high *v.* low) and Cohen's d for continuous outcomes (fat, fruit and vegetable intakes). We used multiple linear regression models to examine the adjusted relationships between levels of stress and demographics with dietary fat, fruit and vegetable intakes. The adjusted covariates in the multiple linear regression models were variables significantly associated with either stress or dietary intake in the bivariate tests, including trimester, gravidity, age, race, education, employment and smoking status. The statistical software package SAS version 9.4 was used for all analyses.

Results

The sample consisted of 353 pregnant women with overweight or obesity (Table 1). The mean age of the study sample was 25·7 (SD 5·5) years. The mean pre-pregnancy BMI was 32·4 (SD 6·1) kg/m^2. Participants were evenly divided among three trimesters. Most women were multigravida, under 35 years old, white, educated beyond high school, employed full- or part-time, non-smokers and obese.

Table 2 shows demographic risk factors associated with high stress. Of the sample, 45 % reported high stress. Women who were at least 35 years old (OR = 4·09; 95 % CI 1·45, 11·51), had high school or less education (OR = 1·88; 95 % CI 1·22, 2·89) or were unemployed (OR = 1·89, 95 % CI 1·15, 3·12) were significantly more likely to report high stress than women who were younger, had at least some college education or were employed/homemakers. No significant relationships were found between race, smoking status and stress.

Table 3 summarizes mean fat, fruit and vegetable intakes by level of stress and sample characteristics and their bivariate associations. Table 4 presents the adjusted relationships of level of stress and demographics with dietary intakes of fat, fruits and vegetables.

Table 2 Subgroups of low-income pregnant women with overweight or obesity and with high stress (*n* 353) recruited from four local Special Supplemental Nutrition Program for Women, Infants, and Children agencies in Michigan, USA, May–August 2010

Characteristic	High stress (%)	OR of having high stress	95 % CI	*P* value
All participants	44·6			
Age (years)				0·006
18–24	47·4	Reference		
25–34	42·7	0·85	0·55, 1·31	
35–46	78·3	4·09	1·45, 11·51	
Race/ethnicity				0·455
Non-Hispanic White	45·5	Reference		
Non-Hispanic Black	49·7	1·18	0·77, 1·79	
Education				0·005
Some college/technical school or higher	40·9	Reference		
High-school graduate or less	57·4	1·88	1·22, 2·89	
Employment status				0·005
Employed	43·5	Reference		
Unemployed	59·5	1·89	1·15, 3·12	
Other (student/homemaker/other)	38·1	0·81	0·48, 1·38	
Smoking status				0·903
Never smoked	46·1	Reference		
Smoked, but quit	48·1	1·08	0·69, 1·70	
Smoker	49·0	1·14	0·60, 1·15	

Descriptive analysis and χ^2 tests were performed. The cut-offs are OR of 1·68, 3·47 and 6·71 for small, medium and large effect size, respectively[81].

Table 3 Mean dietary intakes of fat, fruits and vegetables by level of stress and sample characteristics of the low-income pregnant women with overweight or obesity (*n* 353) recruited from four local Special Supplemental Nutrition Program for Women, Infants, and Children agencies in Michigan, USA, May–August 2010

