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Attitudes toward weight gain during pregnancy: Results from the Norwegian mother and child cohort study (MoBa)

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Abstract

Objective—To explore attitudes toward weight gain during pregnancy in women with and without eating disorders and across eating disorder subtypes, and to examine associations among weight-gain attitudes and actual gestational weight gain, infant birth weight, and infant size-for-gestational-age.

Method—Pregnant women (35,929) enrolled in the prospective population-based Norwegian Mother and Child Cohort Study (MoBa) provided information at approximately week 18 of gestation regarding eating disorders and weight gain attitudes. We explored these variables in women with anorexia nervosa (AN), bulimia nervosa (BN), eating disorder not otherwise specified, purging type (EDNOS-P), and binge eating disorder (BED).

Results—The presence of an eating disorder as associated with greater worry over gestational weight gain. In women without eating disorders, greater worry was associated with higher gestational weight gain, higher infant weights, greater likelihood of a large-for-gestational-age infant, and reduced likelihood of a small-for-gestational-age infant. Women with BED who reported greater worry also experienced higher weight gains during pregnancy.

Conclusion—Women with eating disorders tend to experience weight-gain-related worry during pregnancy. Early worry about gestational weight-gain may be a harbinger of high gestational gain.

Keywords

gestational weight gain; anorexia nervosa; bulimia nervosa; binge eating disorder

The past decade has witnessed a growing literature on pregnancy and birth outcomes in women with eating disorders.^{1–9} This interest is well founded, since both insufficient and

excessive gestational weight gain can adversely affect maternal and infant well-being.^{10–12} Pregnant women with either a history of an eating disorder or an active eating disorder during pregnancy have been reported to be at increased risk of miscarriage, preterm birth, cesarean-section delivery, postpartum depression, and having a low birth weight infant,^{1–7} although findings do vary depending on the sample studied.^{8–9} The increased risk of adverse outcomes in women with eating disorders may be partially explained by low pre-pregnancy body mass index (BMI)⁵ or by active or sub-threshold symptomatology during pregnancy.^{2, 6}

Although attention has been paid to actual weight gain during pregnancy, less is known about women's attitudes toward weight gain during pregnancy, and the relation between these attitudes and pregnancy outcomes, both in healthy women and in women with eating disorders. No association has been found between attitudes toward weight gain as measured by scores on the Pregnancy and Attitude to Weight Gain Scale,¹³ and the actual amount of weight gain during pregnancy in samples of healthy adolescents¹³ and in adult women.¹⁴ Healthy pregnant women have been observed to have lower body dissatisfaction scores, fewer weight concerns, and less dietary restraint compared with both their pre-pregnant state,^{15, 16} and compared with healthy non-pregnant women.^{17–18} These data suggest that in healthy women, pregnancy may offer a state-dependent reprieve from societal pressures toward thinness. Similar to the findings in healthy women, relative decreases in weight and shape concerns during pregnancy have also been reported in women with eating disorders,^{5, 19–20} although weight concerns do remain higher than in control women.

However, subgroups of women exist for whom pregnancy does not provide a temporary liberation from weight concerns. Women with higher pre-pregnancy BMIs,^{21–23} sedentary women,¹⁶ smokers with high weight concerns,²⁴ depressed women,²⁵ and restrained eaters¹⁴ report less favorable attitudes toward weight gain in pregnancy, and may be less likely to achieve weight gain within the recommended range. A survey by Abraham et al.¹ of 100 consecutive primigravid women, 24% of whom reported a history of “disordered eating,” found that 59% would have preferred a smaller weight gain, and 20% to 34% experienced worsening of weight control attitudes and behaviors during their pregnancy. There is a striking paucity of research on weight gain attitudes during pregnancy in women with binge eating disorder (BED).

Thus, the current study aims to further describe attitudes toward weight gain in a large sample of Norwegian women with anorexia nervosa (AN), bulimia nervosa (BN), eating disorder not otherwise specified, purging type (EDNOS-P), BED, and in women without eating disorders. We also examined the association between fear of weight gain and the following pregnancy outcomes: gestational weight gain, birth weight, and infant's size for gestational age.

Methods

Participants

The data collection was conducted as part of the Norwegian Mother and Child Cohort Study (MoBa) at the Norwegian Institute of Public Health.²⁶ The study was approved by the Institutional Review Board of the University of North Carolina at Chapel Hill and appropriate regional committees for ethics in medical research and the Norwegian National Data Inspectorate.

