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Association of early pregnancy body mass index with postpartum weight change among African American women

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Abstract

Postpartum weight retention is relatively common and increases the risk for future obesity. Women who are overweight or obese prior to pregnancy, or who gain excessively during pregnancy, are more likely to retain weight postpartum. Much of the existing research is limited by a single postpartum body weight measure and therefore cannot distinguish postpartum weight retention from postpartum weight accrual. This study tested the hypothesis that early pregnancy body mass index (BMI) is positively associated with postpartum weight change, independent of gestational weight gain (GWG) and breastfeeding (BF) among African American women, a demographic group with greater risk for obesity. Healthy African American women (n=32) were weighed at 2 weeks and 3 months postpartum to derive postpartum weight change. Data from prenatal care records were retrieved to calculate BMI at the first prenatal care visit, and GWG. BF status at 2 weeks postpartum was self-reported. Early pregnancy BMI was positively associated with postpartum weight change (partial $r=0.53$, $P<0.005$), independent of GWG and BF status at 2 weeks postpartum. These results extend the literature by suggesting that the association between early pregnancy BMI and postpartum weight retention may be at least partially attributable to the accrual of new weight during the postpartum period. Future research in a larger and more diverse cohort is warranted, and should explore potential mechanisms contributing to postpartum weight change.

Keywords

postpartum; weight gain; maternal obesity

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Conflicts of interest statement

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Introduction

Postpartum weight retention is common and is associated with new or worsening overweight and obesity (1-3). Most studies of postpartum weight retention rely upon a single measure of body weight during the postpartum period, and thereby fail to distinguish the retention of weight gained during pregnancy from weight accrual during the postpartum period. This distinction is important however, to understand how and when pregnancy contributes to the risk for obesity.

Prior research suggests that body mass index (BMI) prior to, or early in, pregnancy, is associated with postpartum weight retention; however, the direction and magnitude of this association has been inconsistent (4-7). This inconsistency may be at least partially due to differences in when body weight was measured during the postpartum period, or, as discussed above, whether a single measure of body weight was obtained postpartum, versus two or more measures. In one study for which maternal weight was measured at multiple postpartum time points, women with obesity were more likely to gain or maintain weight postpartum compared to women with normal weight (4), suggesting that pre-pregnancy BMI may be an important predictor of postpartum weight change. However, it is unclear whether the association between pre-pregnancy BMI and postpartum weight change is independent of other factors that may influence maternal weight patterns postpartum.

Breastfeeding (BF) and gestational weight gain (GWG) are important factors to consider in studies of postpartum weight retention. Physiologically, breastfeeding should facilitate weight loss because of the energy required to produce breastmilk; however, the association of BF with postpartum weight retention has been inconsistent (8). Conversely, GWG has been consistently associated with postpartum weight retention (5, 9-11). Several studies have reported that BF and GWG may be important predictors of postpartum weight change (5, 9-14). However, there is a dearth of studies examining whether the association of pre-pregnancy BMI with postpartum weight change is independent of BF and GWG, particularly among African American women.

The overall objective of this study was to examine whether BMI in early pregnancy is associated with postpartum weight change. It was hypothesized that early pregnancy BMI would be positively associated with weight gain from 2 weeks to 3 months postpartum, independent of GWG and BF. This hypothesis was tested in a cohort of low income African American women; a demographic that is disproportionately burdened by obesity (15), and who tend to gain less weight during pregnancy as compared to Caucasians, but retain more weight during the postpartum period (16-18).

