



Mothers' loss of control over eating during pregnancy in relation to their infants' appetitive traits



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1. Introduction

Infants' appetitive traits, which represent individual variation in appetite and eating behavior (Carnell & Wardle, 2008a), predict obesity risk in later infancy and childhood (Quah et al., 2015; van Jaarsveld, Llewellyn, Johnson, & Wardle, 2011; van Jaarsveld, Boniface, Llewellyn, & Wardle, 2014). Early studies of infant sucking rate found that a vigorous eating style, including sucking more rapidly and with greater pressure, in infancy was associated with higher caloric intake and greater adiposity at age two (Agras, Kraemer, Berkowitz, Korner, & Hammer, 1987). Food approach behaviors, such as responsiveness to food cues, are linked to higher BMIs and greater weight gain during infancy, whereas food avoidance behaviors, such as responsiveness to satiety cues, are linked to lower BMI and less weight gain during infancy (Quah et al., 2015; van Jaarsveld et al., 2014). Thus, infancy is a critical period for understanding appetitive traits.

Infant appetitive traits are a complex set of behaviors with a multifactorial etiology. The behavioral susceptibility theory posits that genetic susceptibility to obesity is partly attributable to appetitive traits (Llewellyn & Wardle, 2015), highlighting the heritability of infant appetite (Llewellyn, van Jaarsveld, Johnson, Carnell, & Wardle, 2010; Llewellyn, van Jaarsveld, Plomin, Fisher,

& Wardle, 2012). Parental characteristics and behaviors also are associated with infant appetite. For example, infant appetite is associated with parental eating behaviors (Agras, Berkowitz, Hammer, & Kraemer, 1988) and parental weight. Compared to infants born to parents with normal weight, infants of parents with overweight/obesity have higher suck rates (Milstein, 1980) and a higher number of sucks (Stunkard, Berkowitz, Schoeller, Maislin, & Stallings, 2004) during feeding tasks. A higher number of sucks in infancy also predicts higher weight at age 2 years, suggesting that infant appetite may be a prognostic indicator of obesity (Stunkard et al., 2004). Given that appetite is a proposed target in the prevention of obesity (Llewellyn & Wardle, 2015), it is important to identify early precursors of infant appetitive traits such as maternal characteristics during pregnancy.

Although maternal weight is associated with infants' appetite (Milstein, 1980; Stunkard et al., 2004), little is known about how maternal characteristics during pregnancy prospectively affect infant appetitive traits. Maternal eating behavior is one characteristic that could influence fetal and infant appetite development. We recently examined loss of control eating (LOC), an appetitive phenotype characterized by a sense that one is unable to control what or how much one is eating (Striegel-Moore et al., 2009), in a cohort of pregnant women with overweight and obesity. We found that LOC was present in nearly one-quarter of women during the first 20 weeks of pregnancy (Kolko, Emery, Marcus, & Levine, 2017). This rate of LOC is similar to published studies among community samples of non-pregnant adults (Striegel-Moore et al., 2009). Recent studies in non-pregnant adults have demonstrated that binge eating, the experience of LOC coupled with the consumption of a large amount of food, relates to food approach behaviors and is associated with obesity (Bouhassira, McBride, Trivedi, Agurs-Collins, & Persky, 2017). Prior research on LOC indicates that independent of the amount of food consumed, LOC represents a behavioral phenotype associated with psychiatric distress (Colles, Dixon, & O'Brien, 2008), obesity (Telch, Agras, Rossiter, Wilfley, & Kenardy, 1990), and weight gain (Sonnevile et al., 2013). Thus, we were interested in prospectively examining mothers' LOC during pregnancy in relation to their infants' appetitive traits. In particular, we were interested in this relationship among women with

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overweight/obesity, given that their infants are at greater risk for obesity.

Accordingly, in the current study, we interviewed pregnant women with overweight/obesity and examined the role of maternal LOC during pregnancy as a predictor of infant appetitive traits. We hypothesized that LOC in mothers during early pregnancy would be associated with obesity-related appetitive traits in infants: higher food responsiveness, higher enjoyment of food, lower satiety responsiveness, lower slowness in eating, and higher general appetite. We anticipated that LOC would be more strongly related to infant food responsiveness and satiety responsiveness, given that these infant appetitive traits have the most consistent associations with weight and weight gain in infants (Quah et al., 2015; van Jaarsveld et al., 2014) and children (Carnell & Wardle, 2008b).

