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Pregravid BMI is associated with dietary restraint and psychosocial factors during pregnancy[1]

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Abstract

The objective was to investigate the association of pregravid weight status, dietary restraint and psychosocial factors during pregnancy. We used data from the Pregnancy, Infection and Nutrition study, that recruited 2,006 women at prenatal clinics before 20 weeks' gestation who were >16 years and English speaking. Institute of Medicine BMI cutpoints of underweight (<19.8), normal weight (19.8–26.0), overweight (>26.0–29.0), obese (>29.0–34.9) and an additional category morbidly obese (≥ 35.0), were used to categorize weight status. Eight psychosocial measures and dietary restraint were assessed with regard to BMI; perceived stress, trait anxiety, depression symptoms, and internal locus of control (LOC), chance LOC, powerful others LOC, self-esteem and mastery. Linear regression was used to estimate associations, controlling for potential confounders. A significant test for trend was found between increasing pregravid weight categories and perceived stress, trait anxiety, depression symptoms, powerful others LOC, self-esteem, mastery and dietary restraint. In adjusted models, pregravid obesity was independently associated with perceived stress, trait anxiety and depression. Morbidly obese status was independently associated with all measures except internal LOC. A strong linear association was found between increasing weight categories and dietary restraint. A consistent association was found between pregravid weight status, psychosocial factors and dietary restraint. If corroborated, these findings suggest that with increasing pregravid weight, pregnant women are at greater risk for experiencing negative psychological states, are less likely to experience positive personal dispositions, and may need additional support to prevent adverse maternal complications and pregnancy outcomes.

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Keywords

BMI; obesity; psychosocial factors; pregnancy

INTRODUCTION

Pregravid overweight and obesity has increased steadily over time, and women now enter pregnancy at higher weights than ever before (1–3). A study of 79,022 live births to mostly Caucasian, highly educated women showed that over the five-year study period, there was a 9.2% increase in overweight and obese pregnant patients, with 40.5% of all patients entering pregnancy as overweight or obese (3). These trends reflect the overall increase of overweight and obesity in the general population (4,5).

The negative impact of pregravid overweight and obesity on pregnancy complications has been documented, including gestational diabetes (6–10), gestational hypertension (6–8,11,12), preeclampsia (6–8,13), cesarean deliveries (6,7) and late fetal death (8). The risk of these complications increases with increasing BMI (7). Overweight and obesity has been consistently associated with excessive weight gain during pregnancy (14–16). For these reasons, strategies for preventing and managing obesity-related complication of pregnancy are critical.

Managing weight gain during pregnancy is a current focus of prevention efforts. Both diet and physical activity have been implicated as reasons for poor weight management during pregnancy, however, association between pregravid overweight and obesity and physical activity is not clear. At least two studies find a null relationship between pregravid weight status and physical activity (17,18), while one study found an increase in physical activity with increased weight (19). Obesity has been associated with poor dietary intake (20,21). The reasons women eat differently during pregnancy are not well understood, but stress has been suggested as a factor in eating behaviors (22–24).

Overweight and obesity has been associated with a variety of psychosocial problems for both genders, including depression (25–27), anxiety symptoms (25), bipolar disorder (27), agoraphobia (27), lack of internal locus of control (28), and poor global health (28). Several studies show that women are at a particular disadvantage with regards to psychosocial problems, and that the obesity-depression effect is greater for women than for men. Irrespective of BMI, women are more likely to be depressed at some point in their lives than are men (29, 30), and overweight and obese women have been shown to be more depressed than healthy-weight women (31,32). Several studies indicate obesity significantly affects depression for women and not for men (31,32), and that while higher BMI's predict depression for women, lower BMI's among men are associated with higher depression scores (32).

There is a lack of research exploring the direct relationships between pregravid BMI and psychosocial factors during pregnancy; although, the psychosocial state of pregnant women has been studied to understand the overall psychological profile and dietary intake. Negative psychosocial states (i.e., depression, anxiety, and stress) have been inversely related to positive personal dispositions (i.e., self-esteem, mastery, and locus of control) during pregnancy (33–37). Higher depression symptom scores have been linked to lower levels of personal resources such as self-esteem (33–35) and mastery (36), and have been linked to higher levels of stress (33,38). Low self-esteem has also predicted anxiety during pregnancy (34). On the other hand, having personal resources such as optimism, mastery, and self-esteem has been linked to lower stress during pregnancy (37). In one study, stress during pregnancy was associated with decreased iron and zinc intake, while stress and fatigue were associated with increased energy intake (38). This suggests that stress during pregnancy may influence an increase in caloric

intake while compromising diet quality and influencing eating behaviors and subsequently, optimal weight gain.