Materials and Methods

Participants

Non-diabetic African American women were recruited during the third trimester of pregnancy as part of a prospective cohort study to investigate metabolic health during pregnancy. Results of the primary study have been published previously (19, 20). Potentially eligible women were recruited from among those receiving prenatal care at community

clinics and planning to deliver at a large urban university hospital. Women eligible to participate were 16 years of age or older at recruitment, initiated prenatal care prior to 19 weeks' gestation, and were experiencing a healthy singleton pregnancy. Exclusion criteria included pre-existing type 1 or type 2 diabetes mellitus, gestational diabetes mellitus in the current pregnancy, a history of preterm birth (<37 weeks' gestation), a history of delivering a low birth weight infant (<2500 grams), or the presence of any medical condition believed to interfere with fetal growth. For this secondary analysis, data from women who delivered prior to 37 weeks' gestation, who did not attend both postpartum visits, or whose 2 week postpartum visit occurred later than 21 days after delivery were excluded.

Protocol

After delivery, mother-infant dyads reported to the laboratory for two follow-up visits for the parent study: 2 weeks (16 ± 2 days) and 3 months (93 ± 3 days) postpartum. Women's weight was measured at each visit and they were asked about their current infant feeding practices. Other data pertinent to this study, such as early pregnancy BMI and GWG, were retrieved from prenatal care records.

The Institutional Review Board for Human Use at the University of Alabama at Birmingham approved all study procedures for the parent study. Informed consent was obtained from all maternal participants.

Measures

Women's height was measured during late pregnancy to the nearest 0.5 cm using a wall-mounted stadiometer (Seca, Model 216; Chino, CA) by the same trained clinical research nurse. Women's race, measured weight at the first and last prenatal care visits (mean $\pm$ SD: 10 weeks $\pm$ 23 days and 39 weeks $\pm$ 9 days gestation, respectively), and birth dates were retrieved from prenatal care medical records. Women's age at entry to the study was calculated as the difference between their birth date and the date of enrollment in the study. Parity was self-reported at the initial study visit. A trained research nurse administered the Hollingshead "Four-Factor Index of Socioeconomic Status Survey" (21) at the initial study visit to assess women's marital status, occupation, and education. Early pregnancy body mass index (BMI; kg/m^2) was calculated from the measured body weight at the first prenatal care visit, and height measured at enrollment. GWG was calculated as the difference between body weight measured at the first and last prenatal care visits.

At each postpartum visit, women's body weight was measured by a trained research assistant with participants wearing light clothing and no shoes. Weight measurements were reported to the nearest 0.1 kg using a Health o Meter® Professional Digital Physician Scale (Pelstar LLC., Model 500KL; McCook, IL). At the 2 week visit, women were asked if they were breastfeeding, and if so, whether they were exclusively breastfeeding or supplementing with formula.

Statistical Analysis

The primary outcome variable was postpartum weight change, defined as women's body weight at 2 weeks postpartum subtracted from body weight at 3 months postpartum, with a

positive value indicating weight gain from 2 weeks to 3 months postpartum. GWG group was based on whether women failed to meet, met, or exceeded the 2009 IOM GWG criteria (22). BF was examined as a dichotomous variable based on mothers report of either no BF or any BF (including partial and full) at 2 weeks postpartum. Parity was dichotomized as either nulliparous or parous. Level of educational attainment was dichotomized (less than high school versus high school graduate), as was marital status (single versus married) and employment status (unemployed versus part-time or full-time employment). Time between postpartum measurements was calculated as the infant's age in days at the 3 month postpartum visit minus the infant's age in days at the 2 week postpartum visit.

Prior to analyses, all continuous variables were assessed for normality of distribution using the Shapiro-Wilk Test. Multiple linear regression was used to examine whether BMI in early pregnancy was associated with postpartum weight change, independent of GWG and BF. All assumptions for multiple linear regression were verified to be met. Descriptive data were summarized as mean $\pm$ SD, unless indicated otherwise.

Data analysis was performed using the Statistical Package for the Social Sciences (SPSS) software version 22.0 (SPSS Inc., Chicago, IL, USA), and statistical significance was accepted at alpha less than or equal to 0.05.

