Obesity and Reproductive Functioning: Psychiatric Considerations

Kelly C. Allison, PhD, Megan E. Lavery, MA, and David B. Sarwer, PhD

ABSTRACT
The United States is in the midst of an obesity crisis. The majority of American women of childbearing age are overweight or obese. The presence of excess body weight in a woman can negatively impact fertility, pregnancy, postnatal recovery, and the health of her child. Psychiatric comorbidities, including eating and mood disorders, can influence nutrition and weight gain during pregnancy and weight loss in the postpartum period. Stress associated with caretaking in the postpartum period impacts levels of sleep and physical activity, which further impact postpartum weight retention. This article reviews the literature in these areas; the article discusses the management of excess body weight during and after pregnancy as well as related psychiatric conditions in pregnant and postpartum women.

INTRODUCTION
Approximately two-thirds (65.1%) of American women >20 years of age are overweight (Body Mass Index [BMI] >25 kg/m²).1 Almost 50% are obese (BMI ≥30 kg/m²).1 In the United States, there were >4 million live births in 2003, with >50% likely born to overweight or obese mothers.2 While overweight and obesity affect women of all ethnic groups, they differentially affect those from minority groups. Almost half (49%) of non-Hispanic white women and 70% of non-Hispanic black women between 20–39 years of age are overweight or obese. Obesity has often been miscategorized as a psychiatric disorder, although it does not appear in the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition–Text Revision.3 Disorders of eating and mood, however, have been associated with obesity. These characteristics may negatively impact reproductive functioning and pregnancy outcomes. This article reviews the relationship among obesity, psychopathology, and reproductive functioning, including fertility, pregnancy, and the postpartum period.

OBESITY AND REPRODUCTIVE FUNCTIONING
Numerous comprehensive reviews4–5 have characterized the relationships between obesity and reproductive functioning. Obesity has been associated with an early onset of menarche6 and an increased risk of menstrual problems in adolescence and early adulthood.7 Obesity is also associated with many adverse effects on fertility.8–10 These include irregular menstrual cycles, increased androgenization, oligo/amenorrhea, anovulation, polycystic ovarian syndrome (PCOS), decreased

FOCUS POINTS
• There is a strong relationship between obesity, fertility, and pregnancy that can affect psychiatric well being.
• Growing evidence shows that there is a relationship between mood and polycystic ovarian syndrome and weight.
• Certain factors influence pregnancy weight gain and postpartum weight retention.
• There are interventions associated with weight control during pregnancy and in the postpartum period.
conception rates after fertility treatments, increased risk of morbidity and miscarriage in pregnancy, and worsened outcomes of preterm deliveries. Excess abdominal fat is associated with irregular menstrual cycles, several hormone-sensitive cancers, and increased risk of miscarriage (Table 1).4,11,12

**POLYCYSTIC OVARIAN SYNDROME AND PSYCHOLOGICAL FUNCTIONING**

PCOS is the most common endocrine disorder in women of reproductive age, affecting 5% to 10% of females, ~50% of whom are obese.13-15 The syndrome is characterized by chronic anovulation and hyperadrogenism and is manifested by hirsutism, cystic acne, hair loss, insulin resistance, and weight gain.15,16 PCOS is also one of the primary causes of infertility.17

Women diagnosed with PCOS experience increased incidence of depression18,19 and report significantly decreased quality of life (QOL)18,20 and emotional well-being.19 Barnard and colleagues19 found that women with PCOS were significantly more depressed than controls, with >66% of participants with PCOS experiencing some level of depression. Further, Elsenbruch and colleagues18 reported that women with PCOS, as compared to age-matched controls, reported higher levels of distress as assessed by the Symptom Checklist-Revised.

Weight appears to be the strongest determinant of psychological distress associated with PCOS.16,19,22 Excess hair growth, acne, obesity, and menstrual irregularity are also correlated with distress and anxiety. Women with PCOS report greater body image dissatisfaction and less sexual satisfaction and see themselves as less feminine than other females.14,22,23 Recent evidence suggests that some of these symptoms may be associated with the physiologic manifestations of PCOS, including hyperandrogenism and insulin resistance.24,25

The experience of infertility, faced by 66% of women with PCOS,14 may be one of the strongest determinants of psychosocial distress and reduced QOL in women with PCOS.17,26,27 It is well documented that weight loss is associated with improved social and physical functioning within obese populations.22 However, few studies have examined changes in psychological functioning for PCOS patients who lose weight. A recent study28 examined the effects of metformin on psychosocial functioning for women with PCOS. Results indicated that improvements in health-related QOL and emotional well-being were significantly correlated with weight loss and regulated menstrual cycles, suggesting that weight loss may be associated with enhanced psychosocial functioning for women with PCOS.28

