

The Implications of Maternal Overweight and Obesity on the Course of Pregnancy and Birth Outcomes

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Abstract The increasing prevalence of overweight and obesity among women of childbearing age is a growing public health concern in the United States. The average body mass index (BMI) is increasing among all age categories and women enter pregnancy at higher weights. Women are also more likely to retain gestational weight with each pregnancy. Women who are overweight (BMI 25–30) and obese (BMI ≥ 30) are at greater risk of adverse reproductive health outcomes compared to women of normal weight status (BMI 19.8–25). This article provides an overview of the complications associated with maternal overweight and obesity including diabetes, pre-eclampsia, c-sections, and birth defects. We present updated information on the weight trends among women. Finally, we present an overview of the prevention studies aimed at adolescents and women prior to pregnancy.

Keywords Obesity · Nutrition · Women · Pregnancy · Postpartum

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Introduction

The effect of maternal nutritional status prior to pregnancy on birth outcomes is of great public health importance. Epidemiological studies have shown a clear association between maternal pregravid weight and birth outcomes. As a marker of nutritional status, a woman's pregravid body mass index (BMI = kg/m^2), if low (<19.8 BMI), may reflect chronic nutritional deficiency whereas a high BMI (>26.1 BMI) reflects an imbalance between energy intake and expenditure, and thus varying degrees of adiposity [1]. The effects of each on birth outcomes differ, with low BMI being associated with intrauterine growth retardation (IUGR), preterm birth, and iron deficiency anemia [2–5]. Whereas, BMI above the normal range of 19.8 to 26.1 (IOM 1990) is associated with a number of adverse reproductive health outcomes. For example, infertility [6] gestational diabetes [7], pregnancy induced hypertension and pre-eclampsia [8], birth defects [9], large for gestational age (LGA) or macrosomia (>4500 g) [10], cesarean sections [11–13], prolonged labor [14], and recently postpartum anemia [15–17] have all been associated with maternal overweight yet the exact mechanisms have not been identified. The purpose of this paper is to describe an overview of the complications associated with maternal overweight and obesity; present updated information on the weight trends among women; and review prevention studies aimed at adolescents and women prior to pregnancy.

Prevalence of overweight and obesity among women of childbearing age

Until recently, most studies on the topic of maternal pregravid weight focused on the lower end of the weight spectrum; however, with the shift in body weight that has occurred

globally, more recent research has examined the effect of overweight and obesity on birth outcomes. Obesity world wide (>30 BMI) now exists at a prevalence of 15–20% and accounts for 2–7% of the total health care costs [18]. In the US, the latest NHANES survey (1999–2002) indicate that 26% of non-pregnant women 20–39 years of age are overweight (25–29.9 BMI), and 29% are obese (>29.9 BMI) [19]. On average, obesity among all women appears to have peaked at 33% with no appreciable increase between 1999–2000 and 2003–2004 [20].

Determinants of overweight among women

A higher proportion of women of child bearing age are overweight or obese compared to men, and women of younger or older ages. In addition, upwards of 80% of African American women are either overweight or obese [19]. Using 2003–2004 data from NHANES, non-Hispanic black women are twice as likely to be obese than their non-Hispanic white counterparts (OR 2.01, 95% CI, 1.76, 2.29) [20]. Among individuals with less than a high school education, the prevalence of obesity was roughly twice that of college graduates [21]. Paradoxically, low-income households appear to have a higher risk of obesity [22], although, at the same time they are more likely to be at risk of food insecurity. Household food insecurity has been associated with increased BMI [23] and an increased risk of overweight [24] in women, but not among men or children [25–27].

Influences of adolescent overweight on reproductive health

Moreover, thirty percent of non-pregnant adolescent girls 12–19 years of age are considered overweight or at risk, based on a BMI for age at the 85th percentile or higher [19]. Excessive weight gain at younger ages is associated with earlier menarche, especially among black and Hispanic girls. Younger and more severely obese girls reaching reproductive capacity perpetuate obesity if left untreated, directly through the influence of maternal weight on fetal origins and indirectly through maternal to child social and developmental interactions [28].

Pregravid BMI is a predictor of gestational weight gain

Among women who become pregnant, the shift towards higher pregravid weight also appears evident [29]. One study using a perinatal data base to ascertain weight before pregnancy for a 19 year period showed that the mean maternal

weight of women at their first prenatal visit increased by 20% between 1980 and 1999, and the percentage of women weighing >200 lbs at that visit increased from 7.3 to 24% and for those weighing >300 lbs the percentage increased from 2 to 11% [30]. Another study using a perinatal data system of all live births from 8 contiguous counties in New York, an 11% increase in pregravid overweight and an 8% increase in pregravid obesity between 1999 and 2003 [29]. Not only are more women beginning pregnancy at a higher BMI, but women are also gaining in excess of the 1990 Institute of Medicine recommendation for gestational weight gain [1]. Specifically, and overweight and obese women are more likely to gain excessive gestational weight and keep it on after delivery [31–33]. In affluent countries, women retain some weight with each successive pregnancy, gaining more weight than their non-pregnant counterparts [34, 35]. These observations beg the far larger and more important question of how and when to intervene in order to optimize reproductive and individual health?