A woman's stress profile may extend into the postpartum period and continue to influence her dietary intake and weight trajectory. Women entering pregnancy as overweight and obese are at a higher risk for postpartum depression than women entering pregnancy at normal BMI's, and this risk increases with higher weight categories (39). A population-based survey of 3,439 women showed that those entering pregnancy as overweight and obese were twice as likely compared to normal-weight women to have postpartum depressive symptoms that required some form of treatment (39). Irrespective of BMI, depression during pregnancy has been a strong predictor of postpartum depression (40,41)and anxiety during pregnancy has predicted postpartum anxiety and depression (41).

The purpose of this study was to identify the extent to which an independent association exists between pregravid BMI and psychosocial factors that characterize negative psychological states (i.e., depression, anxiety, and stress), protective personal dispositions (i.e., self-esteem, mastery, locus of control) and restrained eating (i.e., dietary restraint, concern about dieting and weight cycling). It was hypothesized that increasing BMI would be positively associated with negative psychological factors as well as restrained eating, and inversely associated with protective personal dispositions.

METHODS

Study Sample

This study used data from the Pregnancy, Infection, and Nutrition (PIN) cohort, a prospective study that examines the influence of infection, physical activity, nutrition, food security, and stress on preterm birth. Between 2000 and 2004, 2,006 women were recruited though the University of North Carolina Hospitals residents' and private physicians' obstetrics clinics before 20 weeks' gestation. Women were excluded from the analysis between BMI and psychosocial factors if they had incomplete delivery information, psychosocial measures, weight and/or height (n=220). Women excluded had a lower mean age (27.0 vs. 29.1 years), mean education (13.8 vs. 15.5 years), mean income (266.5% vs. 400.0% poverty), respectively, and a higher proportion were black or other race compared to white (p value = 0.001 for each). The Revised Restraint Scale (RRS) was added to the study four months after recruitment began. Analysis of the relationship between pregravid BMI and cognitive dietary restraint, was limited to 1,217 women who had information on pregravid height, weight, and weight gain and who completed the RRS. The procedures followed for this study were in accordance with the ethical standards of the Institutional Review Board of the University of North Carolina.

Psychosocial Factors and Eating Behaviors

A woman's body mass may influence several personal psychological states such as anxiety, depression symptoms, and perceived stress during pregnancy. In addition, pregravid body mass may negatively influence personal dispositions such as self esteem, mastery, or internal locus of control, or be associated with the belief that one's locus of control is subject to chance or to powerful others. A description of these measures and how they were constructed follows.

- Cohen's Perceived Stress Scale addresses the link between the occurrence of stressful events and the perception by the respondent regarding how threatening or demanding such an event was. This measures the "degree to which situations in one's life are appraised as stressful" and has been assessed for internal consistency (42,43). The 14-item scale provides a stable index of chronic stress or strain, and coping with these stresses. Each item is rated on a five-point scale ranging from never to almost always totaling 70 points.

- Spielberger's Trait Anxiety Inventory has been used extensively in health research and includes 20 items with a four-point response totaling 80 points. The trait-anxiety scale measures general perception of stressful situations that may involve danger or threats to the individual and reflects how often and intensely an individual responds with anxiety. It is designed to be a stable measure of anxiety (44).
- The Center for Epidemiologic Studies Depression (CES-D) Scale assesses psychological disposition or generalized distress in the general population (45). The 20-item scale has Likert response categories assessing feelings and activities the respondent experienced during the past week. The range is from 0 to 60 points. Internal consistency reliability measure using Cronbach's alpha were excellent, ranging from 0.83 to 0.92. Neugebauer et al. (46) found that two-thirds of women with scores of 30 or more would be expected to meet diagnostic criteria for major depressive disorders.
- Rosenberg's Self Esteem Scale assesses an individual's favorable or unfavorable attitude toward self (47), based on ten items. The scale was implemented with a six-point agree-disagree format and is considered a stable measure across time. The scale has high reliability with test-retest correlations in the 0.82 to 0.88 range and Cronbach's alpha ranging from 0.77 to 0.88 (48).
- Pearlin's Mastery Scale is a seven-item scale with a six-point agree-disagree format to measure personal mastery (49). The scale has been used to assess control of one's life ranging from having self control to fatalistically ruled (50) and it has been widely used in health research. The impact of persistent problems is thought to be blunted in persons with higher levels of mastery.

