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# Is gestational weight loss safe for obese women?

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## Abstract

*Obesity, defined as having a body mass index (BMI) greater than or equal to 30 kg/m2, is a global epidemic affecting an estimated 650 million people. The risks related to obesity at the start of pregnancy are substantial, and may affect the health of mothers and their offspring child, both short- and long-term. Although there is a lack of high-level evidence to support the health benefit of weight loss during pregnancy, some obese women try to lose weight in pregnancy on volunteer basis. The potential mechanism and benefits/harms of gestational weight loss (GWL) among obese women on maternal and childhood outcomes are not clearly understood. We hypothesis that GWL in obese women, regardless of severity, is associated with increased risk of adverse neonatal outcomes and long-term infant cognitive performance, compared to women with adequate gestational weight gain. If our hypothesis has been confirmed, the GWL should not be recommended in obese women although GWL may reduce risk of some pregnancy complications.*

## Introduction

Obesity, defined as having body mass index (BMI)>30 kg/m2, is a chronic health problem with rising prevalence since the 20th century with an estimated 650 million adults worldwide are affected by obesity [1]. In 2014, it was estimated that there were 14.6 million obese pregnant women worldwide [2]. Obesity prior to pregnancy has been associated with increased risks of various adverse outcomes in the affected mothers and their offspring child [3,4]. In addition, there is a trend of graded relationship between adverse pregnancy outcomes with severity of obesity [5,6]. It is well recognized that women with normal weight were much less likely to have adverse maternal and neonatal outcomes, compare to obese women [7,8]. Some obese women, especially for severely obese women, try to lose weight before pregnancy even during pregnancy to minimize the adverse maternal and childhood outcomes [3,9].

Over the past decades, the guidelines for ideal weight gain have been periodically questioned and revised. In 2009, the Institute of Medicine (IOM) further revised recommended guidelines for gestational weight gain during pregnancy for women by pre-pregnancy BMI, including obese women [10]. IOM recommended that obese women should gain between 5 and 9 kg during pregnancy to obtain the best maternal and perinatal outcomes and weight loss should be discouraged [10]. However, recommendations by severity of obesity were not specified because of a paucity of research [10]. Although gestational weight loss (GWL) during pregnancy is not part of the guidelines recommended by IOM and there is no high-quality evidence to support the GWL for obese women, around 8.1% of obese women were reported to try to lose weight during pregnancy on volunteer basis.11 Moreover, the prevalence of GWL increased with elevated obesity class, reaching as high as 15% in obesity class III [12].

Currently, the available studies of GWL on pregnancy outcomes were very limited with conflicting results, especially for severe obese women (BMI >40 kg/m2). There is a strong need to further study the effects of GWL on the mothers and offspring among obese women by severity of obesity.

## Hypothesis

We hypothesize that GWL (gestational weight change from maternal pre-pregnancy weight to weight at delivery is negative) in obese women, regardless of BMI classes, is associated with increased risk of adverse perinatal outcomes including preterm birth, small-for-gestational age (SGA), neonatal morbidity and mortality, and long-term infant cognitive performance, compared to women with adequate gestational weight gain. If our hypothesis is confirmed, GWL should not be recommended in obese women regardless of severity, which could be served as a weight management counselling during pregnancy.

## Evidence support the hypothesis

### Potential mechanistic and physiological association between GWL and adverse perinatal outcomes

Under normal circumstances, pregnancy is supposed to be a time to gain weight to meet increased needs of energy and other nutrients for the mother and growing fetus. Energy requirements increase in pregnancy by approximately 200, 300, and 400 kcal/day in the first, second, and third trimesters, respectively [13]. In general, gestational weight gain is composed of water, protein, or fat in the fetus, placenta, uterus, and amniotic fluid, maternal blood volume, mammary gland, and maternal adipose tissue. The minimal amount of gestational weight gain required for fetal

growth and deposits of maternal energy for postpartum lactation is estimated at 8 kg [14]. In a typical pregnancy characterized by 25 lb or 11 kg total gestational weight gain and delivery at 40 weeks, the products of conception (placenta, fetus, amniotic fluid) comprise approximately 35% of the total gestational weight gain [15]. If an obese woman delivered a normal weight baby but did not gain any weight during pregnancy, she actually consumed at least 8 kg of substances from her own body. It was indicated obese women should undergo an apparent decrease in both lean body mass and fat mass if weight gain is negative [12]. A study published by Catalano et al. proposed an adaptive physiological mechanism which prioritizes the preservation of the mother's lean body mass, whereas a greater proportion of fat mass is lost [12]. For the fetus, this means a reduced protein supply which would lead to its reduced lean body mass. A reduced lean body mass of the fetus may present various physiological implications such as metabolic, nutrient and cognitive deficits [12]. Moreover, there is a concern that fetal brain function may be negatively affected by maternal ketonemia [16,17], which could result from fasting during pregnancy among women attempting weight loss [18-20]. However, studies are lacking in direct associations between weight loss and child cognition. It is reasonable to assume that GWL should be harm for offspring among obese women including severely obese women.