**WEIGHT LOSS FOR INFERTILITY**

Weight loss is often recommended as the first line of treatment for obese women with fertility problems.8,9,29-32 Moderate weight loss has been repeatedly shown to improve menstrual regularity, ovulation, and infertility.5,9,30,33,34 Similar improvements have been shown for women with PCOS.31,32,35,36 A weight loss of ≥5% of initial body weight appears necessary to improve markers of infertility in most women.35,36 Weight reduction of this magnitude is attainable for the majority of women treated in behavioral weight-loss programs or with pharmacotherapy.37 Few studies38,39 have examined the effect of bariatric surgery on markers of infertility. At least one investigation40 has found that 70% of females who were anovulatory prior to bariatric surgery reported regular menstrual cycles postoperatively.

**OBESITY AND COMPLICATIONS DURING PREGNANCY**

Obesity is associated with numerous complications during pregnancy, many of which have increased along with rates of obesity. The Cesarean section rate in the US rose to the highest recorded level (27.6%) in 2003;2 Preterm (12.3%) and low birth weight (7.9%) births also rose to their highest levels in 30 years.2 The rates of pregnancy-associated hypertension and diabetes, the most frequently reported medical risk factors

**TABLE 1**

<table>
<thead>
<tr>
<th>OBESITY NEGATIVELY IMPACTS FERTILITY IN WOMEN ACROSS A WIDE SPECTRUM OF MEDICAL COMORBIDITIES</th>
<th></th>
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<tbody>
<tr>
<td>Precocious menarche</td>
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<td>Irregular menstrual cycles</td>
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<td>Increased androgenization</td>
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<tr>
<td>Oligo/amenorrhea</td>
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<tr>
<td>Anovulation</td>
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<td>Potential pathophysiological role in the development of PCOS</td>
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<td>Decreased conception rates after fertility treatments</td>
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<td>Increased morbidity in pregnancy</td>
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<td>Increased risk of miscarriage</td>
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<td>Worsened outcomes of preterm deliveries</td>
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PCOS=polycystic ovary syndrome.


PREGNANCY AS A RISK FACTOR FOR
THE DEVELOPMENT OF OBESITY

Many women anecdotally report weight gain during pregnancy as a major catalyst in the subsequent development of obesity. Numerous studies have confirmed that excess weight gain during pregnancy, and/or failure to lose weight in the first few years after a pregnancy, are associated with later-life obesity. In these investigations, a sizable percentage of women have exceeded the Institute of Medicine (IOM) recommendations for weight gain during pregnancy. These recommendations state that women with a BMI <19.8 kg/m² gain 28–40 lbs (13–18 kg); 19.9–26.0 kg/m² gain 25–35 lbs (11.4–15.9 kg); 26.1–29.0 kg/m² gain 15–25 lbs (6.8–11.4 kg); and >29 kg/m² gain a minimum of 15 lbs (6.8 kg) during the course of pregnancy (Table 2).

The IOM recommendations, published in 1990, have been criticized for being too liberal and for failing to consider the potential adverse effects of excessive weight gain during pregnancy. Two prominent groups have provided guidelines for attaining these recommendations. The American College of Obstetricians and Gynecologists suggest that nutritional support be provided for overweight women during and after pregnancy. The National Institute of Diabetes and Digestive and Kidney Diseases have provided specific dietary and physical activity guidelines for pregnancy and across the lifespan. It is unknown whether expectant mothers are aware of these guidelines or if practitioners routinely use them in clinical practice.

Several factors, both internal and external, likely contribute to women’s difficulty following these guidelines. Psychosocial factors such as depressive symptoms at early and late stages of pregnancy, as well as believing that fetal health is influenced by external (rather than internal) factors, were associated with inadequate gestational weight gain. Another study suggested that either a lack of a weight gain recommendation, or a recommendation above the IOM guidelines, was associated with excessive weight gain during pregnancy. In another study, minority status, pre-pregnancy weight, and excessive gestational weight gain, particularly during the first trimester, have been identified as risk factors for excessive weight retention.

These factors, however, are shaped by the Western world’s “toxic” food environment, in which calorically dense and high-fat foods make the development of excessive body weight almost inevitable. Reliance on fast food and other prepared foods is, in some respects, a logical by-product of the workaholic, stress-filled American way of life. The effects of this environment may be exaggerated during pregnancy when many women feel less pressure to restrict food intake.

### DISORDERED EATING, OBESITY, AND PREGNANCY

Generally, two forms of disordered eating are linked to overweight and obesity: binge eating disorder (BED) and night eating syndrome (NES). Both disorders typically begin during early adulthood when most pregnancies occur and could contribute to excessive weight gain during pregnancy or the retention of excessive amounts of weight during the postpartum period, although the relative newness of NES has led to little study of the condition as it relates to pregnant women.

