

## Original Research Article

## Body Image Concerns and Reduced Breastfeeding Duration in Primiparous Overweight and Obese Women

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**Objectives:** To test differences in breastfeeding duration by prepregnant maternal weight status, and determine whether body image concerns mediate any differences.

**Methods:** A prospective longitudinal cohort of primiparous women was followed from pregnancy to, at minimum, 6 months postpartum. Questionnaire responses on body concerns were obtained during pregnancy and at 4 months postpartum. Kaplan-Meier curves compared breastfeeding duration in overweight/obese and normal weight groups. Cox proportional hazard regression was used to determine whether body image variables mediated the relationship between maternal weight and duration.

**Results:** Although intended duration was similar between groups, overweight/obese women had a shorter median duration of any breastfeeding (38.6 weeks) compared to normal weight women (48.9 weeks) ( $P < 0.01$ ) and they experienced higher risk of breastfeeding cessation over the entire first year postpartum [hazard risk (HR) = 1.43; confidence interval (CI) = 1.02–2.01;  $P < 0.05$ ]. Overweight/obese women reported lack of body comfort/confidence postpartum more frequently than normal BMI women ( $P < 0.01$ ). Lack of body comfort/confidence postpartum was negatively associated with duration after adjusting for maternal BMI ( $P = 0.01$ ). Thus, the effect of BMI on duration was reduced by this variable (HR = 1.31; CI = 0.93, 1.86;  $P = 0.13$ ), suggesting mediation.

**Conclusions:** Women with high prepregnant BMI have reduced lactation duration that is mediated by lack of comfort/confidence with one's body. Further research into the interplay between body image, weight status, and breastfeeding outcomes may point to behavioral targets amenable to intervention and modification that may in turn improve breastfeeding outcomes for overweight/obese women and their infants. *Am. J. Hum. Biol.* 24:339–349, 2012. © 2012 Wiley Periodicals, Inc.

Maternal transmission of obesity is widely known from findings that consistently demonstrate a positive association between maternal obesity and offspring adiposity in childhood and adulthood (Lake et al., 1997; Parsons et al., 1999; Safer et al., 2001; Whitaker et al., 1997). Although familial risk of overweight and obesity stems from both maternal and paternal sources, overweight and obese mothers can also transmit obesity to their offspring via prenatal mechanisms during pregnancy (Kral et al., 2006; Schack-Nielsen et al., 2010). In addition, postnatal behavioral factors related to infant feeding can play an important role in the transmission of obesity (Anzman et al., 2010).

Breastfeeding is one component of a constellation of healthy infant feeding practices protective against obesity. Observational studies suggest a dose dependent relationship between longer breastfeeding duration and reduced risk of later obesity (Harder et al., 2005), which some hypothesize to exist because breastfeeding promotes the development of internal, as opposed to external appetite control in the infant (Taveras et al., 2004). Results from a randomized trial suggest these outcomes may be the result of residual confounding (Kramer et al., 2007). However, rapid growth and obesity in early infancy predict elevated obesity risk in later life (Kain et al., 2009; Monteiro and Victoria, 2005; Stettler et al., 2002) and longer breastfeeding duration has a protective effect against this rapid weight and adiposity gain (Baird et al., 2008; Chivers et al., 2010). Increasing evidence shows that women with high prepregnancy body mass index (BMI) have shorter durations of both exclusive and any breastfeeding compared to women of normal BMI (Baker et al., 2007; Donath and Amir, 2000; Forster et al., 2006; Hilson et al., 1997, 2004; Kugyelka et al., 2004; Li et al., 2003; Liu

et al., 2009; Oddy et al., 2006). Thus, maternal obesity is one factor that shapes individual vulnerability to obesity, in part because children of overweight/obese mothers may not fully realize the many benefits of breastfeeding, including a likely reduction in their own risk of excessive early weight gain.

The mechanism(s) underlying the negative association between maternal prepregnancy BMI and lactation duration is unknown, but because of the complex nature of breastfeeding, there are likely to be multiple and possibly interacting causes. Low prolactin levels in obese women shortly after parturition (Rasmussen and Kjolhede, 2004), inefficient positioning while breastfeeding between obese mothers and infants (Dewey et al., 2003), as well as delayed onset of milk production relative to women of normal BMI (Chapman and Perez-Escamilla, 1999; Dewey et al., 2003) may all be possible causes.

Psychosocial factors, such as body image, have been little studied in regard to breastfeeding duration among overweight women. Body image is defined as a multidimensional assemblage of one's internal representation of

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her outward appearance (Pruzinsky and Cash, 2002), of which body dissatisfaction may be a component (Thompson et al., 1999). Greater maternal weight during the perinatal period exacerbates body image dissatisfaction (Fox and Yamaguchi, 1997; Huang et al., 2004; Jenkin and Tiggemann, 1997; Walker, 1998; Wiles, 1993) that develops in many women of all weights during pregnancy or the postpartum period (Drake et al., 1988; Skouteris et al., 2005; Strang and Sullivan, 1985; Rallis et al., 2007). Poor body image or dissatisfaction with one's body has a negative implication for infant health as those with greater body image concerns tend not to initiate breastfeeding and formula-feed instead (Barnes et al., 1997; Foster et al., 1996; Gjerdingen et al., 2009). There is only scarce and conflicting information relating body dissatisfaction to breastfeeding duration, among those who have already initiated breastfeeding.

This study explores the largely unexamined relationship between maternal overweight, body image, and breastfeeding duration by examining the following hypotheses in a prospective cohort of nulliparous pregnant women planning to breastfeed: (a) Prepregnant overweight body mass index (BMI) is associated with both shorter exclusive and any breastfeeding duration; (b) Greater body image concerns are associated with both high maternal BMI and shorter lactation duration; and (c) The relationship between prepregnant BMI and lactation duration is mediated by body image concerns. This study is the first to critically examine all three variables of breastfeeding duration, body image, and high maternal prepregnancy body mass in primiparous women who are well supported and committed to breastfeeding. This research is important because interventions may be better targeted to help overweight/obese women reach their breastfeeding goals only when the causes of short lactation duration among overweight/obese women are better understood.