Levenson's IPC Locus of Control is a 24-item questionnaire with three subscales:

- The Internality Scale measures the extent to which people believe they have control over their own lives, where a high score indicates a belief of having a high level of control.
- The Powerful Others Scale measures the belief that other persons control the events in one's life where a high score indicates this belief in others' control.
- The Chances Scale indicates whether the respondent believes that chance affects her experiences or outcomes, and a high score indicates a stronger belief in chance (51).

Previous research has demonstrated that seven of these scales are markers of long-standing characteristics. The only scale which is more episodic is the CES-D. We used Z-scores for each psychosocial measure, with a change of one standard deviation as the unit of interpretation.

Pregravid body mass may be associated with eating behaviors. We assess behaviors associated with restrained eating such as history of dieting and weight fluctuations using the Revised Restraint Scale (52,53). A modified scale by Conway and colleagues (54) was used that focused on the period prior to pregnancy, and not on weight changes accruing during pregnancy.

- Revised Restraint Scale (RRS) is a 10-item scale with four to five possible responses. An overall score for Restrained Eating was calculated by summing the scores for all of the questions. The Concern with Dieting subscale (55) was constructed by summing items on frequency of dieting, eating behaviors, emotional eating, awareness of food choices, and amount of time spent concerned about food. The Weight Cyclers subscale was constructed by summing items on weight fluctuations and ideal weight.

Main Exposure—Pregravid BMI

Self reported pre-pregnancy weight and measured height were used to construct BMI. Recalled pre-pregnancy weight is shown to correlate well with measured weights (56). An imputed weight was used in lieu of the self-reported measure only when it was missing or considered biologically implausible. This imputed weight was calculated using the measured weight at the first prenatal visit (if taken prior to 16 weeks) minus the recommended amount of weight to be gained in the first and second trimesters as defined by the IOM (57). This methodology has been previously used by our group (58,59). If the first weight measurement was after 15 weeks of gestation, a pre-pregnancy weight was not imputed. Weight status categories were defined using the Institute of Medicine BMI cutpoints for pregnant women as follows: <19.8 kg/m^2 (underweight), 19.8–26.0 kg/m^2 (normal), >26.0–29.0 kg/m^2 (overweight), and >29.0–34.9 kg/m^2 (obese), and we added a fifth category of morbidly obese ≥35.0 kg/m^2 (60). These BMI cutpoints were used because gestational weight gain recommendations are based on these categories. The normal weight category was used as the referent category for the analysis between BMI categories and psychosocial factors, while the underweight category was used for analysis between BMI categories and cognitive dietary restraint.

Covariates

Exploratory analyses included the following socioeconomic and demographic variables previously identified as associated with pregravid BMI and psychosocial factors: race (indicator for black and other race compared to white), education (indicator for high school, college, greater than college, compared to less than high school), marital status (dichotomized as married or not married), any children (yes/no), household income (indicator for at or below 185% poverty, compared to over 185% of poverty) and maternal age in years.

Statistical Analysis

Descriptive statistics were conducted to test for statistical significance between pregravid BMI category and each of the covariates using t-tests for the continuous variables of maternal age, years of education, number of children, percent of the income/poverty ratio, and all psychosocial variables, and χ^2 tests for the categorical variables of maternal race and marital status. A linear relationship between psychosocial factors and BMI categories was assess with a nonparametric test for trend across ordered BMI groups with significance if probability > |z| = 0.05. Linear regression models were used to estimate the association between psychosocial factors, dietary restraint and pregravid BMI category, controlling for other factors. Due to the high correlation coefficients (>0.70) among most psychosocial factors, each psychosocial factor was modeled separately adjusting for all of the selected socioeconomic variables. Stata software (61) was used for data management and statistical calculations.

RESULTS

Characteristics of the study population

The average age of the cohort was 28.9 (±5.7), with 15.3 (±3.0) years of education, and had an income of almost 400% of the income/poverty ratio. The majority of the women were non-Hispanic white (72.3%), were married (75.3%), and 45% were pregnant for the first time. With regard to pregravid BMI categories, 14% were underweight, 49% were of normal weight, 11% were overweight, 14% were obese and 12% were morbidly obese. Women with pregravid weights in the overweight, obese and morbidly obese ranges had a lower income levels, fewer years of education, more children, and were less likely to be married compared to women in the underweight or normal ranges. There were no differences in age or percentage of any given racial/ethnic group by categories of pregravid weight status.

