

# Early weight gain during pregnancy: Which women are the most affected?

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## ABSTRACT

**Background:** Maternal weight gain during pregnancy is a good prediction tool in short- and long-term health of pregnant women and their children. **Objectives:** To study the effect of early weight gain of pregnant women until the end of the 2<sup>nd</sup> trimester of pregnancy, depending on their prepregnancy body mass index (BMI). **Materials and Methods:** A total of 116 healthy pregnant women were followed until the 2<sup>nd</sup> trimester of pregnancy, their weight and height before pregnancy, as well as the current weight at the end of the 1<sup>st</sup> and 2<sup>nd</sup> trimesters were collected. Data included age, parity, eating habits, and physical activity level. Statistics were performed using the StatView software. **Results:** The mean prepregnancy BMI was  $27 \pm 5.27$  kg/m<sup>2</sup>. Weight gain in the 2<sup>nd</sup> trimester is  $6.33 \pm 4.84$  kg. It decreases with the increasing age of the mother (25% of women between 20 and 24.9 years vs. 12.5% of >35). Furthermore, it decreases with the increasing number of children (62.5% in nulliparous vs. 25% in multiparous). Breakfast is skipped by 64.5% of overweight pregnant women in the 1<sup>st</sup> trimester and 90% in the 2<sup>nd</sup> one. 80.17% and 69.83% of pregnant women do not practice any physical activity. **Conclusion:** Overweight and obese pregnant women before pregnancy do not take enough weight during pregnancy. Prospects will to analyze behaviors related to health and social status.

**KEY WORDS:** Prepregnancy Body Mass Index; Weight Gain; 1<sup>st</sup> and 2<sup>nd</sup> Trimester

## INTRODUCTION


Rates of obesity have increased significantly over the past several decades. Today over 35% of reproductive age women are obese (body mass index [BMI]  $\geq 30$  kg/m<sup>2</sup>), and 8% are extremely obese (BMI  $\geq 40$  kg/m<sup>2</sup>).<sup>[1]</sup> The obesity epidemic is impacting pregnancy. Over half of all women entering pregnancy in the United States are either overweight or obese.<sup>[2]</sup>

Numerous studies have shown obesity and excessive gestational weight gain (GWG) is associated with both maternal and fetal complications including gestational

diabetes, hypertension, preeclampsia, fetal macrosomia, cesarean delivery, and postpartum weight retention.<sup>[3,4]</sup>

Weight gain during pregnancy is attributable to the uterus and its contents (fetus, amniotic fluid, and placenta), breasts, blood, and interstitial fluid. A smaller fraction of that weight gain is due to an increase in cellular water and deposition of new fat and protein constituting maternal reserves.<sup>[5]</sup> Although the range of weight gain considered normal is wide, it depends on the pregestational BMI.<sup>[6]</sup> The most widely accepted recommendations regarding GWG are those published by the institute of medicine (IOM) of the United States of America.<sup>[7]</sup>

These guidelines state that healthy women who have a normal weight for their height (BMI 18.5-24.9) should gain 11.5-16 kg during pregnancy. Overweight women (BMI 25-29.9) should gain 7-11.5 kg and obese women (BMI >30) should only put on 5-9 kg. It is also recommended to gain between 0.5 and 2 kg during the 1<sup>st</sup> trimester.<sup>[4]</sup> In the

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2<sup>nd</sup> trimester, underweight women should gain 0.5 kg each week of pregnancy, normal women 0.4 kg/week, overweight women 0.3 kg/week, and obese women 0.2 kg/week.<sup>[4]</sup>

Despite these guidelines, over 55% of obese women gain more than the recommended amount.<sup>[2]</sup> GWG is not linear over the course of pregnancy. Weight gain starts slowly in the 1<sup>st</sup> trimester and increases more consistently in the 2<sup>nd</sup> and 3<sup>rd</sup> trimesters.<sup>[8]</sup> The ability to identify women at risk for excessive GWG allows for weight management interventions.

The 2<sup>nd</sup> half of pregnancy is characterized by progressive insulin resistance,<sup>[9,10]</sup> and maternal fat accumulation appears to influence subsequent maternal insulin resistance.<sup>[9,11]</sup> The pattern of GWG is higher in the 2<sup>nd</sup> trimester at a rate of 0.563 kg/week and birth weight is strongly correlated with weight gain during that period.<sup>[12]</sup>

Previous studies have suggested that excessive early GWG might be associated with an early increase in insulin resistance leading to exhaustion of the pancreatic B-cell. This B-cell depletion could reduce the capacity to compensate for the increasing insulin resistance of pregnancy, and therefore, lead to hyperinsulinemia, maternal hyperglycemia, and excessive fetal growth.<sup>[9,13-15]</sup>

However, it is important to remember the proposed objectives by the Swedish study of 2007 which allow decreasing the number of caesarean sections but also of persistent overweight and obesity in 1 year of childbirth, without increasing the number of other complications. These objectives are a weight gain of 10 kg maximum, regardless of the initial BMI of the patient. A weight gain >10 kg at 6 months of pregnancy is deemed excessive (risk factor of gestational diabetes). It is to be modulated according to the prepregnancy BMI.<sup>[16]</sup> Our study assessed the effect of early weight gain of pregnant women until the end of the 2<sup>nd</sup> trimester of pregnancy, depending on their prepregnancy BMI.