Weight intervention studies

Many research studies of dietary, physical activity and weight interventions focus on individuals who are already obese or experiencing co-morbidities such as heart disease, diabetes or cancer. In contrast, only a limited number of interventions have focused on weight loss and/or maintenance of optimal weight in the context of reproductive health. On one end of the spectrum, surgical interventions such as gastric bypass and lap-band surgeries have been successful among obese women of child-bearing age with a decrease of reported rates of gestational diabetes, macrosomia, cesarean section while achieving adequate weight gain [36, 37]. Some interventions have been targeted to address obesity during adolescents, pregnancy, and the postpartum or inter-conceptional periods. These commonly have been school- or clinic-based in nature. School-based randomized intervention trails such as the Trial of Activity in Adolescent Girls (TAAG) are presently underway to determine if increased opportunities for moderate and vigorous activity may decelerate the age related decline in physical activity [38].

Clinic-based interventions

Clinic-based intervention usually begin with obesity management training for physicians because of the existence of a combination of a paucity of nutrition, physical and weight educational materials, lack of knowledge of how to counsel women, and lack of resources and personnel to assist with obesity management. For example, results from a survey of pediatricians found that only 12% of pediatricians reported

high self-efficacy in obesity management, although 39% stated that physicians were important health care providers that could be effective with obesity management. Lack of non-MD staff reimbursement, of an on-site dietitian, and of patient educational materials were each highly associated with low self-efficacy in obesity management [39].

Weight loss interventions

Tsai and Wadden [40] conducted a systematic review of major commercial weight loss programs undertaken to provide physicians with information on components, cost, and efficacy of these programs. eDiets.com, Health Management Resources, Take off Pounds Sensibly, OPTIFAST, and Weight Watchers were represented in the academic literature. The review identified Weight Watchers as the least costly with maintenance of 3.2% loss of initial weight at two years. Medically supervised very-low-calorie diet programs had the greatest weight loss (approximately 15 to 25% of initial weight), but were associated with high costs and high attrition rates. Finally, Internet (i.e., eDiets.com) and organized self-help programs (i.e., Overeaters Anonymous) produced minimal weight loss. In a clinical intervention conducted among pregnant women, physicians were trained to chart and monitor gestational weight gain adequacy based on the Institute of Medicine weight gain recommendations. Women received five patient education newsletters by-mail with action-oriented messages of how to gain adequate weight in pregnancy. Findings indicated that low-income women who received the intervention were less likely to gain excessive gestational weight. Overweight low-income women were at a reduced risk to retain more than 2.7 kg of weight at one year [41]. A hospital based randomized control trial with an intensive stepped-care, behavioral intervention found that the intervention significantly decreased the percentage of normal weight women gaining in excess of the IOM recommendations [42].

Significance of weight status during postpartum period

The postpartum period is hypothesized to significantly contribute to overweight and obesity through pregnancy weight retention. Olson et al. [31] found that over 25% of women participating in a cohort study experienced major weight gain, defined as 4.55 kg or more, at one year postpartum. Gestational weight gain, postpartum exercise frequency, and food intake were all significantly associated with weight change from early pregnancy to one year postpartum. Lower income women who gained more than the IOM recommendation were at increased risk for major weight gain at one

year postpartum. In a randomized trial of 40 overweight postpartum women receiving either a 12 week structured or self-directed diet and physical activity intervention, the structured intervention group had significant weight loss (7.3 kg), decrease in percent body fat (6%) and no change in fat-free mass, whereas the self-directed group had no significant change at one year postpartum [43]. Randomized control trials are currently underway in low-income WIC populations receiving usual care or a multi-component intervention including home visits, group classes and monthly telephone counseling [44].

Conclusion

Given that the costs associated with treating obesity are so high and their limited success rates, the best strategy is to prevent obesity from occurring in the first place. However, prevention first requires a clear understanding of its etiology. Obesity is a chronic disease thought to develop from a complex interaction of genotype and environmental factors [45]. Our knowledge of how and why this disease develops is far from complete, but currently funded research projects are targeting the integration of social, behavioral, cultural, and biological factors. In addition, best practices at obesity prevention, treatment and optimal weight maintenance must be identified to provide practitioners with an array of strategies to help curb the ensuing epidemic.

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