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Prepregnancy body mass index, socioeconomic status, race/ethnicity and breastfeeding practices

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Abstract

Objective—While socioeconomic status (SES) and race/ethnicity are known predictors of breastfeeding practices, the added disparity caused by the rising rates of obesity among women of childbearing age remains untested. The purpose of this study was to examine differences in breastfeeding initiation and duration among black, white and Hispanic women of low and middle SES within the context of prepregnancy body mass index (BMI).

Methods—Data from the Early Childhood Longitudinal Study-Birth Cohort were analyzed. Adjusted logistic regression models were built to examine differences in breastfeeding initiation and duration for the three racial/ethnic groups of low and middle SES.

Results—Normal BMI Hispanic women of low SES demonstrated higher rates of breastfeeding initiation (74 %) compared to other groups. Overweight/obese black women of low SES had lower rates of breastfeeding initiation. Overweight/ obese Hispanic women of middle SES were significantly less likely to continue breastfeeding up to 4 months (OR: 0.65, 95 % CI: 0.41, 0.98) compared to their white counterparts. Among women who initiated breastfeeding, overweight/ obese white women of low SES had the highest rate of stopping within two months of giving birth (66.7 %).

Conclusions—Examination of SES and racial/ethnic differences within the context of prepregnancy weight revealed specific groups with low rates of breastfeeding initiation and duration. Interventions tailored for these at-risk groups are needed to increase the overall proportion of mothers and infants who benefit from the positive health outcomes associated with breastfeeding.

Keywords

Breastfeeding; ECLS-B; prepregnancy body mass index; race and ethnicity; socioeconomic status

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Introduction

Breastfeeding is one of the most effective health promotion measures a mother can take to protect herself and her infant [37]. Among the benefits for women who breastfeed are an earlier return to prepregnancy weight status and a lower risk for premenopausal breast cancer and ovarian cancer [20]. Infants who are breastfed are at lower risk for otitis media, respiratory tract infections, diarrhea, and necrotizing enterocolitis [1, 2]. In light of the positive effects of breastfeeding, the new *Healthy People 2020* objectives for maternal and child health in the USA include targets of 81.9 % for breastfeeding initiation and 46.2 % for duration up to 3 months [36].

To reach these objectives, evidence-based strategies are needed to identify and support mother-infant dyads at greatest risk for low breastfeeding rates. Current USA estimates indicate that breastfeeding practices vary by socioeconomic status (SES) and race/ethnicity. The Centers for Disease Control (CDC) analyzed data from a recent national cohort study and found that women who participated in a special supplemental program for women, infants, and children (WIC), a nutrition program for low income families, were less likely to have ever breastfed their infants than women with income levels sufficiently high to preclude participation in the program (67.5 % vs. 84.6 %) [6]. Breastfeeding rates also varied by race and ethnicity with black mothers found to be least likely to have breastfed their infants (58.1 %) compared to their Hispanic (80.6 %) and white (76.2 %) counterparts [6]. These findings are similar to those of prior research that have consistently shown a pattern of disparity based on SES and race/ethnicity [9, 13, 24, 32].

Maternal body mass index (BMI) also appears to play an important role in breastfeeding practices. With the rise in obesity rates among women of reproductive age [28], examining the association between maternal weight status and breastfeeding has become a public health priority. Several large studies in Australia, the UK, and the USA have found negative associations between increased maternal BMI and breastfeeding initiation and duration [7, 21, 27, 30, 34]. In the USA, two studies using separate population-based surveys found similar associations between maternal weight and breastfeeding duration. Using data from the Pediatric Nutrition Surveillance System, the Pregnancy Nutrition Surveillance System and Early Childhood Longitudinal Study-Birth Cohort (ECLS-B), researchers found that women who were obese before pregnancy were less likely to initiate and had shorter durations of breastfeeding than normal weight women [21, 27]. A recent review of 13 studies of the association between prepregnancy BMI and breastfeeding practices found an overall negative impact of being overweight but concluded that further studies are needed to better understand the role of potential moderators [39].

For instance, the association between prepregnancy BMI and breastfeeding initiation and duration is less clear when examined among separate racial/ethnic groups in the USA. Liu and colleagues found a negative association between high prepregnancy BMI and breastfeeding initiation and duration rate among white women [29]. This was consistent with an earlier study that showed a negative association between maternal BMI and rates of breastfeeding at hospital discharge after birth among white women [15]. Another study found a negative association between maternal obesity and breast-feeding initiation and

duration among Hispanic women but did not find a similar association for black women [22].