## METHODS

### *Study participants*

Two hundred and fifty-seven pregnant women from Minneapolis-St. Paul were recruited via advertisements in six clinics, prenatal birth classes at four hospitals, and around the University of Minnesota campus during the time period from September 2008 to October 2009. The study ran through June 2010. Women giving birth for the first time and planning to breastfeed their infants were included. Women were excluded from the study if they were cigarette smokers, <18-years-of-age, planned to use estrogen-based birth control within 6 months postpartum, delivered their infant earlier than 37 gestational weeks, gave birth to an infant whose birth weight was less than 2,500 g or had an APGAR score (used to assess the health of newborns) of <7 after 5 min. Participants were characterized as normal weight when their BMI was 18.5–24.9 kg/m<sup>2</sup>, overweight when their BMI was 25.0–29.9 kg/m<sup>2</sup>, and obese when their BMI was ≥30.0 kg/m<sup>2</sup>. Those of overweight and obese BMI were grouped together and compared to the normal BMI group in analyses. Approximately 33% of the overweight/obese group was obese. Seven women had a BMI of <18.5 kg/m<sup>2</sup>, but were included in the normal BMI group because their demographic characteristics and breastfeeding duration outcomes did not differ from others in this category. Participants' prepregnancy height and weight were self-reported. Informed

consent was obtained from each subject after study explanation. The protocol was approved by the University of Minnesota Institutional Review Board (2008).

Eight women decided not to participate after consenting to the study and thus there is no information on the characteristics of these individuals. Ten individuals stopped participation after taking the first survey: three were excluded because their babies were born <37 weeks gestation and seven because they could not be reached for follow-up after taking the first survey. These ten women did not differ from the remaining participants in demographic characteristics, nor in frequency of overweight/obesity status or intention of breastfeeding duration. Two participants could not be reached for follow-up after taking the second survey at 2 weeks postpartum. Four participants completed all study components but failed to report a date when they stopped breastfeeding or to communicate that they were still breastfeeding when the study ended. These six women were included in analyses in which their information was provided. Thus, the final sample consisted of 239, except for analyses involving duration of any breastfeeding in which case  $N = 233$ . In summary, a total of 9.3% (24/257) of participants were lost to follow-up over the course of the entire 22-month study period.

### *Measures*

The two outcome variables in this study were exclusive breastfeeding duration (weeks) and any breastfeeding duration (weeks). Participants were considered to be exclusively breastfeeding if they were providing only breastmilk to their infant and no other liquids or solids for nutritional value. Exclusive breastfeeding duration was measured from the time of infant birth until the infant received non-breastmilk liquids or solids and continued to do so without going back to a breastmilk only diet. Participants were considered to be breastfeeding if they were nursing or pumping/expressing milk to any extent for their infant. Duration of any breastfeeding was measured from the time of infant birth until the time when participants completely ceased all nursing and pumping.

All women submitted a prenatal questionnaire (during the third trimester of pregnancy), another at 2 weeks postpartum and a third at 4 months postpartum (or time of weaning, whichever came first). These responses provided information relating to demographic characteristics, hospital delivery experience, intended and actual breastfeeding patterns, and questions on a variety of psychosocial issues related to breastfeeding. Psychosocial measures, such as maternal perception of personal and institutional support, as well as variables relating to maternal body image were assessed from responses to the questions shown in Table 1. Body image questions were adapted from published, validated questionnaires designed for use in women (Ben-Tovim and Walker, 1991; Cooper and Fairburn, 1987; Evans and Dolan, 1993). Responses to each question were voluntary and as such, some participants did not answer some questions despite completing the rest of the questionnaire. Sample size for a particular analysis may fluctuate in accordance with these types of missing data.

### *Statistical analysis*

Chi-square ( $\chi^2$ ) and *t*-test (2-tailed) analyses were conducted to compare the characteristics of women with nor-

TABLE 1. Description of psychosocial measures used in analyses

Psychosocial measure	Description
<b>Prenatal questionnaire</b>	
Describe the level of agreement the baby's father (or other person you will raise the child with) has with your plan to feed your infant	Answers were provided using a five-point scale from Strongly agree to Strongly disagree
Were you ever breastfed as a baby?	Answers were Yes/No
Will you have attended a class on breastfeeding by the time your baby is born?	Answers were Yes/No
Do you think you will avoid breastfeeding in public because others might see your breasts?	Answers were Yes/No
Were you ever concerned about your body shape or weight before you became pregnant?	Answers were: No; Yes, but rarely concerned; Yes, I was sometimes concerned; Yes, I was often concerned
Are you comfortable with and self-confident in your body?	Answers were Yes/No
<b>Two weeks postpartum questionnaire</b>	
While you were in the hospital or birth center for delivery of this baby, did anyone help you with breastfeeding by showing you how or talking to you about breastfeeding?	Answers were Yes/No
Since your baby was born, have you attended a breastfeeding support group or visited with a lactation consultant?	Answers were Yes/No
<b>Four months postpartum questionnaire</b>	
Are you currently concerned about your body shape or weight?	Answers were: No; Yes, but rarely concerned; Yes, I am sometimes concerned; Yes, I am often concerned
Are you currently comfortable with and self-confident in your body?	Answers were Yes/No

mal BMI prepregnancy to those with overweight/obese BMI prepregnancy. All participants had stopped breastfeeding exclusively when the study ended; accordingly, complete exclusive duration lengths are reported. Thirty-four percent of participants were still breastfeeding to some extent when the study ended, thus, duration lengths of any breastfeeding are only observed partially. These participants were classified as not having the event of interest (i.e., cessation of breastfeeding) and were, therefore, right-censored for analyses that involve duration of any breastfeeding. The Kaplan-Meier life table method was used to determine whether the outcome variables of exclusive and any breastfeeding duration, differed by maternal prepregnant BMI categories, as well as by other independent variables. Wilcoxon's test was used to compare the survival curves.