	Fat (range 0–68)				Fruit (range 0–10)				Vegetable (range 0–25)			
Characteristic	Mean	SD	Cohen's *d*	*P* value	Mean	SD	Cohen's *d*	*P* value	Mean	SD	Cohen's *d*	*P* value
All participants	24·4	10·4			5·5	2·5			7·4	4·5		
Stress				0·760				0·012				0·017
Low	24·2	10·2	Reference		5·8	2·5	Reference		7·9	4·9	Reference	
High	24·6	10·7	0·04		5·2	2·6	0·24		6·8	3·9	0·25	
Age (years)				0·240				0·499				0·003
18–24	23·6	12·0	Reference		5·4	2·6	Reference		6·8	4·7	Reference	
25–34	24·9	8·6	0·12		5·6	2·5	0·08		7·7	4·1	0·20	
35–46	26·9	8·9	0·31		6·0	2·6	0·23		9·9	4·3	0·69	
Race/ethnicity				<0·001				0·052				0·171
Non-Hispanic White	22·3	8·9	Reference		5·3	2·4	Reference		7·1	4·1	Reference	
Non-Hispanic Black	27·2	11·6	0·47		5·8	2·6	0·20		7·8	4·8	0·16	
Education				0·689				0·838				0·213
High-school graduate or less	24·1	10·4	Reference		5·5	2·6	Reference		7·0	4·8	Reference	
Some college/technical school or higher	24·6	10·5	0·05		5·5	2·5	0·00		7·6	4·2	0·13	
Employment status				0·143				0·719				0·137
Employed	24·8	10·2	Reference		5·4	2·5	Reference		7·8	4·5	Reference	
Unemployed	25·3	9·2	0·05		5·4	2·6	0·00		6·7	3·9	0·26	
Other (student/homemaker/other)	22·7	12·0	0·19		5·7	2·5	0·12		7·7	4·9	0·02	
Smoking status				0·060				0·691				0·516
Never smoked	23·0	11·3	Reference		5·4	2·6	Reference		7·1	4·5	Reference	
Smoked, but quit	25·7	9·4	0·26		5·7	2·5	0·12		7·7	4·5	0·13	
Smoker	25·6	9·6	0·25		5·4	2·5	0·00		7·6	4·1	0·12	

Descriptive analysis, *t* tests and ANOVA were performed. The *P* value indicates the overall significance of the bivariate association between dietary intake and sample characteristics (e.g. age and fat intake) using the *t* test for dichotomous characteristics (stress, race/ethnicity and education) and ANOVA (age, employment status and smoking status). The cut-offs are Cohen's *d* of 0·2, 0·5 and 0·8 for small, medium and large effect size, respectively[82].

Levels of stress

There was no relationship between level of stress and fat intake. However, women with high stress consumed significantly less fruits ($P=0{\cdot}01$) and vegetables ($P=0{\cdot}02$) than women with low stress, with effect sizes of $d=0{\cdot}24$ and 0·25, respectively, for the between-group differences (Table 3). The significant relationships were sustained after adjusting for covariates (trimester, gravidity, age, race, education, employment and smoking status) using multiple linear regression models (Table 4).

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Table 4 Relationships of level of stress and demographics with dietary intakes of fat, fruits and vegetables, adjusting for covariates using multiple linear regression models, among the low-income pregnant women with overweight or obesity (*n* 353) recruited from four local Special Supplemental Nutrition Program for Women, Infants, and Children agencies in Michigan, USA, May–August 2010

	Fat		Fruits		Vegetables	
Characteristic	Coefficient	SE	Coefficient	SE	Coefficient	SE
Stress						
Low	Reference		Reference		Reference	
High	−0·10	1·11	−0·74**	0·28	−1·24*	0·48
Age (years)						
18–24	Reference		Reference		Reference	
25–34	1·99	1·20	0·18	0·30	0·87	0·52
35–46	3·65	2·35	0·87	0·58	3·25**	1·01
Race/ethnicity						
Non-Hispanic White	Reference		Reference		Reference	
Non-Hispanic Black	5·36***	1·17	0·57	0·29	1·06*	0·51
Education						
High-school graduate or less	Reference		Reference		Reference	
Some college/technical school or higher	1·28	1·20	0·09	0·30	0·24	0·52
Employment status						
Employed	Reference		Reference		Reference	
Unemployed	0·92	1·33	0·18	0·33	−0·70	0·58
Other (student/homemaker/other)	−1·00	1·37	0·33	0·34	0·04	0·59
Smoking status						
Never smoked	Reference		Reference		Reference	
Smoked, but quit	2·40*	1·18	0·25	0·29	0·58	0·51
Smoker	4·14*	1·72	0·23	0·43	0·79	0·74

Multiple linear regression modelling was performed. Covariates included in the model were trimester, gravidity, age, race, education, employment and smoking status.
$^{*}P<0·05$, $^{**}P<0·01$, $^{***}P<0·001$.

