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Association of Restraint and Disinhibition to Gestational Weight Gain among Pregnant Former Smokers

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A B S T R A C T

Introduction: Gaining excessive weight during pregnancy is associated with immediate maternal and fetal complications as well as longer term obesity. Prepregnancy body mass index, age, and smoking cessation have been related to gestational weight gain (GWG); however, less is known about how eating behaviors, that may be amenable to modification and have been related to weight gain outside of pregnancy, affect GWG.
Methods: The present study evaluated the relationship of dietary restraint and disinhibition to GWG in a sample of women ($n = 248$) who quit smoking before or early in pregnancy. Women self-reported height and prepregnancy weight during their third trimester. GWG was calculated by subtracting prepregnancy weight from third trimester weight. The Three-Factor Eating Questionnaire assessed restraint and disinhibition.
Results: Average GWG was 14.60 (±7.64) kg and 47% of women had a GWG greater than the Institute of Medicine recommendations. Linear regression models were used to examine restraint and disinhibition as correlates of GWG, and multinomial logistic regressions were utilized to determine whether eating behaviors were associated with inadequate or excessive GWG. Restraint was associated positively with total GWG, but disinhibition was not associated with GWG. Thus, conscious attempts to restrict intake were associated with GWG beyond the influence of covariates.
Conclusion: These findings highlight the potential influence of modifiable eating behaviors on GWG and demonstrate the need for additional research to determine how these behaviors relate to GWG over the course of pregnancy.

Guidelines for gestational weight gain (GWG), developed by the Institute of Medicine (IOM), were revised in 2009 (IOM and National Research Council, 2009). Excessive GWG, or GWG above that recommended by the IOM based on prepregnancy body mass index (BMI), is associated with numerous negative health consequences, including increased chance of cesarean section (Juhasz, Gyamfi, Gyamfi, Tocce, & Stone, 2005), preterm birth, increased risk for preeclampsia and gestational diabetes, and higher infant birth weights (Seiga-Riz et al., 2009). Despite its harmful consequences, rates of excessive GWG are high (Oken, Taveras, Kleinman, Rich-Edwards, & Gillman, 2007) and understanding factors that contribute to GWG can inform interventions to limit excessive weight gain during pregnancy.

Several demographic and behavioral factors have been related to excessive GWG. Younger age and higher prepregnancy BMI have been associated with excessive GWG (Abrams, Carmichael, & Selvin, 1995; Chu, Callaghan, Bish, & D'Angelo, 2009; Olson & Strawderman, 2003; Stotland et al., 2005). Not surprisingly, increased calorie intake, poor diet quality, and decreased physical activity also affect GWG (Stuebe, Oken & Gilman, 2009). In addition, smoking status has been related to GWG. Women who quit smoking prenatally gain more weight during pregnancy and are more likely to gain excessive GWG than do those who continue to smoke or who have never smoked (Adegboye, Rossner, Neovius, Lourenco, & Linne, 2010; Favaretto et al., 2007; Groff, Mullen, Mongoven, & Burau, 1997; Mongoven, Dolan-Mullen, Groff, Nicol, & Burau, 1996; Washio et al., 2011). Although these demographic and behavioral predictors provide

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insight into factors associated with GWG, the potential influence of other modifiable behaviors that have been related to weight outside of pregnancy is unclear.

In particular, two behaviors that have been associated with weight changes outside of pregnancy are restraint (i.e., conscious attempts to limit, control, or reduce food intake) and disinhibition (i.e., a tendency to overeat in response to emotion/social situations; Hays & Roberts, 2008). For instance, restraint is a stronger predictor of weight variability than body weight (Heatherton, Polivy, & Herman, 1991). Restraint also tends to increase during pregnancy (Fairburn, Stein, & Jones, 1992). Interestingly, although the restraint tends to be inversely correlated with weight gain, and thus might be related to lower GWG, elevated dietary restraint before pregnancy has been associated with excessive GWG (Conway, Reddy, & Davies, 1999; Mumford, Siega-Riz, Herring, & Evenson, 2008). However, the relationship between restrained eating and GWG has not been studied during pregnancy, only before pregnancy. Disinhibition is associated with loss of control over eating, overeating, and overweight (Latner, Hildebrandt, Rosewall, Chisholm, & Hayashi, 2007; Lawson et al., 1995). Binge eating, which is similar to the behaviors assessed by disinhibition scales, is associated with greater GWG when it occurs during pregnancy (Nunes, Pinheiro, Camey, & Schmidt, 2012; Soares et al., 2009). Yet, disinhibition, outside of frank disordered eating behavior, has not been examined in relation to pregnancy and GWG. Thus, although restraint and disinhibition are linked to weight changes in general, the relationship of these eating behaviors to pregnancy-related weight changes is less clear, and their association with excessive GWG is unknown.