Psychosocial factors and dietary restraint varied by pregravid weight status and were all significantly associated with morbid obese status (Table 2). There was an apparent increasing trend for each negative psychosocial factor, dietary restraint and a decreasing trend for the protective personal dispositions of self-esteem, mastery and internal locus of control with increasing weight categories. For all psychosocial factors, a significant difference in the mean score was found between morbidly obese and underweight women. For all negative psychosocial factors, a significant difference in the mean score was found between morbidly obese and normal weight women.

In unadjusted models, a significant positive coefficient was estimated for the relationship between overweight, obesity and morbid obesity and trait anxiety and depression symptoms, and a negative coefficient was estimated for self-esteem, compared to normal weight (Table 3). A significant positive coefficient was estimated for the relationship between obesity and morbid obesity and perceived stress, and a negative coefficient was estimated for positive personal dispositions of internal LOC and mastery, while only morbid obesity was positively associated with a chance LOC, compared to the normal weight category. No significant difference in any psychosocial factors was estimated for underweight compared to normal weight.

In adjusted models, weight categories demonstrated a significant trend with all psychosocial factors except internal LOC and chance LOC. In adjusted models, the relationship between overweight and trait anxiety, depression symptoms and self-esteem were attenuated and became non-significant, and only perceived stress and trait anxiety remained significant with obesity. As for morbid obesity, all psychosocial factors except internal LOC remained significantly associated, although most were attenuated except for powerful others LOC.

For dietary restraint, we found a large and positive magnitude of association in crude and adjusted models between weight categories and, dietary restraint and each subscale. Adjustment for individual covariates in these models did not attenuate the relationships.

DISCUSSION

In this analysis of the association between pregravid BMI and previous cognitive dietary restraint, and psychosocial factors reported during pregnancy, we found a significant test for trend between increasing pregravid weight categories and perceived stress, trait anxiety, depression symptoms, powerful others LOC, restrained eating, concern about dieting and weight cycling, and a decreasing trend in self-esteem and mastery. In adjusted models a strong and consistent relationship was found between morbid obesity and each of the dietary restraint subscales, and all but one psychosocial factor, internal LOC. In the non-pregnant population, weight has been found to be positively associated with depression (25–28), anxiety (25) and decreased internal LOC (27). In pregnancy, cognitive dietary restraint has been found to be a marker for disregulated eating, particularly overeating when stimulated by negative emotional queues (54)

Overweight women are more likely to overeat in response to emotional eating (62). Obese adults have been found to score higher for susceptibility to hunger and disinhibition—overconsumption of food in response to cognitive or emotional cues—compared to overweight and nonobese individuals (63). Stress induced eating is hypothesized to increase visceral fat deposit (24,64). In a study among college students, 62% self-identified as stress eaters were more likely to eat more food, have increased levels of nocturnal insulin and cortisol, increased total/HDL cholesterol and gain weight during a stressful event, than students who did not report eating more during the stressful event (65). These findings suggest that stress experienced

during pregnancy may interfere with dietary and weight recommendations, especially among obese women.

During pregnancy many women perceive greater freedom with dietary intake and food choices, while at the same time they are motivated to make positive health behavior changes. If confronted by stress, women may opt for “comfort foods” and may not sustain healthy food choices over the course of pregnancy. In one study obese pregnant women were less likely to meet the recommendation for fruit and vegetable consumption or the Institute of Medicines recommendation for meal pattern, and they had a lower diet quality score (21). Another study found increasing pregravid BMI associated with decreased fiber and folate intake (20). Psychosocial factors of fatigue, stress, and anxiety measured in predominantly white, non-smoking, married and well educated pregnant women were associated with increased food consumption measured by increased macronutrient intake, but had decreased micronutrient intakes (no association was found with measures of depressed mood, anger, or social support and diet) (38). However, BMI was not associated with any of the psychosocial factors. In another study, a higher pregravid BMI was associated with a Western diet, characterized by high-fat dairy, processed and red meats, compared to a Healthy diet, characterized by intake of vegetables, fruits, poultry and fish or an Intermediate diet which is a combination of both (66). The Western diet was associated with an increased risk for small-for-gestational age birth.