BED occurs both before and during pregnancy. Recently, the Norwegian Mother and Child Cohort Study prospectively surveyed >41,000 women. The prevalence of pregestational BED was 3.5%, with 39% of these cases remitting during pregnancy. The BED incidence rate during pregnancy was 1.1 per 1,000 person-weeks (711 new cases), with increased risk among those of lower socioeconomic status (SES). The incidence of other eating disorders was rare. Bulik and colleagues concluded that most eating pathology improves during preg-

### TABLE 2

<table>
<thead>
<tr>
<th>Weight Status</th>
<th>Appropriate Weight Gain</th>
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<tr>
<td>Underweight (BMI not specified)</td>
<td>27–40 lbs (12.2–18.1 kg)</td>
</tr>
<tr>
<td>Normal weight (BMI &lt;25 kg/m²)</td>
<td>25–35 lbs (11.3–15.9 kg)</td>
</tr>
<tr>
<td>Overweight (BMI ≥25 kg/m², &lt;30 kg/m²)</td>
<td>15–25 lbs (6.8–11.3 kg)</td>
</tr>
<tr>
<td>Obese (BMI ≥30 kg/m²)</td>
<td>≥15 lbs (6.8 kg)</td>
</tr>
</tbody>
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BMI = body mass index.


nancy, but pregnancy may be a vulnerable time for the development of BED, particularly among women of low SES.

Siega-Riz and colleagues also studied the nutritional habits of 34,000 women during the first half of pregnancy. Women with BED consumed higher total energy, total fat, monounsaturated and saturated fat, and lower folate, potassium, and vitamin C than those without the disorder. BED diagnosis was also related to the consumption of less juice, fruit, and chicken, and more candy, fats, chocolate and milk desserts, artificially sweetened beverages, and coffee. These findings suggest that BED, either before or during pregnancy, is related to obesity-promoting behaviors.

Several studies have found a relationship between restrained eating and pregnancy-related distress. DiPietro and colleagues studied 130 women between 28–36 weeks of pregnancy. Those with higher levels of dietary restriction reported higher anxiety, depression, anger, and stress, and felt less uplifted by pregnancy. Pre-pregnancy BMI was not independently related to distress, and even those who gained within their recommended weight ranges endorsed negative attitudes about weight gain. It may be that pregnancy both legitimizes increased food intake and removes any previous intentions to eat less, even among those with high levels of restraint before pregnancy.

CONTROLLING EXCESSIVE WEIGHT GAIN DURING PREGNANCY

A sizable body of research has investigated the efficacy of behavioral and pharmacologic treatment for obesity. Behavioral and pharmacologic treatments typically produce a weight loss of ~5% to 10% when used alone. These weight losses can be increased if behavioral and pharmacologic treatments are used in combination.

Unfortunately, few investigations have studied the potential utility of interventions designed to control weight gain during pregnancy. In one study, 120 women with a pre-pregnancy BMI >19.8 kg/m² were assigned to a behavioral intervention or control group. The behavioral intervention consisted of clinic visits where women were weighed and provided with written information regarding appropriate weight gain, exercise, and healthy eating during pregnancy. Those who exceeded the IOM weight gain guidelines during pregnancy weigh-ins were given more intensive care in the form of additional nutrition information and behavioral counseling. The control group received the standard nutrition counseling which emphasized a well-balanced diet and multivitamin/iron supplementation.

Average weight women in the intervention group were significantly less likely to exceed the weight gain recommendations as compared to average weight women in the control group (63% vs. 94%). For overweight women, however, the intervention was not effective. Approximately 66% of overweight women in each treatment group exceeded the weight gain recommendations.

Olson and colleagues also investigated the efficacy of a psychoeducational intervention for controlling weight gain during pregnancy in both average weight and overweight women. Participants were mailed materials on healthy weight gain, nutrition, and exercise during pregnancy. The proportion of participants gaining more than the recommended amount did not differ by group (41% intervention vs. 45% control). However, low income participants in the intervention group, regardless of pre-pregnancy weight status, were less likely to gain excess weight than those in the control group (52% vs. 33%).

Although these two studies suggest that pregnancy weight control interventions are ineffective for the prevention of excessive weight gain among overweight women, two more recent studies have found that such interventions can be effective. For example, Wolff and colleagues randomly assigned 50 obese pregnant females to an intervention or control group. Participants in the intervention group received ten 1-hour dietary consultations focusing on consuming a healthy diet and energy intake restriction. Women who received the intervention gained significantly less weight compared to controls, 6.6 versus 13.3 kg.