Although SES and racial/ethnic differences have been identified as predictors of breastfeeding practices, the added disparity caused by our national epidemic of overweight/obesity among women of childbearing age remains untested. The purpose of this study was to examine these known demographic risk factors for breastfeeding initiation and duration within the context of prepregnancy BMI using the ECLS-B.

Methods

The ECLS-B is a nationally representative study that follows 10,700 children from birth (2001) through kindergarten entry and provides information on their development, health, and early learning experiences [35]. The project was implemented by the USA Department of Education, National Center for Education Statistics (NCES) and approved by its ethics review board. The authors' university has a restricted-use data agreement with NCES for use of the ECLS-B data. In the present study, we utilized the first wave of data collection linked to the children's birth certificates and included children aged 6 to 22 months.

Only singleton births were included, a criterion that yielded 8550 unweighted records. Once these data were weighted, the sample size dropped to about 6000 cases. Of these data, we excluded categories of mothers that were underrepresented in the dataset, including mothers who were underweight, high SES, and other than non-Hispanic black, non-Hispanic white and Hispanic. The resulting total weighted sample size was comprised of approximately 5000 records. These values are rounded to the nearest 50, as required by the NCES for all weighted and unweighted sample sizes [5]. Further, there were no missing data for the variables (described below) used in the analyses, except for the maternal prepregnancy BMI which had < 1.2 % missing values.

Prepregnancy weight and height were self-reported. Information about maternal weight and height was collected when infants were approximately 9 months old or from the first wave of data collection. Prepregnancy BMI was classified into four categories based on the Institute of Medicine prepregnancy BMI criteria: underweight (19.8 kg/m^2), normal ($19.8\text{--}26.0 \text{ kg/m}^2$), overweight ($>26.0\text{--}29.0 \text{ kg/m}^2$) and obese ($>29 \text{ kg/m}^2$) [19]. Race/ethnicity was categorized as non-Hispanic white, non-Hispanic black, and Hispanic. Three levels of SES were created (low, middle, and high) based on parental income and education. However, because the sample size was small for the high SES after weighing the data and stratifying the analyses by race/ethnicity and SES, we decided to drop this SES level. Consequently, our analyses are focused on two levels, namely low and middle SES.

Initiation of breastfeeding was assessed based on responses to the question "Did you ever breast-feed?" Based on this question, we created the breastfeeding initiation variable which consisted of those who "ever breastfed" and those who "never breastfed". Among those who initiated breastfeeding (ever breastfed), we used other questions, such as "For how many months did you breast-feed?" to determine breastfeeding duration. Breastfeeding duration was measured in months and was used to create 2 binary variables (≤ 2 months vs.

<2 months, and 4 months vs. <4 months). These dichotomies of breast-feeding duration were created as previous research has shown that these cut-off points are the most statistically appropriate [30, 40].

The following maternal characteristics were considered as potential confounders: mother's age (<20, 20–34, and >34 years old), marital status (married, not married), parity (none, one, at least 2), smoking during pregnancy (yes or no), mode of delivery (vaginal or cesarean), gestational age (term or <37 weeks of gestation, preterm), and birth weight [normal or <2500 g, low birth weight (LBW)].

Statistical analysis

In order to analyze these data and be able to generalize findings, statistical procedures were incorporated to create normalized and design-effect adjusted weights based on the ECLS-B weight W1R0. Descriptive statistics and χ^2 analyses were performed to identify significant differences in maternal-infant characteristics among the three racial/ethnic groups, stratified by SES. Logistic regression analyses were conducted to examine breastfeeding initiation and duration in black, white and Hispanic women separately for the two SES strata (low and middle). These analyses were adjusted for potential confounders (presented in Tables 1 and 2). Further, all of the analyses were conducted separately for normal BMI and overweight/obese women. This enabled us to study breastfeeding initiation and duration for the three racial/ethnic groups of low and middle SES within the context of prepregnancy BMI. All data presented in the Tables 1–3 were weighted and analyzed using predictive analytics software (PASW) [18].