The study had limitations. Our sample is a cohort of women obtaining prenatal care at UNC hospital clinics and cannot be generalized to all pregnant women. The sample may be representative of women in the US south who seek prenatal care at state funded hospitals. Although many of the psychosocial factors have been characterized as stable measures of one’s psychological disposition, the direction of causality between psychological state and pregravid weight status cannot be established. For example, a woman’s psychological state or personal disposition could influence weight gain through increased caloric intake or disregulated eating behavior thus increasing a woman’s pregravid weight, although it is possible that a woman’s pregravid weight status led to having negative psychological state and a decrease in positive personal disposition. However, the finding that several of these measures were consistently associated in the suspected direction strengthens the notion that pregravid overweight and obesity may be influenced by one’s perceived stress and personal dispositions. Finally, the cross-sectional dataset and the analysis techniques that we used limit our ability to draw causal inferences.

We found a consistent association between pregravid weight status, especially obesity and morbid obesity with psychosocial factors and cognitive dietary restraint. If corroborated, these findings suggest that with increasing pregravid weight, pregnant women are at greater risk for experiencing negative psychological states, are less likely to experience positive personal dispositions, and may need additional support to prevent adverse maternal complications and pregnancy outcomes. Women are entering pregnancy at increased weight, 40% of women are either overweight or obese at the beginning of pregnancy (3). While we may not know the directionality of the relationship between psychosocial factors and pregravid weight status, it is clear that if we are to develop interventions we will need to address the psychosocial disposition of women during pregnancy to assist them with managing their dietary intake, weight gain and stress.

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Table 1

Socioeconomic and demographic characteristics by weight category

Characteristic	Range or Level	Total (n=1786)	Underweight (n=254)	Normal Weight (n=887)	Overweight (n=202)	Obese (n=233)	Morbidly Obese (n=210)
Age, *years*[1]	16–45	28.9 (5.7)	29.2 (5.8)	29.3 (5.5)	28.2 (5.8)	28.4 (5.8)	28.5 (5.9)
Education, *years*[1]	6–12	15.3 (3.0)	16.0 (3.1)	16.0 (2.8)	14.9 (3.0) * †	14.0 (2.5) * †	13.5 (2.4) * †
Income, % *poverty*[1]	11–923	395.2 (226.6)	428.0 (223.6)	446.4 (221.3)	368.5 (230.2) * †	317.8 (199.3) * †	269.5 (197.2) * †
Number of children[1]	0–8	0.86 (1.00)	0.75 (0.84)	0.75 (0.92)	1.06 (1.13) * †	0.98 (1.06) *	1.04 (1.10) *†
Race[2]	White	1,268 (72.3)	206 (81.8)	697 (79.6)	132 (37.0)	133 (59.4)	100 (49.0)
	Black	358 (20.4)	23 (9.1)	110 (12.6)	52 (26.4)	78 (34.8)	95 (46.57)
	Other	127 (7.2)	23 (9.1)	69 (7.9)	13 (6.6)	13 (5.8)	9 (4.4)
Marital status[2]	Married	1,310 (75.3)	204 (81.9)	721 (83.2)	126 (64.6)	141 (62.7)	118 (58.1)
	Single	429 (24.7)	45 (18.1)	146 (16.8)	69 (35.4) †	84 (37.3) †	85 (41.9) †

[1] Values are means ± SD.

[2] Values are percentages

* Probability of difference in scores (p = <0.05) compared to underweight group

† Probability of difference in scores (p = <0.05) compared to normal weight group