Analyses with each body image variable as a potential mediator of the association between BMI and breastfeeding duration were conducted using methods described by Baron and Kenny (1986) as well as formal significance tests of the indirect effect: the Sobel test and a bootstrap method (Preacher and Hayes, 2004). Following procedures outlined by Baron and Kenny (as illustrated in Fig. 1), the following criteria must be met for mediation: (1) the predictor variable (BMI) must be significantly related to the outcome (duration) (path *c*, Fig. 1); (2) the predictor variable (BMI) must be significantly related to the mediator (body image variable) (path *a*); (3) the mediator (body image variable) must be significantly related to the outcome (duration), while adjusting for the predictor (path *b*); and (4) the relationship between the predictor variable (BMI) and the dependent variable (duration) must be reduced when the mediator (body image variable) is included in the model (path *c'*). Results from the last two steps come from the same regression model.

We used Cox proportional hazards regression (Cox, 1972) to assess steps (1), (3), and (4) and logistic regression to assess step (2). Cox proportional hazards regression analyses were conducted to determine the hazard risk (HR) of discontinuing breastfeeding among overweight/obese women compared to those with normal BMI prepregnancy. Models were built in steps on the basis of significance in the bivariate analyses. Variables that were

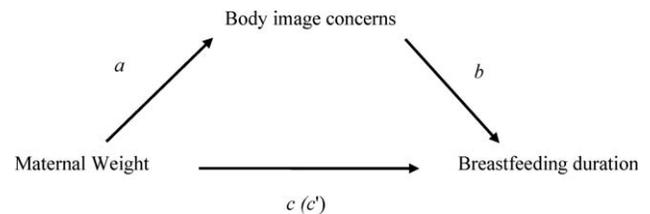


Fig. 1. Diagram of theoretical model behind Baron and Kenny's mediation analysis method. The effect of the predictor variable on the outcome is partitioned between a direct effect (path *c*) and an indirect effect (path *ab*), through which a third variable mediates the effect of the predictor on the outcome (path *c'*).

significantly associated ( $P < 0.10$ ) with duration and/or maternal overweight/obesity were added to the model as covariates. Variables that remained independent significant predictors of duration ( $P < 0.05$ ) were kept in the final model. Potential interactions among the resulting main effect variables and maternal BMI were investigated by adding their cross-product terms to the equation for the final model-building step. No significant interactions were found. Time-dependent covariates were not significant individually or collectively so the assumption of proportionality was met. The final explanatory variables were checked for multicollinearity by examining the variance inflation factor and the values were not high enough to indicate collinearity.

The Sobel test was used to explore the presence of a significant indirect effect, which is the change in the influence of BMI on duration when adjusted for the mediator. The Sobel test compares the strength of the indirect effect of BMI on duration (path *ab*) with the null hypothesis that it equals zero. Bootstrapping, a nonparametric resampling method, was also conducted to provide an estimate and confidence interval (CI) of the indirect effect (Preacher and Hayes, 2004). The Sobel test and bootstrapping method do not account for censored data and direct methods of formally testing mediation using survival analysis data are underdeveloped. Thus, we conducted these tests both without our censored data points ( $N = 152$ ) and with the full sample to examine the effect of the censored data

TABLE 2. Participant characteristics by prepregnant BMI group

	Total sample (N = 239) <sup>c</sup>	Normal BMI (N = 159) <sup>c</sup>	Overweight/ Obese BMI (N = 80) <sup>e</sup>	P value <sup>a</sup>
Demographic characteristics				
Maternal age (yrs)	29.7 ± 4.5	30.0 ± 3.9	29.1 ± 5.1	0.136
Prepregnant BMI (kg/m <sup>2</sup> )	24.3 ± 4.8	21.7 ± 1.9	29.6 ± 4.6	<0.0001
4-year college grad (% yes)	90.8%	96.2%	80.0%	<0.0001
Married (% yes)	88.7% (N = 238)	93.0% (N = 158)	80.0%	0.003
Working 4 mon PP (% yes)	71.6% (N = 236)	74.7% (N = 158)	65.4% (N = 78)	0.136
Income (% WIC eligible) <sup>b</sup>	13.4%	10.1%	20.0%	0.033
Self-identified ethnicity <sup>b</sup>				
Caucasian	84.5% (N = 202)	83.7% (N = 133)	86.3% (N = 69)	–
African American	2.5% (N = 6)	0.6% (N = 1)	6.3% (N = 5)	
Asian	8.4% (N = 20)	10.7% (N = 17)	3.8% (N = 3)	
Hispanic	1.3% (N = 3)	1.3% (N = 2)	1.3% (N = 1)	
Native American	0.4% (N = 1)	0% (N = 0)	1.3% (N = 1)	
Pacific Islander	0.4% (N = 1)	0.6% (N = 1)	0% (N = 0)	
Other or No Response	2.5% (N = 6)	3.1% (N = 5)	1.3% (N = 1)	
Perinatal and support characteristics				
Gestational weight gain <sup>f</sup>				<0.0001
Above recommendation	53.2%	43.4%	73.1% (N = 78)	
Within recommendation	38.8%	47.8%	20.5%	
Below recommendation	8.0%	8.8%	6.4%	
C-section delivery (% yes)	25.3% (N = 237)	21.5% (N = 158)	32.9% (N = 79)	0.057
Gestational diabetes (% yes)	3.8%	2.5%	6.3%	0.150
PP depression (% yes)	5.6% (N = 233)	6.3% (N = 158)	4.0% (N = 75)	0.469
Time PP until milk onset (hrs)	75.3 ± 23.0	73.5 ± 21.8	78.9 ± 25.1	0.086
Attend prenatal BF class	63.2% (N = 238)	62.0% (N = 158)	66.3%	0.418
BF help in hospital (% yes)	96.6% (N = 238)	96.9%	96.2% (N = 79)	0.792
BF help after discharge (% yes)	65.8% (N = 237)	68.6%	60.3% (N = 78)	0.206
Mother BF as baby (% yes)	75.5% (N = 233)	77.9% (N = 154)	70.9% (N = 79)	0.237
Infant sex (% male)	54.2% (N = 238)	57.0% (N = 158)	48.8%	0.230
Infant birth weight (kg)	3.5 ± 0.4 (N = 233)	3.5 ± 0.4 (N = 158)	3.5 ± 0.5 (N = 79)	0.443
Body image characteristics				
Avoid BF in public (% yes)	41.4%	41.5%	41.3%	0.969
Comfort/confidence in body, prenatal (% no)	28.5%	17.0%	51.3%	<0.0001
Comfort/confidence in body, 4-month postpartum (% no)	35.5%	28.5% (N = 158)	50.0% (N = 76)	0.001
Body shape/weight concerns prenatal				
Yes, often concerned	18.8%	15.7%	25.0%	
Yes, sometimes concerned	45.2%	43.4%	48.8%	
Yes, rarely concerned	24.3%	26.4%	20.0%	
No	11.7%	14.5%	6.3%	
Body shape/weight concerns, 4-month postpartum				
Yes, often concerned	19.2%	14.6%	29.0%	0.002
Yes, sometimes concerned	39.3%	36.1%	46.1%	
Yes, rarely concerned	22.7%	27.9%	11.8%	
No	18.8%	21.5%	13.2%	
Breastfeeding duration				
Planned exclusive (wks)	22.0 ± 9.5 (N = 232)	21.8 ± 9.6 (N = 153)	22.5 ± 9.2 (N = 79)	0.627
Actual exclusive (wks)	16.5 ± 9.9 (N = 235)	17.5 ± 9.2 (N = 157)	14.3 ± 10.9 (N = 78)	0.019
Planned any (wks)	43.8 ± 17.7	44.0 ± 16.2	43.6 ± 20.4	0.857
Actual any (wks) <sup>d</sup>	40.9 (27.3) (N = 233)	48.9 (42.9–52.6) (N = 156)	38.6 (27.7–46.0) (N = 77)	0.009 <sup>e</sup>