Results

Normal BMI women: SES, race/ethnicity and breastfeeding practices

Table 1 provides descriptive information for normal BMI mothers and their breastfeeding patterns, stratified by SES and race/ethnicity. Overall, for the low SES group, differences were observed in marital status with a higher proportion ($P<0.001$) of black women being unmarried (83.4 %) and having a preterm baby (19.7 %). Low SES white women were far more likely ($P<0.001$) to have smoked during pregnancy (48.2 %). For the middle SES group, differences were observed in maternal age and marital status with a significantly higher proportion ($P<0.001$) of younger (<20 years old) black women having children (17.9 %) and being unmarried (62.4 %). Further, black women of middle SES had a significantly ($P<0.001$) higher number of LBW (11.5 %) and pre-term births (14.9 %). Similar to low SES white women, white women of middle SES were also more likely to smoke during pregnancy (14.9 %) compared to the other two racial/ethnic groups of the same SES level.

Approximately 74 % of the low SES Hispanic women initiated breastfeeding and this proportion was significantly higher ($P<0.001$) than white (49.1 %) and black (39.5 %) women. Similarly, a higher proportion of middle SES Hispanic (75.9 %) initiated breastfeeding than their white (70.7 %) and black (53.8 %) counterparts. For breastfeeding duration, among those who initiated breastfeeding, a significantly higher proportion ($P<0.001$) of Hispanic and black women of low SES were breastfeeding <2 months (51.7 %

and 62.3 % , respectively), and 4 months (26.0 % and 23.0 % , respectively) compared to their white low SES counterparts. This, however, was not true for Hispanic women of middle SES who were less likely to breastfeed for as long as their white and black counterparts. Black women of middle SES continued to breastfeed for significantly longer than white women.

Table 3 presents the adjusted odds ratio (95 % confidence intervals) of breastfeeding initiation and duration (2 months and 4 months) among women with normal BMI. These analyses revealed that normal BMI Hispanic women of both low and middle SES were more likely to initiate breastfeeding compared to white women. Specifically, Hispanic women of low SES were 2.23 [95% CI (1.30, 3.82)] times more likely to initiate breastfeeding compared to white women, while those of middle SES were 1.37 [95% CI (1.01, 1.90)] times more likely. The likelihood of breastfeeding initiation among black women of both low [OR = 0.52, 95 % CI (0.31, 0.87)] and middle [OR = 0.62, 95 % CI (0.44, 0.85)] SES was significantly less compared to white women of the same SES.

Low SES black women who did initiate breastfeeding, however, were 3.92 [95% CI (1.72, 8.91)] times more likely to continue to do so for at least 2 months compared to their white counterparts. Similarly, the likelihood of breastfeeding for at least 2 months was higher [OR = 2.49, 95 % CI (1.19, 5.20)] among Hispanic women of low SES compared to white mothers. Low SES black and Hispanic mothers were far more likely to breastfeed for at least 4 months compared to white women.

Middle SES Hispanics, however, were 0.75 [95% CI (0.57, 0.99)] and 0.74 [95% CI (0.52, 0.98)] less likely to breastfeed for at least 2 and 4 months, respectively, compared to white women. Adjusted odds of breastfeeding at least 2 months were higher for black women of middle SES in comparison to white women of the same SES.

Overweight/obese women: SES, race/ethnicity and breastfeeding practices

Table 2 provides descriptive information about the mothers with overweight/obese BMIs, stratified by SES and race/ethnicity. Similar to the findings for women with normal BMI, overweight/obese black women of low SES were significantly more likely ($P<0.001$) to be unmarried (83.0 %), and 33.7 % of the white mothers smoked during pregnancy. The percentage of smokers among white women of middle SES was lower than among their low SES counterparts (15.3 %), but significantly higher ($P<0.001$) than the other two racial/ethnic groups of overweight/obese women. The proportion of unmarried (63.2 %) middle SES black mothers was significantly higher ($P<0.001$) than the other two racial/ethnic groups. Middle SES black mothers were also more likely ($P<0.001$) to have a LBW infant (10.4 %) compared to over-weight/obese middle SES white and Hispanic mothers.