In brief, MoBa is a prospective pregnancy cohort study. Pregnant women are recruited through a postal invitation after registering for a routine prenatal ultrasound at about 18 weeks' gestation. Participating women give their informed consent to take part in a

longitudinal study, donate blood and urine samples, and receive a questionnaire. The present study is based on the first questionnaire which includes assessment of a range of exposures and health outcome variables and the third and fourth questionnaires which assess a range of weight variables. The MoBa cohort is linked to Norwegian health registries, particularly the Medical Birth Registry of Norway (MBRN)²⁷ which captures pregnancy outcome variables.

The current study is based on version 3 of the quality-assured data files released in 2007.⁸ The analysis population for this report has been described in detail in a recent publication.⁸ Of the initial 74,200 mother-child records in MoBa, the initial 35,929 (48%) were included in this report. Overall, from 1999 to 2006, approximately 42% of invited mothers have agreed to participate in MoBa.

Measures

The MBRN—The MBRN was established in 1967.²⁷ All stillbirths and live births after 16 weeks of pregnancy are reported to the MBRN through mandatory notification by midwives and doctors. National identification numbers of child and mother are recorded for all births. Variables from the MBRN used for this report included marital status, birth weight, and gestational age of baby at birth. Of all MoBa pregnancies, 9.3% could not be linked with a MBRN record and were excluded. Data from the MBRN have been used for prior biomedical research.^{28–30}

MoBa questionnaire 1—Questionnaire 1 included items on eating disorders and behaviors, which were previously used for studies of eating disorders by the Norwegian Institute of Public Health Twin Panel^{31–34} and were designed in accordance with DSM-IV criteria for AN, BN, EDNOS-P, and BED.³⁵ Diagnostic algorithms were constructed from the questionnaire items to define eating disorder subtypes (see below). Self-reported weight and height were used to calculate pre-pregnancy BMI (kg/m²) and BMI at the time of assessment. Respondents completed questionnaire 1 at a median of 18.4 weeks' gestation (interquartile range 17.1–20.3 weeks and range 6.0–42.0 weeks).

Eating disorder classifications—Diagnostic algorithms and hierarchies were constructed from the questionnaire items to define the presence of eating disorders in the six months prior to pregnancy and/or during pregnancy. Our final categories included broadly defined AN, broadly defined BN, EDNOS-P, and broadly defined BED. Broadly defined AN meant that women met all DSM IV criteria for AN except amenorrhea, and broadly defined BN meant that women endorsed binge eating at least once per week and used either purging (vomiting or laxatives) or non-purging (exercise or fasting) behaviors to compensate. Broadly defined EDNOS-P included women who purged at least once per week without prior binge eating and broadly defined BED included women who endorsed binge eating at least once per week without compensatory behaviors. Questions about binge eating assessed both the quantity of food as well as the feeling of loss of control. Purging was assessed in such a way as to specifically differentiate it from typical nausea and vomiting of pregnancy. Further detail about this diagnostic hierarchy can be found in a recent publication.⁸

Assessment of weight gain concerns—In the first MoBa questionnaire, women were asked 'Are you worried about putting on more weight than necessary during this pregnancy?' with response options being 'very,' 'somewhat,' and 'not especially' worried.

Data analysis

All analyses were carried out with SAS® software for Windows/AIX (SAS Institute, Cary, NC, USA). A generalized logits model was used to estimate the odds of worry across ED

subtypes. To test for associations between level of worry and pregnancy outcomes, a Wilcoxon rank-sum test for differences across levels of worry was carried out for continuous variables (maternal weight gain and child birth weight).

Appropriate size for gestational age was described by two dichotomous outcome variables, 'small for gestational age (SGA; $\leq 10^{\text{th}}$ percentile)' and 'large for gestational age (LGA; $\geq 90^{\text{th}}$ percentile). The relative risk of these two outcomes by level of worry relative to the 'no worry' category was estimated with a Poisson regression for BN, BED, and no eating disorder. The model was adjusted for BMI, parity, household income index, and smoking status during pregnancy for the BED and no eating disorder groups, and adjusted for only BMI for the BN group, due to group size. For eating disorder subtypes with fewer participants (AN; $n=35$ and EDNOS-p; $n=36$), exact logistic regression was used to calculate odds of each outcome by level of worry about weight gain. For these less prevalent subtypes, no adjustment was made. A 95% confidence level was stipulated in advance of analysis and adjustment for multiple comparisons was made using the false discovery rate (FDR)36 method for each eating disorder subtype analysis separately.