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Table 2

Psychosocial indicators by weight status

Measure[1]	Range	Total (n=1,821)	Underweight (n=254)	Normal weight (n=887)	Overweight (n=230)	Obese (n=232)	Morbidly Obese (n=210)
Perceived stress[§]	1 to 55	20.5 ± 8.0	19.0 ± 7.2	19.6 ± 7.6	20.4 ± 7.9	22.2 ± 8.1[*†]	23.9 ± 8.7[*†]
Trait anxiety[§]	20 to 77	36.7 ± 10.5	35.3 ± 9.6	35.4 ± 10.1	37.2 ± 10.0	38.6 ± 11.0[*†]	41.8 ± 11.7[‡]
Depression symptoms[§]	0 to 54	12.3 ± 10.0	10.3 ± 8.0	11.1 ± 9.4	13.0 ± 10.3[*]	14.3 ± 10.7[*†]	17.2 ± 11.6[‡]
Chance LOC[§]	8 to 42	20.8 ± 5.5	20.5 ± 5.8	20.4 ± 5.3	21.1 ± 5.6	21.2 ± 5.7	22.7 ± 5.7[*†]
Powerful others LOC[§]	7 to 36	17.2 ± 4.8	16.8 ± 4.8	17.0 ± 4.7	17.1 ± 4.8	17.0 ± 4.6	18.8 ± 5.4[‡]
Internal LOC[§]	8 to 48	35.1 ± 4.6	35.2 ± 4.4	35.5 ± 4.6	35.0 ± 4.4	34.4 ± 4.6[*]	34.0 ±4.9[*]
Self-esteem[§]	15 to 60	50.9 ± 8.2	51.3 ± 8.0	51.7 ± 7.8	50.3 ± 8.0	50.3 ± 8.6	47.7 ± 9.5[‡]
Mastery[§]	12 to 42	34.0 ± 5.7	34.0 ± 5.9	34.4 ± 5.4	34.1 ± 6.1	33.3 ± 5.8	32.4 ± 6.2[*]
		Total (n=1,217)	Underweight (n=172)	Normal weight (n=614)	Overweight (n=137)	Obese (n=154)	Morbidly Obese (=139)
Restrained Eating[§]	0 to 32	10.8 ± 5.8	6.6 ± 4.5	9.8 ± 5.1[‡]	12.7 ± 5.3[‡]	13.5 ± 5.1[*†]	16.1 ± 5.3[‡]
Concern with Dieting[§]	0 to 18	5.1 ± 3.4	3.7 ± 2.8	4.9 ± 3.3[*]	5.7 ± 3.4[*]	5.6 ± 3.4[*]	6.4 ± 3.6[*†]
Weight Cycling[§]	0 to 16	5.7 ± 3.4	2.9 ± 2.5	4.9 ± 2.9[‡]	6.8 ± 2.7[‡]	7.9 ± 3.0[‡]	9.4 ± 3.0[‡]

[1] Values are means ± SD;

[§] significant nonparametric test for trend across ordered groups Probability > |z| = 0.01

[*] Probability of difference in scores (p = <0.05) compared to underweight group;

[†] Probability of difference in scores (p = <0.05) compared to normal weight group;

[‡] Probability of difference in scores (p = <0.05) compared to all other group

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Table 3

Crude and adjusted β Coefficients and 95% Confidence Intervals (CI) for weight status by psychosocial factor[a]

	Perceived stress		Trait anxiety		Depression symptoms	
	Crude β (95% CI)	**Adj β (95% CI)**	**Crude β (95% CI)**	**Adj β (95% CI)**	**Crude β (95% CI)**	**Adj β (95% CI)**
BMI status						
Underweight	−0.08 (−0.22, 0.06)	−0.09 (−0.22, 0.04)	−0.01 (−0.15, 0.14)	−0.02 (−0.15, 0.12)	−0.08 (−0.22, 0.06)	−0.09 (−0.22, 0.04)
Normal	Referent	Referent	Referent	Referent	Referent	Referent
Overweight	0.09 (−0.06, 0.24)	−0.11 (−0.26, 0.04)	0.17 (0.01, 0.33)	0.01 (−0.14, 0.16)	0.19 (0.03, 0.34)	−0.03 (−0.18, 0.12)
Obese	0.32 (0.18, 0.46)	0.15 (0.01, 0.30)	0.30 (0.16, 0.46)	0.17 (0.02, 0.33)	0.32 (0.17, 0.47)	0.14 (−0.01, 0.28)
Morbidly obese	0.54 (0.39, 0.69)	0.26 (0.10, 0.41) trend = 0.002	0.60 (0.45, 0.76)	0.35 (0.19, 0.51) trend = 0.001	0.60 (0.45, 0.76)	0.30 (0.14, 0.45) trend = 0.001
Maternal Race						
White		Referent		Referent		Referent
Black		0.14 (0.01, 0.27)		−0.14 (−0.28, −0.00)		−0.02 (−0.15, 0.11)
Other		0.02 (−0.15, 0.20)		−0.14 (−0.32, 0.04)		−0.3 (−0.21, 0.14)
Education						
> Collage		Referent		Referent		Referent
Some college		0.20 (0.10, 0.31)		0.21 (0.10, 0.32)		0.14 (0.04, 0.25)
High school		0.46 (0.30, 0.63)		0.48 (0.31, 0.66)		0.45 (0.28, 0.62)
< High school		0.60 (0.36, 0.83)		0.60 (0.35, 0.84)		0.51 (0.27, 0.74)
Marital status						
Married		Referent		Referent		Referent
Not married		0.14 (0.00, 0.27)		0.26 (0.12, 0.40)		0.41 (0.28, 0.55)
Children						
No children		Referent		Referent		Referent
Any children		0.08 (−0.01, 0.18)		0.02 (−0.08, 0.12)		0.04 (−0.05, 0.14)
Income						
High income		Referent		Referent		Referent
Low income		0.28 (0.14, 0.42)		0.24 (0.09, 0.38)		0.29 (.015, 0.43)
Maternal age		−0.00 (−0.01, 0.01)		−0.01 (−0.02, −0.00)		−0.30 (−0.64, 0.02)