A higher proportion ($P<0.001$) of low SES overweight/ obese Hispanic women (75.2 %) initiated breastfeeding in comparison to white (49.5 %) and black (34.0 %) women (Table 2). Middle SES Hispanic women were also significantly ($P<0.001$) more likely to initiate breastfeeding (69.6 %) compared to their white (65.1 %) and black (50.0 %) counterparts. No significant differences were found for breastfeeding duration among black, white and Hispanic women of low and middle SES, although the proportion (not significant) of

Hispanic middle SES women breastfeeding for 4 months and more was lower (22.3 %) compared to black and white (about 30 %). While among low SES women, the proportion of white mothers breastfeeding at 4 months and higher was only 15.6 % compared to black at 26.5 % and 23.3 % for the Hispanic mothers.

Based on the adjusted odds ratio analyses, the likelihood of breastfeeding initiation was higher [OR = 3.12, 95 % CI (1.70, 5.72)] among low SES Hispanic women compared to their white counterparts (Table 3). Further, no significant differences were observed across the three racial/ethnic groups of low SES in breastfeeding duration of 2 and 4 months. Black, overweight/obese women of middle SES were 0.64 (0.45, 0.92) times less likely to initiate breastfeeding compared to white women of middle SES. Further, overweight/obese Hispanic women of middle SES were 0.65 (0.41, 0.98) times less likely to breastfeed at least 4 months compared to white mothers.

Discussion

To our knowledge this is the first study to examine the associations of SES and race/ethnicity with breastfeeding practices within the context of prepregnancy BMI. The American Academy of Pediatrics Committee on Nutrition recommends exclusive breastfeeding for the first 6 months of infant life [2]. Our findings demonstrate that a substantial proportion of low and middle SES women for both BMI groups (normal and overweight/obese) never initiated breastfeeding, and among those who did, most discontinued the practice in <4 months.

Mothers who most closely fit the recommendations for breastfeeding initiation and duration were Hispanic women of low SES and normal BMI. The proportion of these mothers who initiated breastfeeding and continued up to 4 months infant age exceeded that of all other groups. This finding fits with the USA phenomenon of the “Hispanic paradox” in which Hispanic women of low SES demonstrate better health outcomes than their low SES racial/ethnic counterparts [10]. Examples often cited in support of the paradox are the low rates of premature birth and infant mortality among low SES Hispanic mothers, who often have low levels of acculturation [12, 25]. Proponents suggest that a protective factor may be operating whereby Hispanic women with low acculturation retain strong ties of familism (family values) and cultural values [4]. Breastfeeding fits well within the paradigm of traditional Hispanic values.

However, the current study also found that normal BMI and overweight/obese Hispanic women of middle SES were the least likely to breastfeed up to 4 months infant age. Previous research has identified maternal obesity as a risk factor for early termination of breastfeeding [7, 22, 26]. In addition, studies have shown that as Hispanic women in the USA experience increasing levels of acculturation, their breastfeeding practices decrease [11, 12]. Research over the past few decades has associated the Hispanic paradox with lower SES [10]. To the extent to which SES may be considered a proxy for acculturation, our findings align with the Hispanic paradox hypothesis by suggesting that, as women move out of the lower SES and become more acculturated, they may be less likely to retain the cultural values that promote breastfeeding and more likely to choose other available infant

feeding options. The present study findings indicate that Hispanic women of middle SES, regardless of BMI, may need breastfeeding support, specifically public health initiatives that recognize and foster the Hispanic cultural values associated with breastfeeding practices.

Our findings also point to a second group for whom specific intervention may lead to improved maternal-infant health outcomes. Black women across weight and SES groups were shown to have low rates of breastfeeding initiation. They were also more likely to have LBW or premature infants. These birth outcomes may explain, in part, their lower breastfeeding initiation rates, as LBW and premature infants often require intensive care that may interrupt the normal progression of maternal attachment and breastfeeding opportunity [8, 33].

In addition, recent studies have demonstrated that black mothers often have the prenatal intention to breastfeed, but are less likely to initiate breastfeeding because of workplace barriers for breastfeeding [17, 23]. The Surgeon General's Call to Action to Support Breastfeeding (1) recommends a multilevel approach to overcome the barriers to breastfeeding that may be operating for women who return to work after giving birth. Specifically, the action plan indicates that support for a woman's prenatal intention to breastfeed must begin during obstetrical care and include a plan to enlist the early support of family, friends, employers, and child care providers. The report calls for workplace policies in support of breastfeeding intention that include comprehensive, high-quality lactation support programs that enable women to breastfeed while maintaining employment.