Values presented are frequencies or means ± standard deviations.

<sup>a</sup>Sample size provided was used for all statistical tests unless otherwise noted.

<sup>b</sup>P-values determined by *t*-test for continuous variables and chi-square test for categorical variables.

<sup>c</sup>Sample sizes given are actual counts for each level of this variable.

<sup>d</sup>Classified as weight gained *Above*, *Within*, or *Below* in relation to recommendations from the Institute of Medicine for appropriate weight category (IOM 2009).

<sup>e</sup>For this variable, the median (inter-quartile range) is given for the total sample and the median (95% confidence intervals) is given for the total duration values of the BMI groups. Due to censored data points, the distribution cannot be assumed to be normal and, thus, the median is more appropriate.

<sup>f</sup>P-value determined by Kaplan-Meier life table method, Wilcoxon test.

BMI, body mass index; WIC, Women Infant Children; C-section, delivery via cesarean section; BF, breastfeeding; PP, postpartum.

points on the estimate of the indirect effect and to provide a formal test to confirm the results of our mediation analysis using the Baron and Kenny procedure. Results were considered statistically significant at  $P < 0.05$ . All analyses were conducted with SAS (version 9.2; SAS Institute, Cary, NC).

## RESULTS

Characteristics of the total sample and of the participants by prepregnant BMI category are shown in Table 2. Mean maternal age was 29.7 years and most were married

(88.7%), college-educated (90.8%), and of high socioeconomic status (only 13.4% had a household income that qualified for WIC). Over 71% of participants were working for pay at four-months postpartum. Self-identified ethnicity of participants was as follows: 202 participants (84.5% of the total sample) identified as Caucasian, six as African American, 20 as Asian, three as Hispanic, one as Native American, one as Pacific Islander and six as other or no response. Because the number of women who identified as an ethnicity other than Caucasian is small and too heterogeneous as a group to analyze in a statistically meaningful way, the role of ethnicity on lactation duration was not

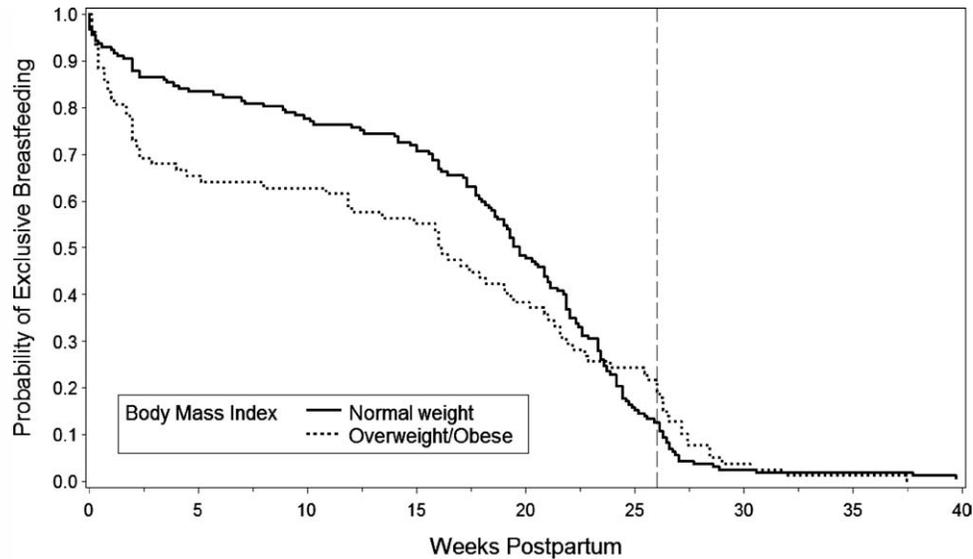


Fig. 2. Kaplan-Meier estimates of probability of exclusive breastfeeding duration by postpartum week and prepregnancy maternal BMI. Note: Dotted vertical line represents the health professional recommended time of exclusive breastfeeding until 6 months postpartum (Gartner et al., 2005).

tested. Fewer than 4% of participants were diagnosed with gestational diabetes and 5.6% with postpartum depression. Many women ( $N = 119$ ) experienced delayed onset of full milk production (defined as  $> 72$  h) as the mean number of h reported until milk “came in” was  $75.3 \pm 23.0$ . Overweight/obese participants were less likely to have a 4-year college degree ( $P < 0.0001$ ) and be married ( $P = 0.003$ ) and they were more likely to have an income that qualifies for WIC ( $P = 0.033$ ) compared to those with normal BMI. There were no significant differences ( $P < 0.05$ ) by BMI group in any other demographic or perinatal characteristics.