Accordingly, the present study examined the relationship between self-reported eating behaviors at the end of pregnancy and GWG in a sample of pregnant women who quit smoking. Given that restraint before pregnancy is associated with excessive GWG (Conway et al., 1999; Mumford et al., 2008), we hypothesized that dietary restraint would be associated positively with greater GWG. We also predicted that disinhibition would be associated with greater GWG because of the relationship between binge eating and greater GWG (Nunes et al., 2012; Soares et al., 2009) and the strong correlation between binge eating and disinhibition (d'Amore et al., 2001).

Methods

The present study used a subset of data from two studies of women smokers who quit as a result of pregnancy. In both studies, participants were initially assessed in the third trimester (i.e., at least 28 weeks gestation). The combined group of women included in the present study were participating in either an ongoing randomized controlled trial designed to examine the efficacy of two approaches to prevent postpartum smoking relapse ($n = 141$; Levine, Cheng, Marcus & Kalarchian, 2013) or a naturalistic study aimed at identifying predictors of postpartum relapse ($n = 112$; Levine, Marcus, Kalarchian, Houck, & Cheng, 2010).

Participants

Only women from whom both prepregnancy body weight and third trimester weight are available were included. Fifty-six percent of participants were Caucasian ($n = 142$), 38% were African American ($n = 97$), 4% were multiracial ($n = 11$), and 1 participant was Asian. Two women did not indicate their ethnicities. Importantly, there were no differences in demographic characteristics between women recruited from the different studies, although women from the naturalistic study were assessed earlier in pregnancy—7.96 $\pm$ 3.27 vs. 3.87 $\pm$ 2.18 weeks until delivery; $t\,(162) = 10.63$ $p < .001$. Participants ($n = 5$) with GWGs that had standardized (z) scores in excess of 3.29 (Tabachnick & Fidell, 2007) were excluded from analyses. Thus, the final sample of 248 participants comprised 138 participants from the randomized controlled trial and 110 participants from the naturalistic study. This research was approved by the Institutional Review Board of the University of Pittsburgh.

Weight

Women self-reported height and prepregnancy weight, which were used to calculate prepregnancy BMI. Prepregnancy weight was self-reported and third trimester weight was assessed in person on a digital scale. GWG was calculated by subtracting prepregnancy weight from third trimester weight. Although weight at the very end of pregnancy was not available, a weight taken at the end of third trimester provides a useful time point to examine potential influences on GWG. Women were, on average, 34 weeks pregnant at the time of assessment. Importantly, we controlled for time to delivery (see Pregnancy Descriptives) to account for changes across women in weight gain between the assessment time point and delivery. GWG categories (inadequate, adequate, excessive) were determined based on whether women's third trimester weight gain fell below, within, or above IOM weight gain recommendations based on their self-reported, prepregnancy BMI (see IOM [2009] for recommended weight gain ranges).

Eating behaviors

The Three-Factor Eating Questionnaire (Stunkard & Messick, 1985) was used to assess levels of dietary restraint and disinhibition. The Three-Factor Eating Questionnaire assesses two factor scales of interest in the present study: restraint and disinhibition. The restraint factor is a measure of conscious attempts to limit, control, or reduce food intake. The disinhibition factor reflects a tendency toward overeating in response to emotions or social situations.

Smoking and nicotine dependence

Prepregnancy daily smoking habits were assessed by asking: "How much did you smoke before becoming pregnant/quitting?" In addition, the Fagerstrom Test for Nicotine Dependence (Fagerstrom, Heatherton, & Kozlowski, 1990), a well-validated, six-item self-report measure was used to assess prepregnancy nicotine dependence.

Pregnancy descriptives

Women self-reported parity. The number of weeks between the third trimester assessment and each woman's precise delivery date was calculated by determining the number of weeks between the third trimester assessment and delivery date for each participant. This variable was used as a precise marker of the length of gestation at the point in the third trimester at which weight and other assessments occurred. The current analyses are focused on the influence of eating behaviors on weight assessed at the same assessment point, while accounting for the fact that each woman has a varying number of additional weeks that they could continue to gain gestational weight. Thus, this "weeks until delivery" variable was included in all models of