OBESITY AND MOOD IN THE POSTPARTUM PERIOD

Weight Retention After Childbirth

The discussion above intuitively suggests that overweight and obese women may experience significant weight retention after childbirth. The empirical evidence, however, is inconclusive, as variability in the methods to assess body weight and length of follow-up have contributed to a range of outcomes. One review concluded the average postpartum weight retention was 0.5–3.0 kg, but could be as high as 17.7 kg. As detailed above, excessive weight gain during pregnancy is strongly associated with weight gain over the life cycle.

Postpartum Depression and Obesity

The increased time demands and sense of responsibility associated with caring for an infant may have a deleterious effect on weight control efforts as well as negatively impact mood and QOL. Postpartum depression affects 10% to 15% of mothers. Prior history of depression, depression or anxiety during pregnancy, lack of social support, and stressful life events have been consistently related to postpartum depression.
The relationship between postpartum depression and obesity has received little attention. In one of the few studies in this area, Herring and colleagues found that new-onset postpartum depression was associated with substantial weight retention in the first postpartum year. In general, the relationship between depression (postpartum or other) and obesity is complex and likely bidirectional. Most postpartum depression studies have not explicitly mentioned weight and the role it may play. However, women with bulimia nervosa and BED experience up to three times higher rates of postpartum depression than women without eating disorders.

Postnatal distress has also been linked to disordered eating attitudes and behaviors. Among 181 healthy women interviewed at 1-week postpartum, postnatal distress was associated with higher body weight, shape concerns, and disordered eating—including binge eating, vomiting, fear of weight gain, and distracting thoughts about food before and during pregnancy. Low-intensity exercise during pregnancy was related to lower postpartum distress.

Randomized intervention studies for postpartum depression are limited. One small, but innovative study found that 81 women assigned to walking with baby strollers for 12 weeks improved their depression and fitness levels significantly more than those in a social support group. These results suggest that exercise is not only important during pregnancy to protect against postpartum depression but may improve postpartum symptoms.

Facilitating Weight Loss During the Postpartum Period

Few studies have investigated the efficacy of weight loss interventions during the postpartum period. In one study, participants were assigned to either a control group (brochure on healthy eating and exercise) or an intervention group. The intervention consisted of two in-person counseling sessions where participants were encouraged to follow a low-calorie (1,000–1,500 kcal/day), low-fat (20% of daily intake) diet and to exercise regularly. The intervention group also received 16 lessons on nutrition, exercise, and behavior change strategies by mail and was contacted by phone at least bi-weekly. The intervention group lost significantly more weight during the postpartum period (7.8±4.5 kg) compared to the control group (4.9±5.4 kg). Women in the intervention group were more likely to reach or weigh less than their pre-pregnancy weight.

There are countless barriers to successful weight control during the postpartum period. One such barrier during this time is significant sleep disruption. Recent studies have linked sleep debt with obesity and potential weight gain. Women who are up at night with their newborns may be especially susceptible to weight gain, or, perhaps, resistant to postpartum weight loss. For example, women sleeping ≤5 hours/day reported substantially higher postpartum weight retention (>5 kg) than those receiving >5 hours/day of sleep, suggesting that increasing sleep time may be an important target for postpartum weight loss.

Low levels of physical activity are another likely barrier to postpartum weight control. Qualitative research suggests that women who plan on exercising during the postpartum period tend to lose more weight than those who do not. In one of the few empirical studies on this issue, women reporting higher levels of postpartum activity retained significantly less weight at 6 weeks than those reporting lower levels of activity (3.9 kg vs. 5.1 kg).

Many other variables may also impact postpartum weight control efforts, including marital status, age, smoking, and dietary changes in the postpartum period. While lactation may facilitate weight loss for the first few months after childbirth, it does not appear to have significant long-term effects on weight unless breast feeding continues past 12 months.

CONCLUSION

A rather sizable literature has demonstrated the detrimental health effects of obesity on reproductive functioning and pregnancy outcomes. These health conditions, such as PCOS, in turn, are often related to distress and depressed mood. Encouragingly, numerous studies have suggested that modest weight losses, perhaps as small as 5% to 10%, may be associated with improvements in fertility.

For some women, it appears that pregnancy may be a catalyst for the development of obesity. Studies designed to prevent excessive weight gain during pregnancy appeared to be particularly effective for average weight (as compared to overweight) women and those from lower socioeconomic status. Given the current obesity epidemic and the potential increased risk of adverse pregnancy outcomes, pregnant women and their physicians should work together to limit excessive weight gain during pregnancy.

Presently, only a handful of studies have investigated strategies to facilitate weight loss during the postpartum period. Due to numerous barriers to treatment during the postpartum period, such as fatigue and sleep disruption, many of the inventions have been modest in scope. One clearly neglected area has been the relationship of obesity and postpartum depression which may represent the most significant barrier to successful weight control and may, over time, exacerbate the severity of obesity.