### Current evidence and controversy surrounding GWL and potential risks/benefits

In 2015, Kapadia and colleagues published a systematic review summarized six cohort studies and concluded that compared to gestational weight gain within the guidelines, women with GWL had higher odds of SGA <10th percentile (adjusted odds ratio [AOR] 1.76; 95% confidence interval [CI] 1.45–2.14) but lower odds of large-for-gestational-age >90th percentile (AOR 0.57; 95% CI 0.52–0.62) [21]. Moreover, there was a trend towards a graded relationship between SGA <10th percentile and each of three obesity classes (I: AOR 1.73; 95% CI 1.53–1.97; II: AOR 1.63; 95% CI 1.44–1.85 and III: AOR 1.39; 95% CI 1.17–1.66, respectively) [21]. In addition to this risk, GWL was also suspected to lead to physiological alterations of the fetal fat proportions [22]. Although the systemic review concluded that GWL in obese women may increase the risk of SGA and reduce the risk of LGA for all classes of obesity [21], there were contradictory results reported in other studies, which were not involved in the meta-analysis. A Bavarian cohort study published by Beyerlein et al [22] found that risk of SGA increased with GWL in class I, class II but not in class III/ severely obese women. Another cohort study examining a Swedish population lead by Bloomberg showed that GWL women with class II and class III obesity were no associated with an increase in SGA prevalence (3.7% versus 3.6%) [23].

On the other hand, several retrospective cohort studies examining different populations have found that GWL may actually reduce the risk of some pregnancy complications, including pre-eclampsia and non-elective caesarian section [22,23].

### Limitations of current studies

In the above available studies, many reports were limited by sample size, failure to control important confounders, lack of uniformity in defining morbid obesity, especially lack of information on reasons for weight loss (e.g., maternal illness, psychosocial factors, a result of intentional dieting, or attributed to improved health behaviors during pregnancy) and lack of long-term maternal and child outcome assessment [7,12–14,22–24]. In an effort to fill this gap, high-quality and population-based studies examining maternal and child outcomes among obese women who lose weight during pregnancy are in great needed.

## Testing of the hypothesis

Since weight loss in pregnancy is not recommended and it could carry risks to the mothers and their offspring child, randomized controlled trials would be unethical. The hypothesis could only be assessed by population-based cohort studies. The study cohort should be large enough with sufficient sample size of obese women for each class. In addition, it would be ideal not only have short-term outcomes such as preterm birth, SGA, neonatal morbidity and mortality, but also should have long-term child health outcome data including cognitive development. Information on reasons for weight loss (e.g., maternal illness, psychosocial factors, a result of intentional dieting, or attributed to improved health behaviors during pregnancy) should be identified in the observational study as well.

## Discussion and Conclusion

Gestational weight gain is a complex, but a critically important variable in prenatal care management as it is one of the few modifiable risk factors which may have an association with maternal and child outcomes. With obesity rate on the rise and some obese women deliberately trying to lose weight in pregnancy, and given the lack of high-level evidence to support weight loss during pregnancy, it is important to evaluate whether GWL is safe for obese women.

In general, there were consistent results of increased risk of SGA of GWL in class I obesity, decreased risk of LGA and no change or lesser occurrence of complication during pregnancy for all obese women with GWL in observational studies, but the conflicting results of GWL in class II and III obese women on the SGA neonates suggest GWL may not safe, even in severely obese women. As SGA is a key predictor for neonatal morbidity and mortality, which is far outweigh the potential benefits of GWL, if our proposed large-scale cohort studies confirmed our hypothesis and could also provide long-term maternal and child outcomes evidence, it will be prove to be an useful information of the safety of GWL in obese women. Such information could also aid with the refinement of IOM-recommended guidelines according to different classes of obesity.

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### Declaration of interests

The authors report no conflict of interest.

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