Participants reported being committed to breastfeeding and receiving familial and institutional support: 75.5% of participants were breastfed themselves as babies, 63.2% took a prenatal breastfeeding class, 96.6% of participants received breastfeeding assistance from hospital staff following delivery, and 100% of those who were raising the baby with another adult had support from that individual to breastfeed the baby. The two BMI groups did not differ in any of these measures of breastfeeding support.

#### *Duration differences by body mass index*

All but 1.7% of participants stated that they were fairly or quite certain of their plans and were determined to follow through with them. Maternal intended duration was positively related to actual duration of both exclusive and any breastfeeding ( $P = 0.0004$  and  $P < 0.0001$ , respectively). Intended duration of both exclusive and any breastfeeding did not differ by maternal BMI group. Those who planned on feeding their infant exclusively for some period of time (97.1%,  $N = 232$ ) intended to do so for an average of  $22 \pm 9.5$  weeks (mean  $\pm$  standard deviation) (Table 2). While actual mean exclusive breastfeeding length ( $16.9 \pm 9.9$  weeks) was shorter than planned for the entire sample, those in the overweight/obese group had significantly lower exclusive duration ( $14.3 \pm 10.9$  weeks) compared to those in the normal BMI group

( $17.5 \pm 9.2$  weeks) ( $P = 0.019$ ). The estimated probability of breastfeeding exclusively was less for overweight/obese women compared to the normal BMI group during the first 24 weeks postpartum (Fig. 2). The largest difference between the groups is at 3 months: the estimated probability that an overweight/obese woman will breastfeed exclusively for at least 12 weeks is 57.7% (CI = 46.0%, 67.7%), compared to 75.8% (CI = 68.3%, 81.8%) for normal BMI women.

The pattern was similar for duration of any breastfeeding. Mean planned duration of any breastfeeding for the entire sample was  $43.8 \pm 17.7$  weeks ( $N = 239$ ), while the actual median duration was 40.9 weeks (inter-quartile range 27.3) ( $N = 233$ ). Because of censored data, the distribution of values for duration of any breastfeeding cannot be assumed to be normal and thus, the median values are presented for this variable. Overweight/obese women had a significantly lower median duration of any breastfeeding (38.6 weeks) compared to normal weight women (48.9 weeks) ( $P = 0.009$ ). The estimated probability for those in the overweight/obese group to be breastfeeding any amount at 6 months was 66.2% (CI = 54.5%, 75.6%) compared to 80.1% (CI = 73.0%, 85.6%) for those in the normal BMI group. The magnitude of this difference persisted as the estimated probability of any breastfeeding was less for overweight/obese women compared to the normal BMI group during the entire first year postpartum (Fig. 3).

#### *Relationship of body image to overweight/obese status and breastfeeding duration*

There were a number of significant associations between body image variables, overweight/obesity status, and lactation duration. A positive response to the question asked in the prenatal survey “Do you think you will avoid breastfeeding in public because others might see your breasts?” was a significant negative predictor for duration

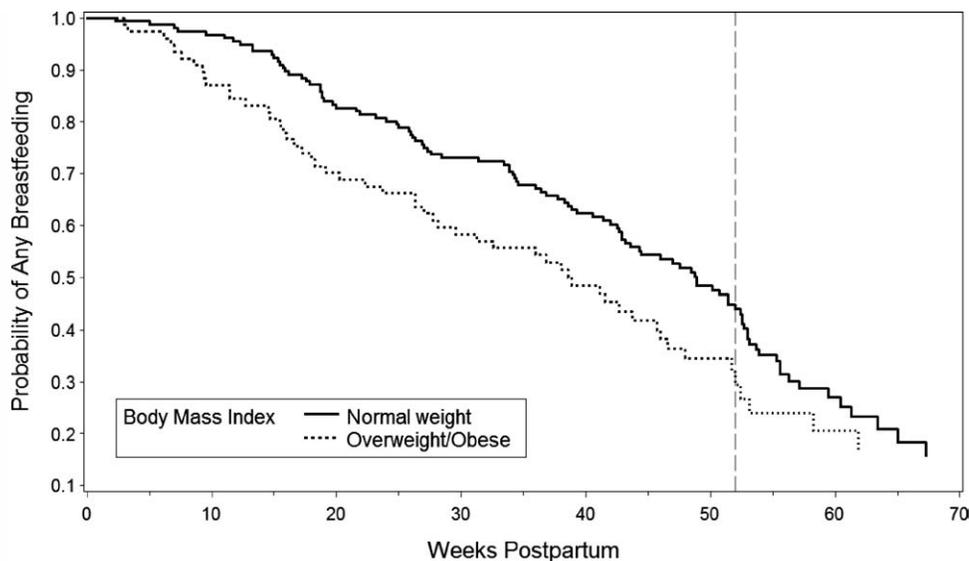


Fig. 3. Kaplan-Meier estimates of probability of total breastfeeding duration by postpartum week and prepregnancy maternal BMI. Note: Dotted vertical line represents the health professional recommended time of breastfeeding to some extent until at least 1 year postpartum (Gartner et al., 2005).

of both exclusive ( $P = 0.0002$ ) and any breastfeeding ( $P = 0.002$ ), but it was not related to maternal overweight/obesity.