	Chance LOC		Powerful Others LOC		Internal LOC	
	Crude β (95% CI)	**Adj β (95% CI)**	**Crude β (95% CI)**	**Adj β (95% CI)**	**Crude β (95% CI)**	**Adj β (95% CI)**
BMI status						
Underweight	0.00 (−0.14, 0.15)	−0.01 (−0.15, 0.14)	−0.04 (−0.19, 0.10)	−0.06 (−0.21, 0.08)	−0.06 (−0.20, 0.09)	−0.05 (−0.19, 0.09)
Normal	Referent	Referent	Referent	Referent	Referent	Referent
Overweight	0.13 (−0.03, 0.29)	−0.5 (−0.21, 0.12)	0.02 (−0.14, 0.18)	−0.07 (−0.24, 0.10)	−0.11 (−0.27, 0.05)	0.03 (−0.13, 0.19)
Obese	0.13 (−0.02, 0.28)	0.04 (−0.13, 0.20)	0.00 (−0.16, 0.15)	0.03 (−0.14, 0.20)	−0.23 (−0.39, −0.08)	−0.07 (−0.23, 0.09)
Morbidly obese	0.41 (0.25, 0.57)	0.21 (0.04, 0.38) trend = 0.074	0.36 (0.20, 0.53)	0.34 (0.16, 0.51) trend = 0.009	−0.32 (−0.48, −0.16)	−0.09 (−0.26, 0.07) trend = 0.274
Maternal Race						
White		Referent		Referent		Referent
Black		−0.20 (−0.35, −0.05)		−0.28 (−0.43, −0.12)		−0.14 (−0.29, 0.00)
Other		0.10 (−0.10, 0.29)		0.14 (−0.06, 0.34)		−0.01 (−0.20, 0.18)
Education						
> Collage		Referent		Referent		Referent
Some college		0.07 (−0.04, 0.19)		−0.07 (−0.19, 0.05)		−0.28 (−0.40, −0.17)
High school		0.40 (0.21, 0.59)		0.14 (−0.05, 0.34)		−0.53 (−0.72, −0.35)
< High school		0.47 (0.20, 0.73)		0.19 (−0.08, 0.46)		−0.66 (−0.92, −0.40)
Marital status						
Married		Referent		Referent		Referent
Not married		0.35 (0.19, 0.50)		0.14 (−0.01, 0.30)		0.04 (−0.10, 0.19)

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	Chance LOC		Powerful Others LOC		Internal LOC	
	Crude β (95% CI)	Adj β (95% CI)	Crude β (95% CI)	Adj β (95% CI)	Crude β (95% CI)	Adj β (95% CI)
Children						
No children		Referent		Referent		Referent
Any children		−0.05 (−0.15, 0.06)		0.01 (−0.10, 0.12)		0.08 (−0.03, 0.18)
Income						
High income		Referent		Referent		Referent
Low income		0.16 (0.01, 0.32)		0.08 (−0.08, 0.25)		−0.30 (−0.46, −0.15)
Maternal age		−0.00 (−0.01, 0.01)		0.00 (−0.01, 0.01)		0.01 (0.00, 0.02)