2. Materials and methods

2.1. Participants

We recruited eighty-six women who were participating in a longitudinal study of perinatal eating behavior in the context of overweight/obesity to provide information about their infants' appetitive traits. Participant characteristics are presented in Table 1. Women were eligible for the longitudinal study if they were ≥ 14 years old, were between 12 and 20 weeks gestation, had a pre-pregnancy BMI ≥ 25 kg/m², and a singleton pregnancy. Exclusion criteria were use of weight-affecting medications, participation in weight-management programming, or psychiatric disorders requiring immediate treatment.

2.2. Procedure

The study site's Institutional Review Board approved the research, and participating women provided written informed consent. Women completed interviews, questionnaires, and weight and height measurements during early pregnancy and again at six months postpartum. Compensation was provided for completing

assessments.

We administered the BEBQ in two ways. We contacted women who had already completed their final postpartum assessment for the larger study if they had delivered within the last 20 months. These thirty-four women (40% of the present sample) completed the BEBQ by phone. Fifty-two women (60% of the present sample) completed the BEBQ in-person as part of their questionnaire packet at six months postpartum.

2.3. Measures

2.3.1. Demographic and weight information

Women self-reported demographic information and pre-pregnancy weight, which has been shown to be valid among pregnant women (Shin, Chung, Weatherspoon, & Song, 2014). Height and weight during early pregnancy (12–20 weeks gestation) were measured via calibrated stadiometer and scale (SECA; Chino, CA), respectively. Weight gain during early pregnancy (early pregnancy [12–20 weeks gestation] weight minus pre-pregnancy weight), pre-pregnancy BMI (kg/m²), and early pregnancy BMI (kg/m²) were calculated.

2.3.2. Maternal LOC during pregnancy

We administered the Eating Disorder Examination-Pregnancy Version (EDE-PV) to assess LOC during women's first study visit (12–20 weeks gestation). The EDE-PV is a structured interview that evaluates eating disorder psychopathology and has been shown to be reliable among pregnant women (Emery, Grace, Kolko, & Levine, *In press*; Fairburn, Stein, & Jones, 1992). Data on LOC were obtained from the Overeating Section in which women's binge eating behaviors are assessed. Women, all of whom were in the first half of pregnancy, were asked about their experience of LOC in the past three months during early pregnancy. We recorded LOC as a dichotomous variable (presence [≥ 1 episode] or absence), given that the experience of LOC at least once is associated with psychological distress (Colles et al., 2008) and has been found to be prevalent in women (Striegel-Moore et al., 2009). Interrater reliability for LOC episodes was high (intraclass correlation

Table 1
Participant characteristics and differences among women with and without loss of control eating.

Variable	All Women N = 86 Mean (SD) or n (%)	Women with LOC n = 19 Mean (SD) or n (%)	Women with no LOC n = 67 Mean (SD) or n (%)
Maternal age (years)	29.12 (5.34)	30.37 (7.47)	28.76 (4.58)
Gestational age to date (weeks)	15.85 (2.51)	15.36 (2.41)	15.98 (2.54)
BMI prior to pregnancy (kg/m ²)	32.01 (6.74)	28.94 (4.67)**	32.88 (7.00)**
BMI during early pregnancy (kg/m ²)	33.34 (7.48)	29.87 (5.47)*	34.33 (7.70)*
Weight gain during early pregnancy (kg)	3.67 (7.58)	2.44 (5.17)	4.02 (8.13)
Education			
Grade school or some high school	6 (7%)	3 (16%)	3 (4%)
High school graduate/GED	16 (19%)	4 (21%)	12 (18%)
Some college/technical school	26 (30%)	6 (32%)	20 (30%)
4-year college graduate	16 (19%)	3 (16%)	13 (19%)
Post-graduate degree	22 (26%)	3 (15%)	19 (28%)
Race			
White or Caucasian	45 (52%)	7 (37%)	38 (57%)
Black or African American	34 (40%)	9 (47%)	25 (37%)
Mixed race	4 (5%)	2 (11%)	2 (3%)
Ethnicity (Hispanic/Latina)			
Yes	5 (6%)	3 (16%)	2 (3%)
No	81 (94%)	16 (84%)	65 (97%)
Household income			
\leq \$30,000	46 (53%)	12 (63%)	34 (51%)
$>$ \$30,000	40 (47%)	7 (37%)	33 (49%)
Infant age (months)	8.82 (3.88)	9.83 (4.96)	8.54 (3.51)
Age when infant began eating solid foods (weeks)	23.58 (9.32)	24.06 (9.20)	23.42 (9.45)

Abbreviations: BMI (body mass index); GED (General Educational Development certificate); LOC (loss of control eating [presence = 1, absence = 0]). * $p < 0.05$, ** $p < 0.01$.

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