A negative response to the question asked during pregnancy, “Are you comfortable with and self-confident in your body?” was strongly associated with overweight/obesity status ( $P < 0.0001$ ). Over 50% of overweight/obese women responded that they were not comfortable with or self-confident in their bodies and they were more than three times as likely as those of normal BMI to report this feeling. This variable was not associated with duration of exclusive breastfeeding ( $P = 0.183$ ) but approached significance with any breastfeeding ( $P = 0.078$ ). The frequency of overweight/obese women that reported feeling not comfortable/self-confident at 4 months postpartum did not change from the prenatal response, while the prevalence of normal weight women who felt this way increased, yet there was still a significant difference between the BMI groups ( $P = 0.001$ ). Feeling comfortable/confident in one’s body at 4 months postpartum was a significant predictor of both exclusive ( $P < 0.0001$ ) and any breastfeeding duration ( $P < 0.0001$ ).

Finally, women who reported during pregnancy that they were more concerned with their prepregnancy body shape/weight tended to have shorter exclusive ( $P = 0.013$ ) and any breastfeeding duration ( $P = 0.0005$ ) compared to those with less concerns. Concerns at this time were only related to overweight/obesity status at the  $P < 0.10$  level. At 4 months postpartum, however, there was a significant relationship to maternal overweight/obesity ( $P = 0.002$ ). Women of normal weight were equally likely to be either *often* or *sometimes* concerned as they were to be *rarely* or *not* concerned, but among overweight/obese women, three times as many were *often* or *sometimes* concerned. Therefore, normal weight women were twice as likely as overweight/obese women to be either *rarely* or *not* concerned about their body shape/weight. Being concerned with one’s body shape/weight postpartum was also significantly

associated with duration of both exclusive ( $P = 0.046$ ) and any breastfeeding ( $P = 0.0001$ ).

#### Mediation of body image on the relationship between overweight/obese status and duration

There was no significant risk of discontinuing exclusive breastfeeding among overweight/obese women using Cox proportional hazards regression. When the risk of discontinuing any breastfeeding was examined for overweight/obese women, they were at a significantly higher risk than normal weight women (unadjusted HR = 1.40; CI = 1.001, 1.95;  $P = 0.049$ ). Several variables known to be related to either maternal overweight/obesity or breastfeeding duration were explored as potential confounders. Three variables were added to the model as covariates because of their significant association: gestational diabetes and avoiding breastfeeding in public were negative predictors and a longer planned duration of breastfeeding was a positive predictor of duration of any breastfeeding. When they were entered into the proportional hazards regression model, the association between maternal overweight/obesity and duration of breastfeeding was not attenuated and remained significant (adjusted HR = 1.43; CI = 1.02, 2.01;  $P = 0.041$ ).

Each body image variable was then tested for mediation using the adjusted model. Three of the variables did not meet step (3) of the Baron and Kenny procedure: body shape/weight concerns during both pregnancy and the postpartum period, as well as lack of comfort/confidence with one’s body during pregnancy did not predict duration with BMI included in the model (all  $P > 0.05$ ). As a result, no further steps were tested for any of these models as there was no mediation between BMI and duration with these variables. Lack of comfort/confidence in one’s body during the postpartum period satisfied all the steps for mediation: overweight/obese BMI predicted lower duration (HR = 1.43; CI = 1.02, 2.01;  $P = 0.04$ ) (path *c*) and

TABLE 3. Mediation analysis for comfort / confidence with one's body postpartum in the association between prepregnant body mass index and risk of ceasing any breastfeeding

Path <sup>a</sup>	Model <sup>b</sup>	HR (95% CI) <sup>c</sup>	P value <sup>d</sup>
c	(1) Effect of overweight/obese BMI on duration	1.43 (1.02–2.01)	0.04
a	(2) Effect of overweight/obese BMI on lack of postpartum body comfort/confidence	2.51 (1.42–4.43) <sup>e</sup>	0.002
b	(3) Effect of lack of postpartum body comfort/ confidence on duration with BMI in the model	1.56 (1.11–2.19)	0.01
c'	(4) Effect of BMI on duration while controlling for the effect of the mediator in the model	1.31 (0.93–1.86)	0.13

<sup>a</sup>Paths correspond to Figure 1.

<sup>b</sup>Models adjusted for gestational diabetes status, avoidance of breastfeeding in public, and intended duration of any breastfeeding. Models analyzed following Baron and Kenny's mediation steps.

<sup>c</sup>Hazard ratios and confidence intervals obtained from Cox proportional hazards regression.

<sup>d</sup>P values based on the Wald test for significance of Cox regression coefficients.

<sup>e</sup>Odds ratio and confidence interval obtained from logistic regression.

HR, hazard ratio; CI, confidence interval; BMI body mass index.

lack of comfort/confidence in one's body (OR = 2.51; CI = 1.42, 4.43;  $P = 0.002$ ) (path *a*), lack of comfort/confidence predicted duration while adjusting for BMI in the model (HR = 1.56; CI = 1.11, 2.19;  $P = 0.01$ ) (path *b*) and its presence in the model removed the effect of maternal overweight/obesity on duration of any breastfeeding (HR = 1.31; CI = 0.93, 1.86;  $P = 0.13$ ) (path *c'*) (Table 3). The Sobel test and bootstrapping method were conducted to test the significance of the indirect effect of BMI on duration through the mediator. The Sobel test estimated the size of the indirect effect at  $-2.01$  weeks ( $P = 0.01$ ) for the full sample and  $-2.54$  weeks ( $P = 0.02$ ) for the sample excluding censored data points ( $N = 152$ ), while the bootstrap method yielded estimates of  $-2.07$  weeks (95% CI =  $-4.28$  to  $-0.59$ ) for the full sample and  $-2.49$  weeks (95% CI =  $-5.13$  to  $-0.62$ ) for the sample excluding censored data points.

## DISCUSSION

We aimed to explain how prepregnant maternal overweight/obesity negatively impacts breastfeeding duration by testing whether body image concerns were associated with breastfeeding duration. Our results indicate that overweight/obese women in this study, although uniformly and highly committed to breastfeeding, and also well supported, more often fell short of their own breastfeeding goals and had significantly shorter durations compared to those of normal BMI. The overweight/obese women expressed significantly more concerns with their body shape and weight and were less confident in and comfortable with their bodies. In addition to their association with BMI, greater body image concerns were associated with shorter lactation duration.