	Self-Esteem		Mastery	
	Crude β (95% CI)	Adj β (95% CI)	Crude β (95% CI)	Adj β (95% CI)
BMI status				
Underweight	−0.04 (−0.19, 0.10)	−0.01 (−0.15, 0.13)	−0.08 (−0.23, 0.06)	−0.07 (−0.21, 0.08)
Normal	Referent	Referent	Referent	Referent
Overweight	−0.17 (−0.33, −0.01)	−0.04 (−0.20, 0.12)	−0.07 (−0.23, 0.09)	0.10 (−0.06, 0.26)
Obese	−0.17 (−0.32, −0.01)	−0.10 (−0.26, 0.05)	−0.20 (−0.35, 0.04)	−0.12 (−0.28, 0.04)
Morbidly obese	−0.48 (−0.64, −0.32)	−0.32 (−0.48, −0.15)	−0.35 (−0.51, −0.20)	−0.22 (−0.39, −0.05)
		trend = 0.001		trend = 0.024
Maternal Race				
White		Referent		Referent
Black		0.37 (0.22, 0.51)		0.35 (0.20, 0.50)
Other		0.06 (−0.13, 0.24)		−0.02 (−0.20, 0.17)
Education				
> Collage		Referent		Referent
Some college		−0.22 (−0.34, −0.11)		−0.15 (−0.55, −0.18)
High school		−0.53 (−0.71, −0.34)		−0.36 (−0.55, −0.18)
< High school		−0.56 (−0.82, −0.31)		−0.51 (−0.77, −0.26)
Marital status				
Married		Referent		Referent
Not married		−0.15 (−0.30, −0.00)		−0.12 (−0.27, 0.03)
Children				
No children		Referent		Referent
Any children		−0.05 (−0.16, 0.05)		−0.07 (−0.17, 0.03)
Income				
High income		Referent		Referent
Low income		−0.22 (−0.37, −0.06)		−0.26 (−0.42, −0.11)
Maternal age		0.01 (−0.00, −0.02)		0.00 (−0.01, 0.01)

[a] β Coefficients and 95% CI for the effect of body mass category on each psychosocial indicator modeled separately, adjusted for maternal race, education, marital status, number of children, income, and age

Table 4

Crude and adjusted β Coefficients and 95% Confidence Intervals (CI) for weight status by dietary restraint scale[a]

	Dieter		Cycler		Restrained	
	Crude β (95% CI)	**Adj β (95% CI)**	**Crude β (95% CI)**	**Adj β (95% CI)**	**Crude β (95% CI)**	**Adj β (95% CI)**
BMI status						
Underweight	Referent	Referent	Referent	Referent	Referent	Referent
Normal	1.25 (0.69, 1.81)	1.19 (0.64, 1.74)	1.94 (1.44, 2.44)	2.03 (1.51, 2.55)	3.23 (2.35, 4.12)	3.27 (2.37, 4.18)
Overweight	2.02 (1.28, 2.76)	2.73 (1.97, 3.49)	3.89 (3.22, 4.56)	4.00 (3.28, 4.72)	6.13 (4.94, 7.32)	6.82 (5.57, 8.07)
Obese	1.88 (1.16, 2.60)	2.66 (1.91, 3.40)	4.96 (4.31, 5.61)	5.08 (4.37, 5.80)	6.91 (5.75, 8.06)	7.86 (6.62, 9.10)
Morbidly obese	2.72 (1.98, 3.46)	3.44 (2.65, 4.22)	6.50 (5.83, 7.17)	6.43 (5.68, 7.17)	9.47 (8.28, 10.65)	9.99 (8.70, 11.28)
Maternal Race						
White		Referent		Referent		Referent
Other		−0.88 (−1.37, −0.39)		−0.42 (−0.89, 0.04)		−1.23 (−2.03, −0.43)
Education						
> Collage		Referent		Referent		Referent
Some college		−0.38 (−1.43, −0.67)		0.17 (−0.83, 1.17)		−0.09 (−1.83, 1.65)
High school		0.32 (−0.75, 1.39)		0.96 (−0.05, 1.98)		1.52 (−0.25, 3.28)
< High school		0.48 (−0.66, 1.62)		0.76 (−0.32, 1.85)		1.53 (−0.24, 3.41)
Marital status						
Married		Referent		Referent		Referent
Not married		−0.62 (−1.21, −0.03)		−0.03 (−0.59, 0.18)		0.75 (−1.72, 0.22)
Children						
No children		Referent		Referent		Referent
Any children		−0.61 (−1.01, −0.03)		−0.20 (−0.58, 0.18)		0.04 (−0.05, 0.14)
Income						
High income		Referent		Referent		Referent
Low income		0.12 (−0.50, 0.73)		0.69 (0.11, 1.27)		0.88 (−0.12, 1.89)
Maternal age		0.10 (0.06, 0.14)		0.04 (0.00, 0.08)		0.14 (0.07, 0.21)
Smoking		0.86 (0.17, 1.55)		−0.99 (−1.64, −0.33)		−0.24 (−0.64, 4.65)

[a] β Coefficients and 95% CI for the association between body mass category and revised restraint subscales modeled separately, adjusted for maternal race, education, marital status, number of children, income, age and smoking