Results

Women who completed both follow-up visits for the parent study (N=35) were considered for this secondary analysis. Data from three women were subsequently excluded however due to delivering prior to 37 weeks' gestation (n=2) or having a delayed 2 week postpartum visit (n=1). Consequently, final analyses were conducted on n=32 women. Those excluded did not differ from the n=32 who remained in this secondary study in terms of age, education, employment status, parity, early pregnancy BMI, gestational age at delivery, or infant birth weight. Study participant characteristics are presented in Table 1. The majority of the women in the cohort were aged 20 to 25 years. Early pregnancy BMI ranged from 17.43 to 52.86 kg/m² and averaged 29.66 ± 9.31 kg/m². BF was not prevalent in this cohort, with 37.50% (n=12) never initiating BF, and only 12.50% (n=4) exclusively BF and 28.13% (n=9) mixed feeding at 2 weeks postpartum. At 3 months postpartum, only one participant was exclusively BF (3.13%) and one was mixed feeding (3.13%). Women's weight change between 2 weeks and 3 months postpartum ranged from a loss of 5.80 kg to gains up to 9.80 kg and averaged 0.45 ± 3.77 kg. Almost half of the cohort, 43.75% (n=14), gained at least 1 kg postpartum.

Table 2 shows simple correlations among gestational age at the early pregnancy BMI measurement, early pregnancy BMI, gestational weight gain, and weight change from 2 weeks to 3 months postpartum. Gestational weight gain was significantly inversely associated with early pregnancy BMI ($r=-0.50$, $P<0.005$). Early pregnancy BMI was significantly positively correlated with postpartum weight change from 2 weeks to 3 months ($r=0.54$, $P<0.005$). No other correlations among these variables were significant.

Multiple linear regression modeling was used to examine whether BMI was associated with women's weight change from 2 weeks to 3 months postpartum after adjusting for GWG group and BF. As shown in Figure 1, early pregnancy BMI was positively associated with postpartum weight change ($P<0.005$) independent of GWG group and BF. The association between early pregnancy BMI and postpartum weight change remained unchanged when GWG was entered as a continuous variable (not shown). When the model was re-run using pre-pregnancy BMI based on self-reported pre-pregnancy weight, instead of the weight measured during the first prenatal care visit, results were the same (not shown). Given that most previous studies define postpartum weight retention as the difference between pre-pregnancy body weight and weight at some point postpartum, we re-ran the multiple linear regression model using 3 month postpartum weight retention, calculated as the difference between body weight at 3 months postpartum and that in early pregnancy, as the outcome variable. Early pregnancy BMI was not associated with 3 month postpartum weight retention independent of GWG and BF (not shown).

Discussion

The overall objective of this study was to examine whether BMI in early pregnancy was associated with postpartum weight change independent of GWG and BF. These analyses were conducted in a cohort of low income African American women, a demographic group for which postpartum weight management may be particularly important due to their relatively greater risk for obesity and obesity-related obstetric complications. In this study, almost half of the cohort gained at least 1 kg from 2 weeks to 3 months postpartum, which is consistent with a previous study using self-reported data from a small cohort of Black women (23). In the current study, early pregnancy BMI was positively associated with postpartum weight change, independent of GWG and BF status at 2 weeks. There was no association however, between early pregnancy BMI and postpartum weight retention, calculated as the early pregnancy to 3 month postpartum difference in body weight. This discrepancy is important because it highlights the need to examine weight changes during pregnancy and postpartum separately, in order to elucidate when and how pregnancy contributes to the risk for overweight and obesity in women.

The association of BMI with postpartum weight change is consistent with the few published studies that have measured weight change specifically during the postpartum period (6, 24). Although the mechanisms underlying postpartum weight change are not completely understood, it is possible that women who enter pregnancy in an overweight or obese state are inherently more susceptible to gain weight during the postpartum period. Similarly, weight gain during the postpartum period may reflect physiological defense of one's previous weight status, particularly if women did not gain enough weight during pregnancy to support fetal growth. Consistent with the "settling point" hypothesis (25), women who mobilized their own energy stores to support fetal development, and thereby effectively "lose" their own body weight during pregnancy, may gain weight during the postpartum period until they return to their pre-pregnancy body weight. Although this study was underpowered to explore these hypotheses, it would be of value in the future to explore whether there are interactions among early pregnancy BMI and GWG that predict postpartum weight change. In addition, the assessment of adiposity specifically, as opposed

to body weight, may yield greater insight regarding the role of pregnancy and the postpartum period in women's long-term risk for obesity and comorbid metabolic disease.