Secondary analyses were performed to assess the relative value of outcome variable by weight attitude (very worried, somewhat worried, and not worried) and eating disorder subtype to examine whether there might be a dose-response relation between worry level and outcome. For each eating disorder subtype, values for 'very worried' were compared with 'somewhat worried' in one analysis and 'somewhat worried' with 'not worried' in another analysis. The analysis types matched those outlined for each response and eating disorder subtype combination as mentioned above. All tests were controlled with a FDR correction. We also examined the data graphically to better understand the general direction of the association between level of worry and weight gain outcomes.

Results

Demographics

Approximately 97% of the 35,929 women were married or cohabitating. Of all women, 9.5% reported having smoked during pregnancy, and 48.6% had ever smoked during their lifetime. The mean age was 29.9 years and 73.9% of women had a combined minimum gross income greater than \$33,000 per year and less than or equal to \$114,000 per year. In the sample, 50.7% of women were primiparous. More detailed descriptions of the MoBa sample used in these analyses can be found elsewhere.^{23, 37}

Weight status

In terms of pre-pregnancy BMI, 3.0% of women were underweight (BMI < 18.5), 64.2% were normal weight (BMI 18.5–24.9), 23.3% were overweight (BMI > 25.0 –29.9), and 9.4% were obese (BMI > 30.0).

Prevalence of eating disorders and weight concerns

The prevalence of eating disorders in this sample was as follows: 0.1% ($n=35$) of women met criteria for AN, 0.85% ($n=304$) of women met criteria for BN, 0.1% ($n=36$) of women met criteria for EDNOS-P, 5.0% ($n=1812$) of women met criteria for BED, and 93.9% ($n=33,742$) of women did not have an eating disorder before pregnancy.

Table 1 presents frequencies of each worry level, and the results of testing for significant differences in worry by eating disorder subtype. In the overall sample, 59.7% of women reported not being especially worried about gaining weight during this pregnancy, while 31.9% reported being 'somewhat worried,' and 8.4% reported being 'very worried.' A total

of 88.6% (n= 31) of women with AN were 'very' or 'somewhat' worried about weight gain, 91.1% (n=277) of women with BN were 'very' or 'somewhat' worried about weight gain, 91.7% (n=33) of women with EDNOS-P were 'very' or 'somewhat' worried about weight gain, and 70.7% (n=1281) of women with BED were 'very' or 'somewhat' worried about weight gain. In contrast, only 38.0% (n=12,826) of women without an eating disorder were 'very' or 'somewhat' worried about weight gain. Altogether, 40.2% of all women (n=14,448) reported some level of worry. All eating disorder subtypes had significantly greater odds of being somewhat or very worried about weight gain compared to women without an eating disorder.

Analysis of pregnancy outcomes

We also measured the following outcomes among all women relative to degree of worry about weight gain: maternal weight gain, infant birth weight, and likelihood of the infant being either small for gestational age (SGA) or large for gestational age (LGA). For categorical variables, Poisson regression was carried out to test differences in outcome by level of worry regarding weight gain, while for continuous measures (birth weight and maternal weight gain) a Wilcoxon rank-sum test for differences was performed without adjustment. The results are shown in Table 2 and Table 3.

In the non-eating disorder referent group, there was generally a positive relation between worry about weight and outcome measures (except SGA, for which there was a negative association). In women without eating disorders, worry about weight gain was associated with higher maternal weight gain, higher infant birth weight, a greater likelihood of having an LGA baby, and a lesser likelihood of having an SGA baby. In the BED group, women who reported being 'very worried' about weight gain had significantly higher infant birth weight than those who were not worried.

After determining in the non-eating-disordered group that worried women were more likely than those without worry to have larger weight gains and larger infants, we sought to examine whether this effect was proportionate to the level of worry; that is, whether being 'very' worried had a greater effect on outcome than being 'somewhat' worried, which in turn would have a greater effect on outcome than being not worried. However, there was limited evidence to support this dose-response pattern with regard to worry level and birth outcome. In women with BED, offspring of very worried women had higher birth weights than women who were somewhat worried, but women who were somewhat worried did not have significantly heavier infants than those who were not worried. In the non-eating-disordered group, women who were somewhat worried had greater gestational weight gains and higher birth weight infants than those who were not worried, but there was no significant difference in outcome between those who were 'very' and 'somewhat' worried. Also in this population, the likelihood of having an SGA infant was lower for women who were somewhat worried as opposed to those who were not worried; however, being 'very worried' made no statistically significant additional impact. The risk of having an LGA infant was the only variable for which there was a consistent positive association seen. For women without eating disorders, being somewhat worried increased the risk of LGA, and being very worried further increased that risk as compared to those who were only 'somewhat' worried.