A third group that may be targeted for early breastfeeding support is comprised of low SES white women. Among women in this category who initiated breastfeeding, over half stopped in <2 months (63.9 % normal BMI, 66.7 % overweight/obese). A potential explanation may be the disproportionately high incidence of tobacco use in this group (48.2 % normal BMI, 33.7 % overweight/obese). The relationship between maternal smoking and early termination of breastfeeding has been well-established [3, 16, 31, 38]. Our findings add to this body of evidence and underscore the importance of smoking cessation interventions that have been found to increase breastfeeding duration [14].

The present study has limitations. First, the maternal prepregnancy weight and height data used to calculate BMI were self-reported and thereby subject to a recall bias. Given the current national emphasis on the obesity epidemic, it is likely that any error in reporting may be an underestimate of weight. Second, measures of acculturation and stress that may have informed the interpretation of some study findings were not available in this dataset. In addition, stratifying the data by BMI, SES and race/ethnicity reduced the cell sample size for certain variables, such as maternal health problems during pregnancy and labor/delivery complications and thus they were not included in the analyses. These variables may have also informed the interpretation of some study findings such as the low breastfeeding initiation rates.

Despite these limitations, a major strength of the study is that the findings emerge from a nationally representative dataset that allows for comparison across weight classes and

demographic groups. As a result, we were able to begin the identification of risk groups for targeted breastfeeding support interventions that have not been previously specified.

Conclusions

Within the context of prepregnancy BMI, unique groups of women who were at risk for low levels of breastfeeding initiation and duration were identified. If these findings are confirmed in future studies, assessment strategies may be designed for use in clinical practice that help identify women most in need of support for breastfeeding practices. Given increasingly limited financial resources available for health care, coupled with escalating obesity rates, the identification of risk groups for more targeted public health interventions to support breastfeeding practices is urgently needed.

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Table 1

Breastfeeding and characteristics (%) of women with normal BMI stratified by SES and race/ethnicity.

	<u>Low</u>				<u>Middle</u>			
	Black (%)	White (%)	Hispanic (%)	P-value	Black (%)	White (%)	Hispanic (%)	P-value
Maternal age								
<20 years	36.3	35.5	21.7	0.120	17.9	7.4	13.7	<0.001
20–34	57.3	59.2	71.7	–	72.2	81.5	75.5	–
>34	6.4	5.3	6.6	–	9.8	11.1	10.8	–
Marital status								
Married	16.6	44.4	50.3	<0.001	37.6	75.2	62.8	<0.001
Not married	83.4	55.6	49.7	–	62.4	24.8	37.2	–
Parity								
None	39.1	44.6	45.6	0.570	43.2	40.9	41.9	0.240
One	29.5	24.4	22.1	–	31.2	38.3	35.1	–
2	31.4	31.0	32.3	–	25.6	20.9	23.0	–
Smoking during pregnancy								
No	88.5	51.8	96.5	<0.001	94.5	85.1	96.8	<0.001
Yes	11.5	48.2	3.50	–	5.5	14.9	3.2	–
Delivery				0.877				0.016
Vaginal	80.8	81.2	79.2	–	76.4	78.6	71.2	–
Cesarean	19.2	18.8	20.8	–	23.6	21.4	19.7	–
Birth weight								
Normal (>2500 g)	87.9	92.3	92.4	0.100	88.5	93.8	94.5	0.001
Low (<2500 g)	12.1	7.7	7.6	–	11.5	6.2	5.5	–
Gestational age								
Term (>37 weeks)	80.3	91.1	88.3	0.010	85.1	91.1	91.0	0.020
Preterm	19.7	8.9	11.7	–	14.9	8.9	9.0	–
Breastfeeding initiation								
Never breastfed	60.5	50.9	25.9	<0.001	46.2	29.3	24.1	<0.001
Breastfed	39.5	49.1	74.1	–	53.8	70.7	75.9	–
Breastfeeding duration								
Breastfed <2 months	37.7	63.9	48.3	0.006	32.5	44.6	51.6	0.002
Breastfed 2–3 months	62.3	36.1	51.7	–	67.5	55.4	48.4	–
Breastfed <4 months	77.0	89.2	74.0	0.023	62.7	68.2	74.9	0.033
Breastfed ≥4 months	23.0	10.8	26.0	–	37.3	31.8	25.1	–

Table 2

Breastfeeding patterns and characteristics (%) of overweight/obese women stratified by SES and race/ethnicity.