Strengths of this study include the objective assessment of body weight twice during the postpartum period, and the retrieval of early pregnancy BMI and GWG from prenatal care records. However, this study also had a number of limitations including the small and relatively homogeneous sample, and the limited numbers of women who were breastfeeding. In addition, no information was collected on women's postpartum physical activity or diet, both of which have been associated with postpartum weight retention (5, 26-29).

To conclude, the current study found that African American women with a higher early pregnancy BMI gained more weight from 2 weeks to 3 months postpartum. However, this association was not detected when postpartum weight retention was used as the outcome, highlighting the importance of considering weight changes during pregnancy and the postpartum period separately. It will be of interest in the future to compare postpartum weight change of African American versus Caucasian women, and to examine potential social, environmental, and physiological mechanisms by which pre-pregnancy weight status contributes to postpartum weight change.

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What is already known about this subject

- Postpartum weight retention is relatively common and increases the risk for developing or worsening obesity.
- Women who are overweight or obese prior to pregnancy, and those who gain excessively during pregnancy, have greater risk for postpartum weight retention.
- Previous studies often rely upon a single postpartum measure of body weight, and thereby fail to distinguish retention of weight gained during pregnancy from accrual of new weight during the postpartum period.

What this study adds

- Weight gain was common during the first 3 months postpartum in this cohort of African American mothers.
- Body mass index (BMI) in early pregnancy was positively associated with postpartum weight gain independent of gestational weight gain and breastfeeding status.
- Results suggest that it may be important to measure body weight at least twice during the postpartum period to differentiate retention of pregnancy weight versus postpartum weight gain.

Figure 1.

Table 1

Demographic characteristics of participants

Characteristic	Unadjusted mean $\pm$ SD or n(%)
Age at entry (years)	23.55 $\pm$ 4.07
Gestational age at first prenatal visit (weeks)	9.71 $\pm$ 3.36
Early pregnancy BMI (kg/m ²) ^a	29.66 $\pm$ 9.31
High school graduate	29 (90.63%)
Marital status	
Married	2 (6.25%)
Single ^b	30 (93.75%)
Employed (PT or FT)	10 (31.25%)
Nulliparous	15 (46.88%)
Gestational weight gain	
Failed	10 (31.25%)
Met	11 (34.38%)
Exceeded	11 (34.38%)
Gestational age at delivery (weeks)	39.68 $\pm$ 1.12
BF at 2 weeks postpartum (yes) ^c	13 (40.63%)
Postpartum weight change (kg)	0.45 $\pm$ 3.77

BMI, body mass index; PT, part-time; FT, full-time; BF, breastfeeding.

^aMeasurements taken at the first prenatal visit were used to compute the early pregnancy BMI.

^bIncludes never married, separated, divorced, and widowed;

^cIncludes partial and exclusive breastfeeding.

Table 2

Simple correlations among prenatal factors and postpartum weight change.

	Gestational age at first prenatal visit	Early pregnancy BMI	Gestational weight gain (kg)
Early pregnancy BMI ^a	$r = -0.30^{+}$		
Gestational weight gain (kg)	$r = 0.22$	$r = -0.50^{**}$	
Postpartum weight change	$r = -0.07$	$r = 0.54^{**}$	$r = -0.35^{+}$

⁺ $0.05 < P < 0.1$;^{*} $P < 0.05$;^{**} $P < 0.005$ ^a Measurements taken at the first prenatal visit were used to compute the early pregnancy BMI.