Age

While no statistically significant relationship was found between age and fat and fruit intakes, women aged 35 years or older reported a significant higher vegetable intake ($P=0·003$) than women aged 24 years or younger, with an effect size of $d=0·69$ for the between-group difference (Table 3). The significant relationship between age and vegetable intake was sustained after adjusting for covariates (Table 4).

Race/ethnicity

Black women were more likely to report higher fat ($P<0·001$) but not fruit or vegetable intake than white women in unadjusted analyses, with $d=0·47$ for the between-group difference in fat intake (Table 3). The significant relationship between race and fat intake was sustained in the adjusted analyses (Table 4).

Education, employment status and smoking status

Education, employment status and smoking status were not associated with fat, fruit and vegetable intakes in either unadjusted (Table 3) or adjusted (Table 4) analyses.

Discussion

Our first objective was to identify demographic risk factors associated with high stress in low-income pregnant women with overweight or obesity. Our results showed that nearly half of these pregnant women reported high stress. This finding is of concern because high stress impairs executive function (a mental process that enables individuals to coordinate thought, action and emotion to achieve positive health outcomes)[46]. Executive function deficits are associated with increased high fat intake[47], snacking[48], unhealthy eating[49,50], overeating[51–54], weight gain[50,55] and obesity[49,56–58]. Our results also showed that older age, lower education and unemployment were associated with higher risk of stress. Although the associations were of small to medium effect sizes (OR = 1·88–4·09), they translated to the clinical meaningful difference that a 15–30 % higher proportion of these women reported high stress. There are multiple possible explanations for the three identified demographic risk factors. First, pregnant women aged 35 years or older may experience stress due to their awareness of risks related to their age, namely miscarriage, gestational disorders and labour complications[59,60]. Women with lower education may have fewer positive coping skills, which is associated with less resilience to stress[61,62]. Becoming unemployed decreases income, which is associated with less resilience to stress[62]. The lack of racial differences in the study may be explained by the fact that, regardless of race, our study participants were already under stress due to their status of having low income and being pregnant[63,64].

The findings of our first objective are consistent with findings of some studies[22–24], yet disagree with the

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findings of others[12,13,23,24]. The discrepancies between our findings and others may be explained by differences in study populations and methodology. While we studied only black or white low-income pregnant women with overweight or obesity, other studies focused on pregnant women with racially diverse backgrounds[13,24], highly educated white women (85 %)[22], only Latinas[12] or African Americans[23]. The methodology differences include the instrument used to measure stress and the cut-off value to dichotomize high *v.* low stress. While other researchers have used the Prenatal Psychosocial Profile Stress Scale[24] or the Kessler Distress Scale[13] to measure stress, our study and two other studies utilized the Perceived Stress Scale[12,23]. While we used 3·0 as a cut-off value to quantify high *v.* low stress, other studies either used a cut-off value of 2·1[12] or did not report the cut-off value used[23].

The American College of Obstetricians and Gynecologists recognizes that psychosocial factors (e.g. stress, depression, intimate partner violence) increase the risk of perinatal depression and screening for those factors may improve maternal health outcomes[65]. We have identified subgroups of women at high risk of stress. Therefore, obstetricians and midwives (or clinicians) may consider screening stress in pregnant women with low income and overweight or obesity, especially those who are least 35 years old, have a high school or less education or are unemployed, by asking a single question: 'How do you rate your current stress level – low or high?'[66] Then, they may consider further screening for depression in those who self-report high stress, for two reasons. First, high stress is strongly associated with depression[67]. To our knowledge, currently there are limited or no services available for those who solely report high stress; however, there are mental health services available for those who report more depressive symptoms. Intimate partner violence is associated with high stress[68]. Clinicians may consider screening for intimate partner violence by asking two questions privately: 'Do you feel unsafe where you live?' and 'In the past year, has anyone hit you or tried to hurt you?'[66], then providing appropriate resources. Other approaches that clinicians may take for women identified as having high stress would be to encourage them to attend their scheduled referral appointments, provide lists of community resources (e.g. food pantry, food bank) and refer them to free clinics for other health issues as needed. Also, clinicians may consider suggesting women with high stress to practise or engage in mindfulness exercise (e.g. meditation, mindfulness breathing and yoga), a potential effective approach to reduce stress in pregnant women[69–72].