### *Duration and body mass index*

It is recommended that women breastfeed exclusively for 6 months postpartum and to some extent for at least twelve months postpartum (Gartner et al., 2005). It seems that normal weight and overweight/obese women planned to follow these recommendations because, on average, both groups intended to breastfeed exclusively for just under 6 months and to some extent through eleven months postpartum. While women of normal BMI were approximately 1 month shy of their exclusive duration intentions, they exceeded their goal for duration of any breastfeeding. In contrast, those in the overweight/obese BMI category were several weeks short of their goals for both exclusive and any breastfeeding.

These results are consistent with what is demonstrated in the literature regarding shorter lactation duration among overweight women. Many studies also show that obese women have shorter planned durations (Hilson et al., 2004) and even initiate breastfeeding less frequently than do women of normal weight (Li et al., 2003; Oddy et al., 2006; Scott et al., 2006), which may affect the shorter duration lengths these studies report. Our study is unique, however, in that all participants were committed to breastfeeding and intentions did not differ between participants in the two BMI groups. In addition, participants were extremely well supported by their families and health professionals: every participant raising her baby with another adult had that individual's support to breastfeed and almost all received breastfeeding assistance in the hospital following the birth. In addition, a majority attended a prenatal breastfeeding instruction class and received support from a health professional after hospital discharge. There were no significant differences between overweight/obese and normal weight women in any of these measures, indicating that the shorter breastfeeding duration of overweight/obese than normal weight women is unlikely to stem solely from differences in intention or support from partners and health professionals.

### *Effect of body image concerns on duration in overweight/obese women*

Overweight/obese women differed considerably from normal weight women in their concerns surrounding body image. Overweight/obese women reported being concerned about their prepregnant and postpartum body shape/weight more frequently than the normal BMI group. In addition, they were three times as likely to report a lack of comfort/confidence with their body during pregnancy and twice as likely to report lack of comfort/confidence postpartum. That women who were overweight/obese before pregnancy have greater body image concerns during the perinatal time period is expected and has been demonstrated before (Fox and Yamaguchi, 1997; Gjerdingen et al., 2009; Hilson et al., 2004; Huang et al., 2004; Walker, 1998), but this is the first study to demonstrate a relationship between greater body image concerns and shorter exclusive breastfeeding duration.

Most research shows that those intending to breastfeed their infants have a more positive body image or fewer body shape concerns than those intending to bottle-feed formula (Barnes et al., 1997; Foster et al., 1996; Gjerdingen et al., 2009), although one study showed no difference in body image between the two groups (Walker and

Freeland Graves, 1998). While these studies explore intentions for infant feeding, only two studies, to our knowledge, have examined the relationship between body image and breastfeeding success among those who already intend to breastfeed. In contrast to this study, Hughes (1984) found no difference in body satisfaction between those who were successful at breastfeeding (defined as breastmilk constituting all but up to 8 oz of an infant's daily intake at 4-weeks postpartum) versus not. In addition, her study did not investigate the influence of maternal weight on either body image or breastfeeding success. Hilson et al. (2004) examined short breastfeeding duration among obese women and found that "less satisfaction with appearance" was one of several factors that was significantly associated with both maternal obesity and shorter duration of any breastfeeding, however, it did not mediate the effect of obesity. In the study by Hilson et al., it is important to note that obese women planned to breastfeed for three fewer months than normal BMI women, which may play a role in the relationship between obesity and short duration in their sample.

Our bivariate analyses clearly confirmed the previously known association between high maternal BMI and shorter breastfeeding duration, as well as demonstrated that body image concerns were significantly associated with both high BMI and reduced breastfeeding duration. A final aim of this study was to assess whether body image variables were a possible explanation for how high BMI might result in shorter duration. Results from multiple mediation methods similarly conclude that lack of comfort in and confidence with one's body during the postpartum time period mediated the effect of maternal overweight/obesity on duration of any breastfeeding. This is the first study to affirm the mediating effect of a body image variable on the relationship between high maternal BMI and shorter breastfeeding duration. In this sample, the shorter breastfeeding duration among overweight/obese women can be explained, in part, by lack of comfort/confidence with their bodies postpartum.

Responses collected during pregnancy, in contrast, did not mediate this association, which may indicate that postpartum body image concerns, rather than body image *per se*, are particularly important in this context. Considering that duration, and not breastfeeding initiation, is the outcome of interest, it might be expected that body image concerns occurring while women are actually engaged in breastfeeding might be more salient. This finding supports previous research that shows the postpartum time period to be one of increased body image concerns relative to pregnancy (Clark et al., 2009; Jenkin and Tigge-mann, 1997; Rallis et al., 2007).

It is also interesting to note that of the two body image measures assessed in this study, lack of comfort in and confidence with one's body had a stronger effect than concerns about one's body shape/weight. Breastfeeding requires women to use their body in new ways and has even been named a "confidence trick" (Jelliffe and Jelliffe, 1978). Establishing and maintaining a breastfeeding pattern often requires persistence in the face of a variety of physiological, anatomical, and social obstacles. These obstacles could be exacerbated for overweight individuals who may have large breasts or extra body tissue that reduces available "lap" area (Hoover, 2008). For a first-time mother, not being comfortable and confident in one's body could make combating breastfeeding obstacles a con-

tinual struggle. It is known that body image dissatisfaction relates to lower self-esteem (Clark et al., 2009; Walker et al., 2002) and that low maternal confidence in ability to breastfeed consistently predicts shorter breastfeeding duration (Blyth et al., 2002; Noel-Weiss et al., 2006; O'Campo et al., 1992). Less confidence and comfort in one's body could lead to either lower self-esteem and/or early breastfeeding difficulties, either of which could lower confidence in one's ability to breastfeed, ultimately resulting in shorter duration.