Finally, as shown in the Figure, the general direction of the association between worry and outcome appeared to vary across eating disorder subtype. With regard to infant birth weight, although non-significant statistically, the nature of the relation between worry and outcome was reversed in women with AN for whom greater worry was associated with lower infant birth weights.

Discussion

Using the unique Norwegian MoBa sample, we confirmed the high rates of concern about weight gain in women with eating disorders and added to existing knowledge concerning the association between early worry over pregnancy-related weight gain and birth outcomes.

Prevalence of worry over weight gain in pregnancy

This study is among the first to examine the weight gain attitudes of women across a range of eating disorder subtypes, including BED. It is particularly notable that women suffering from all eating disorders were more likely to worry about gestational weight gain than women with no eating disorders. These findings, although expected, suggest that the weight gain concerns associated with eating disorders persist during pregnancy and that continued mental health support and assistance with gauging the appropriateness of gestational weight gain may be warranted.

Association of worry and pregnancy outcomes in women without eating disorders

In women without eating disorders, worry about weight gain was associated with greater weight gain, greater child birth weight, greater likelihood of an LGA infant and decreased likelihood of an SGA infant. In fact, the degree of worry was correlated with a greater likelihood of an LGA infant, with those who were 'very' worried being more likely to have an LGA infant than those who were 'somewhat' worried. These findings have several potential explanations. Given the need to use non-parametric analyses, we were unable to control for additional potential confounders including pre-pregnancy BMI. Thus, it could be that the women who gave birth to larger babies were simply those who were indeed overweight prior to pregnancy and appropriately worried about gaining too much additional weight, as has been shown in the literature.³⁸ However, in the analysis of the categorical SGA and LGA variables, we did control for a variety of demographics including BMI, and the same trend emerged: women with greater worry tended to have more large babies and fewer small ones. This suggests that factors other than pre-pregnancy BMI were involved. Since the MoBa questionnaire was administered at 18 weeks, it may be that those women who, early in the second trimester, found themselves already having gained a considerable amount of weight, were those who were most worried and who continued to gain the most weight and to deliver larger infants. This would be consistent with existing literature demonstrating larger infant size in women who have larger gestational weight gains,³⁹ and with literature suggesting that women who gain weight early in pregnancy have reason to be concerned over weight gain, since they are more likely to exceed pregnancy weight gain recommendations and to retain weight postpartum.⁴⁰ Alternately, it cannot be excluded that higher levels of worry, perhaps via stress-induced hormonal cascades,⁴¹ might contribute to higher weight gain and larger infants. Or, worry about weight could lead to attempts at dietary restraint which could fail or even rebound given the increased appetite that can occur with pregnancy. Indeed attempts at restraint may cause greater weight gain in some women.⁴²

Measured weights and dietary recording throughout the progression of the pregnancy would allow for a more detailed exploration of this question.

Association of worry and pregnancy outcomes in women with eating disorders

We were particularly interested in the association between weight gain attitudes and pregnancy outcome across a variety of eating disorder subtypes. Few significant differences in worry level across eating disorder subtypes were found. It must be noted that although the MoBa dataset is large, there were so few women in the AN and EDNOS-P groups as to preclude meaningful analysis. Thus, our failure to find significant differences in outcome by

worry level should not be interpreted as strong evidence that such differences do not exist. In the BED sample, we did detect a significantly greater gestational weight gain in those who were very worried compared with those who were not worried. This mirrors our findings in women without eating disorders, and may be due to any of the potential reasons discussed above. It is particularly important that we have demonstrated this finding in women with BED, as they have not previously been explicitly studied with regard to this question. Our research suggests that women reporting BED prior to pregnancy could benefit from interventions designed to assist them with keeping gestational weight gain on target.

Finally, although significant differences did not emerge in the small AN group it is noteworthy that the pattern of association between worry and birth weight in this group was the opposite of that observed for other women. In these women, worry seems to be associated with lower birth weight infants. This suggests that the association between worry and gestational weight gain may differ across eating disorder subtypes and generalizations across eating disorders should not be made. Additional studies with greater power would have to be carried out in order to confirm whether this association may in fact exist.