Our second objective was to examine the relationships between level of stress, demographics and dietary fat, fruit and vegetable intakes. Our results revealed that high stress was not associated with fat intake, but women with high stress reported lower fruit ($d=0·24$) and vegetable intakes ($d=0·25$) than women with low stress even after adjusting for covariates. It is possible that our study participants tried to reduce high-fat food intake (e.g. fried chicken, lunch meats and hamburgers that were measured in our survey) for the good health of their fetus regardless of their stress level[73]. However, increasing fruit and vegetable intakes might be difficult when under high stress[74]. Our finding on the relationship between stress and dietary intake supported findings of a prior study[75] but contradicted another study showing a positive relationship between stress and fat intake but no relationship between stress and fruit and vegetable intake[22]. The inconsistent findings may be due to a difference in target populations. While the prior study included well-educated, middle-class women with all body sizes[22], we studied low-income women with overweight or obesity.

In terms of examining the relationships between demographic characteristics and dietary intakes of fat, fruits and vegetables, we found that women with older age were likely to report higher vegetable intake ($d=0·69$). Also, black women reported higher fat intake ($d=0·47$) than white women even after adjusting for covariates, which may relate to the availability of high-fat foods in their environments. Previous studies have shown that more fast-food restaurants[76] but fewer chain supermarkets[77] are located in black neighbourhoods than white neighbourhoods. The significant associations were of medium effect size ($d=0·47$–$0·69$). The dietary intakes of fat, fruits and vegetables were measured by items each scored 0 ('less than one time per week') to 5 ('two or more times a day'). Therefore, the effect sizes are not translatable to clinically meaningful measures in actual amount of intake. Future studies using more precise dietary intake measures (e.g. 24 h dietary recall or FFQ) are needed to further quantify the associations and related clinical meanings. The lack of differences based on education, employment and smoking status might be explained by the low income of our cohort. Prior studies have shown that being low income has a negative impact on individuals' dietary choices, which may have prevented low-income adults from following nutritional recommendations for a healthy diet[78–80]. Comparing results of our study regarding the relationships between demographics and intakes of fat, fruits and vegetables is challenging, because this is one of few studies investigating the relationship. Nevertheless, our findings may provide potentially useful information to clinicians working with low-income pregnant women with a higher BMI. Since age and race are typically reported during a prenatal visit, clinicians may consider providing targeted nutrition education that focuses on increasing vegetable intake in younger women and reducing fat intake in black women to potentially improve maternal and birth outcomes.

There are several limitations to the current study. First, the cross-sectional design precludes declarations of causal relationships. Our data, including the assessment of stress and dietary intake, were based on self-reported values and may therefore be subject to recall bias. Also, the Rapid Food Screener that we used can only assess frequency of fat, fruit and vegetable intake; we were limited in our ability to evaluate whether our participants met dietary guidelines. However, the Rapid Food Screener has been widely used because of its practicality to assess nutrition status in community settings. Moreover, the study included only black and white English-speaking pregnant women with overweight or obesity who were recruited from Michigan. Thus, our sample may not represent the full diversity of low-income pregnant women with overweight or obesity in all geographic locations.

Conclusion

We have demonstrated that stress is likely to be higher in women who are older, less educated and unemployed. Stress was negatively associated with fruit and vegetable intake and age was positively associated with vegetable intake. Finally, black race was associated with higher fat intake. Clinicians may consider targeted nutrition counselling on reducing fat intake for women who are black and increasing fruit and vegetable intake for women who are younger or report high stress. Finally, future longitudinal studies of low-income pregnant women with overweight or obesity are needed to confirm our study findings.

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