	Low				Middle			
	Black (%)	White (%)	Hispanic (%)	P-value	Black (%)	White (%)	Hispanic (%)	P-value
Maternal age								
<20 years	18.0	21.3	13.9	0.520	8.5	3.7	6.9	0.060
20–34	74.0	73.4	77.0	–	77.6	82.5	81.1	–
>34	8.0	5.3	9.1	–	13.9	13.8	12.0	–
Marital status								
Married	17.0	45.3	49.7	<0.001	36.8	79.2	63.6	<0.001
Not married	83.0	54.7	50.3	–	63.2	20.8	36.4	–
Parity								
None	20.2	33.7	27.3	0.190	32.3	37.4	30.2	<0.001
One	34.3	29.5	26.1	–	29.4	36.6	30.7	–
2	45.5	36.8	46.7	–	38.3	26.0	39.1	–
Smoking								
No	89.0	66.3	99.4	<0.001	93.5	84.7	96.3	<0.001
Yes	11.0	33.7	0.6	–	6.5	15.3	3.7	–
Delivery								
Vaginal	84.8	68.4	75.6	0.270	66.7	70.7	78.7	0.196
Cesarean	15.2	31.6	24.4	–	33.3	29.3	21.3	–
Birth weight								
Normal (≥2500 g)	89.0	91.6	92.1	0.330	89.6	94.8	93.1	<0.001
Low (<2500 g)	11.0	8.4	7.9	–	10.4	5.2	6.9	–
Gestational age								
Term (≥37 weeks)	88.0	84.0	88.5	0.570	88.1	90.4	90.8	0.570
Preterm	12.0	16.0	11.5	–	11.9	9.6	9.2	–
Breastfeeding initiation								
Never breastfed	66.0	50.5	24.8	<0.001	50.0	34.9	30.4	<0.001
Breastfed	34.0	49.5	75.2	–	50.0	65.1	69.6	–
Breastfeeding duration								
Breastfed <2 months	44.1	66.7	54.4	0.128	42.6	48.1	46.6	0.599
Breastfed ≥2 months	55.9	33.3	45.6	–	57.4	51.9	53.4	–
Breastfed <4 months	73.5	84.4	76.8	0.452	70.0	69.7	77.7	0.165
Breastfed ≥4 months	26.5	15.6	23.2	–	30.0	30.3	22.3	–

Table 3

Adjusted odds ratios (95% CI) of breastfeeding initiation and duration in black, white and Hispanic women of normal BMI and overweight/obese stratified by SES.

	Normal BMI women		Overweight/obese women	
	Low adjusted OR (95% CI) ^a	Middle adjusted OR (95% CI) ^a	Low adjusted OR (95% CI) ^a	Middle adjusted OR (95% CI) ^a
Breastfed (breastfeeding initiation)				
Black	0.52 (0.31, 0.88)	0.61 (0.44, 0.84)	0.55 (0.29, 1.05)	0.64 (0.45, 0.92)
White	1.00	1.00	1.00	1.00
Hispanic	2.23 (1.30, 3.82)	1.37 (1.01, 1.90)	3.12 (1.70, 5.72)	1.22 (0.85, 1.73)
Breastfed 2 months				
Black	3.92 (1.72, 8.91)	1.69 (1.11, 2.57)	2.57 (0.91, 7.20)	1.18 (0.73, 1.89)
White	1.00	1.00	1.00	1.00
Hispanic	2.49 (1.19, 5.20)	0.75 (0.57, 0.99)	1.78 (0.74, 4.27)	1.04 (0.70, 1.54)
Breastfed 4 months				
Black	5.02 (1.51, 16.66)	1.45 (0.95, 2.22)	2.60 (0.70, 9.69)	0.97 (0.57, 1.62)
White	1.00	1.00	1.00	1.00
Hispanic	5.38 (1.70, 17.07)	0.74 (0.52, 0.98)	1.72 (0.54, 5.49)	0.65 (0.41, 0.98)

^a Analyses have been adjusted for all variables presented on Tables 1 (normal BMI women) and 2 (overweight/obese women).