Limitations

Limitations of this study include low numbers of participants in the AN and EDNOS-P groups reducing precision of estimates. In addition, the MoBa questionnaire relies on self-report for assessment of eating disorders. However, this is a reasonable approach given the population-based nature of the data and the large number of participants. Finally, the MoBa response rate was 42%, which could introduce participation bias, but which is typical for epidemiologic studies of this size. Indeed, MoBa participants seem to be of a higher socioeconomic status than those who do not participate.²⁶

Implications

In summary, the present study provides needed information regarding the association between worry over weight gain in pregnancy, and pregnancy outcomes in women with and without eating disorders. Our findings emphasize the fact that early pregnancy is a time during which women are in need of guidance to help alleviate and/or moderate their concerns about weight gain, as the presence of early concern is associated with higher weight gain and larger infants on average. As the MoBa children will be followed over time, future research will be well-positioned to explore the impact of weight gain attitudes and gestational weight gain on the growth trajectories of offspring.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

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Table 1

Women reporting each level of worry, with odds ratio (OR) of worry versus 'Not worried' compared to no eating disorder group*

	Very worried		Somewhat worried		Not worried	
	N (%)	OR [95% CI]	N (%)	OR [95% CI]	N (%)	N (%)
Anorexia nervosa	22 (62.9)	49 [17, 142]	9 (25.7)	4 [1, 15]	4 (11.4)	4 (11.4)
Bulimia nervosa	187 (61.5)	62 [41, 92]	90 (29.6)	7 [4, 10]	27 (8.9)	27 (8.9)
EDNOS-P	18 (50.0)	80 [19, 345]	15 (41.7)	15 [3, 65]	2 (5.6)	2 (5.6)
Binge eating disorder	434 (24.0)	7 [4, 10]	847 (46.7)	3 [3, 4]	529 (29.2)	529 (29.2)
No eating disorder(referent)	2345 (6.9)	----	10481 (31.1)	----	20885 (61.8)	20885 (61.8)

* all odds significant at alpha level <0.001 with the exception of anorexia nervosa (somewhat worried vs. not) (p=0.01)

Abbreviations: EDNOS-P Eating disorder not otherwise specified-purging type

Table 2

Size for gestational age risk across worry level and eating disorder subtype.

	Anorexia nervosa [†]		Bulimia nervosa ⁺		EDNOS-P [‡]		Binge eating disorder [§]		No eating disorder [§]	
	%	RR	%	RR	%	RR	%	RR	%	RR
Large for gestational age (LGA) (%)										
Very Worried	9.1	12.8	3.03	0.0	17.1	1.19	15.1	1.22		
Somewhat Worried	0.0	8.9	2.33	0.0	13.8	1.14	11.3	1.10		
Not Worried (referent)	25.0	3.7	0.0	0.0	10.6		9.4			
Small for gestational age (SGA) (%)										
Very Worried	13.6	6.4	1.00	16.7	4.4	0.98	6.4	0.81		
Somewhat Worried	0.0	12.2	1.74	0.0	5.3	1.00	7.4	0.89		
Not Worried (referent)	0.0	7.4	0.0	0.0	5.9		8.6			

* Values represent percent who had SGA/LGA infant per worry level, with RR if available for comparison to 'Not Worried' reference group. Bolded values indicate a RR significant at an alpha level=0.05 after FDR adjustment

[†] Model not adjusted for any covariates

⁺ Model adjusted for BMI only

[§] Model adjusted for BMI, income, parity, smoking

Abbreviation: EDNOS-P Eating disorder not otherwise specified-purging type

Table 3

Median weight gain and birth weight by worry level across ED subtypes

	Level of Worry	Eating Disorder Subtype				
		Anorexia nervosa (n=35)	Bulimia nervosa (n=304)	EDNOS-P (n=36)	Binge eating disorder (n=1812)	No eating disorder (n=33742)
Maternal Weight Gain (kg)	Very worried	18	17	16	17	15
	Somewhat worried	17	16	15	16	15
	Not worried (referent)	18	14	11	16	14
Child Birth weight (g)	Very worried	3468	3600	3475	3774	3665
	Somewhat worried	3630	3530	3810	3680	3650
	Not worried (referent)	3818	3430	2993	3630	3600

Bolded values indicate statistically significant location shifts between the worry group and 'not worried' significant at an alpha level=0.05 after FDR adjustment

Abbreviation: EDNOS-P Eating disorder not otherwise specified-purging type