Expected avoidance of breastfeeding in public was also negatively associated with both exclusive and any breastfeeding duration. Women must remove milk from the breast frequently to produce sufficient milk to support exclusive breastfeeding. As women are away from home for longer periods as the time since delivery increases, it will be necessary to breastfeed or express milk outside of the home to maintain milk supply. If one avoids doing so in public, it could lengthen the time between feedings, which decreases the milk supply and necessitates supplementation of the infant's diet, thereby decreasing duration. We therefore hypothesized that avoidance of breastfeeding in public might be a link between body image concerns and maternal overweight/obesity, but no significant differences in public avoidance were found between the BMI groups. It is possible that this measure only captured participants' level of modesty, which may not differ by BMI, and not the degree of hassle associated with breastfeeding in public, which was thought to perhaps be greater for overweight/obese women.

#### *Strengths and limitations*

This study has a number of potential limitations. First, while participation by women who identified as non-European/Caucasian was sought and encouraged, the final sample was not demographically diverse and thus, cannot be generalized to other populations. In addition, recruitment largely took place in a university setting, which likely contributed to the older and more highly educated sample. Second, the value of this research would increase with additional quantitative measures of body image and qualitative information on women's attitudes toward their bodies as they experience their new role as breastfeeding mothers. Body image is a complex concept and it is difficult to comprehensively capture in a small number of questionnaire items. The particular choice of questions to address body image may have influenced the results, such that conclusions about breastfeeding duration and body image are limited solely to the issues presented here and may relate differently if additional or different questions are asked. It is also possible that the questions we chose to capture body image and confidence, which were from questionnaires designed for non-pregnant women, may be less sensitive and valid measures of these constructs during pregnancy than during the postpartum period. If true, then the apparent mediation only by a postpartum measure may be due to measurement bias. Further research to establish better reliability is desirable. Third, while we adjusted for confounding and accounted for censored duration observations in the Baron and Kenny analysis, the Sobel test and bootstrap method only provide unadjusted results that do not take into consideration censored data. We tested the effect of the censored data by conducting the tests both with and without the censored data points

and the results showed similar patterns suggesting that the censored data points had limited effect. The significant results from these analyses add support to our conclusions from the Baron and Kenny mediation procedures. Finally, a limitation of observational studies is lack of certainty on the direction of causality between exposure and outcome. While we attempted to avoid this difficulty by measuring body image repeatedly and prior to breastfeeding initiation and cessation, nonetheless, women sometimes ceased exclusive or any breastfeeding before or at the time of reporting on body image at the 4-month postpartum time point. For this reason, it is possible, although not likely, that the association between postpartum body image and breastfeeding duration could reflect reverse causality; that is, that cessation of breastfeeding could induce reduced body image and confidence.

On the other hand, the socio-demographic advantage of the participants also constitutes a strength of the study because we expect that these women, albeit overweight/obese, should be among the most successful at breastfeeding. In addition to socio-demographic characteristics associated with breastfeeding success, they report high levels of familial and institutional support, while living in a state that has higher breastfeeding rates compared to the national average (in Minnesota 20.4% of infants are exclusively breastfed at 6 months and 26.6% are still breastfed at 1 year, compared to national rates of 13.3% and 22.4%, respectively) (CDC, 2007). That they are not more successful at meeting their breastfeeding goals is particularly striking.

Despite these advantages, perhaps living in the United States, a country that is not as culturally supportive of breastfeeding as others, serves as a disadvantage compared to living in parts of the world where breastfeeding is more supported. Even though women in this sample are more likely to continue exclusive and any breastfeeding longer than most other U.S. women, these rates are low relative to global rates as 37% of infants worldwide are exclusively breastfed at 6 months and 39% breastfed to some extent at 20–23 months (UNICEF, 2008). Breastfeeding patterns develop in response to particular ecological and cultural contexts (Vitzthum, 1994). Women in this study live in a context in which they are often unavailable for nursing their infants due to reasons such as working away from the home (Fein and Roe, 1998), lack of co-sleeping (McKenna and Gettler, 2007), and discouragement of breastfeeding in public (Hannan et al., 2005). In addition, infant formula and adequate supplemental foods are widely available, the use of which decreases breastfeeding. The popular “Breast is Best” slogan, rather than a claim that breastfeeding is the only appropriate way to feed an infant, as well as our modest national breastfeeding goals of only 25% breastfeeding exclusively through 6 months and 34% to some extent through the first year (HealthyPeople 2020, 2011), demonstrate that breastfeeding is not normative behavior in this cultural context.

This article also demonstrates how the psychosocial costs of being overweight, especially in a culture obsessed with thinness, can shape additional negative effects for overweight/obese women and their children. Cross-cultural studies have suggested that the U.S. is one country that stigmatizes obesity most strongly (Brewis, 2011; Crandall et al., 2001). The poorer body image of overweight/obese women that impeded attainment of their own breastfeeding goals in this study may be a reflection

of this stigmatization. In cultural contexts where obesity is less stigmatized, the same association between maternal overweight and reduced lactation duration may not be found. Studies outside “Western” cultures are lacking, but would be a fruitful area of future research. In this vein, it is interesting to note that within the U.S., African Americans report being more satisfied with their bodies (Roberts et al., 2006; Rucker and Cash, 1992), even during the perinatal period (Carter-Edwards et al., 2010), compared to women who identify as Caucasian. In addition, the association between obesity and poor breastfeeding outcomes does not hold among African American women in that obese African American women have similar lengths of breastfeeding duration compared to African American women of normal BMI (Kugyelka et al., 2004; Liu et al., 2009). It is not yet clear why obesity status appears to have a different relationship to breastfeeding success in African American women, but issues of body image should be explored further.

In summary, the results presented here show that overweight/obese women, who are well supported and intend to breastfeed for as long as women of normal weight, experience reduced breastfeeding duration that appears to be mediated by postpartum lack of comfort/confidence with one’s body. Given the increasing prevalence of maternal obesity and its associations with poorer body image and breastfeeding outcomes, further research in this interplay is needed to identify effective ways to enhance mothers’ body image and confidence levels during the perinatal period. Doing so may improve interventions aimed at supporting lactation in overweight/obese women, so that more mothers and infants realize the full benefits of breastfeeding.

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