## MATERIALS AND METHODS

We conducted a prospective and a longitudinal cohort study nearby 116 pregnant women during the 1<sup>st</sup> and 2<sup>nd</sup> trimesters of pregnancy in maternities, antenatal centers and private gynecologists in Constantine, Algeria from December 2013 to August 2015. The participants were recruited and followed up longitudinally, as described previously. The trimesters were defined as 1<sup>st</sup> (<16 complete weeks), 2<sup>nd</sup> (15-28 complete weeks). Women were recruited before 16 weeks of amenorrhea. Women were eligible for participation if they entered prenatal care before the 16 weeks of amenorrhea, aged 18 years old and more and were healthy and mentally competent. We excluded women refusing to participate in the study, missing information on prepregnancy weight, known diabetes, hypertension, and anemia before pregnancy.

Potentially eligible women were sent an informational letter explaining the study and its objectives and requesting their participation. Written consent was obtained from the mother at inclusion. At enrollment, a standardized questionnaire was completed. Data collected include maternal characteristics (age, parity), maternal prepregnancy weight, height, prepregnancy BMI, weight gain at the end of the 1<sup>st</sup> and 2<sup>nd</sup> trimesters of pregnancy, eating habits (such as eating between meals, taking or not of breakfast and consuming more fried foods) and the practice of physical activity (at least walking). These informations were obtained by face to face interview with each pregnant woman. Weight and height were measured according to a standard protocol. Weights of pregnant women were self-reported or recorded at the early 1<sup>st</sup> trimester during their first visit and continued in every trimester using an electronic weighing balance Seca to the nearest 0.1 kg. Height was measured in cm using a locally made anthropometer. The pregnant women were asked to maintain an upright and erect posture with her feet together and the back of her heels touching the pole of the anthropometer. The height was measured when the horizontal headpiece was lowered onto the women's head. We calculated prepregnancy BMI using either a documented 1<sup>st</sup> trimester weight and height or a self-reported weight. Prepregnancy BMI was computed as reported weight (kg) divided by square of measured height (m) and categorized into four groups as underweight (<18.5 kg/m<sup>2</sup>), normal (≥18.5 and <25 kg/m<sup>2</sup>), overweight (≥25 and <30 kg/m<sup>2</sup>), and obese (≥30 kg/m<sup>2</sup>). Prepregnancy BMI and GWG were categorized based on IOM BMI groups and GWG guidelines.<sup>[4]</sup> Weight (in kg) at each prenatal visit (at the end of the 1<sup>st</sup> and the 2<sup>nd</sup> trimesters) were collected. The weight gain variate was categorical and had 3 values: Weight gain above, below, or within IOM recommendations. At the end of the 1<sup>st</sup> trimester of pregnancy, all women should gain between 0.5 and 2 kg.<sup>[4]</sup> In the 2<sup>nd</sup> trimester, underweight women should gain 0.5 kg each week of pregnancy, normal women 0.4 kg/week, overweight women 0.3 kg/week, and obese women 0.2 kg/week.<sup>[4]</sup>

Statistical analysis was performed using StatView software. Quantitative variables were analyzed by student's *t*-test and one-way analysis of variance. Binary logistic regression analysis was done to find out the association among BMI, GWG, some maternal factors such as age, height, and parity. *P* < 0.05 was considered significant. The  $\chi^2$  test was used in comparison analyses, whereas correlations were evaluated by Pearson and Spearman tests.

## RESULTS

The database contained 245 women, and of these, 116 women met all inclusion criteria and were included in the study. We excluded women with missing or implausible information on prepregnancy BMI, prepregnancy weight, known diabetes, hypertension, and anemia before pregnancy.

We identified 116 patients who received care through maternities, antenatal centers and private gynecologists in Constantine, Algeria from December 2013 to August 2015. All women initiated care at <16 weeks of amenorrhea and had a documented 1<sup>st</sup> trimester weight.

The sociodemographic and other characteristics (age, parity, prepregnancy body weight, height, BMI, and gestational age) of the 116 women in the analysis cohort are shown in Table 1. Mean weight before pregnancy was  $71 \pm 13.99$  kg, the overall mean prepregnancy BMI was  $27.29 \pm 5.27$  kg/m<sup>2</sup>. GWG in the 1<sup>st</sup> trimester was  $1.25 \pm 3.8$  kg and in 2<sup>nd</sup> trimester was  $6.34 \pm 4.84$  kg (0.53 kg/week). A majority of the women 43 (37.07%) started pregnancy with a normal BMI. The second largest BMI group was overweight 36 (31.03%) and obese 35 (30.17%). The majority of women in the sample were between 20 and 34 years of age (81.03%).

In general, as prepregnancy BMI increased, the amount of weight gained during pregnancy decreased ( $7.96 \pm 4.86$  kg in normal weight women vs.  $4.58 \pm 4.14$  kg in obese ones,  $P = 0.0017$ ) (Table 2).

The rate of maternal weight gain from the 1<sup>st</sup> to the 2<sup>nd</sup> trimester of pregnancy was a significant predictor of excessive weight gain.

Second - GWG rate varied with many sociodemographic characteristics, including maternal age and parity. In contrast, 1<sup>st</sup> trimester GWG rate did not vary with these characteristics, but was associated with behaviors including, pregnancy physical activity, and diet pattern. GWG rate varied across prepregnancy BMI categories for 2<sup>nd</sup> trimester gain but not for 1<sup>st</sup> trimester gain.

Among the 116 women analyzed, 62.5% of women with a normal prepregnancy BMI, 25% of overweight, and 12.5% of obese women had an excessive early GWG ( $P = 0.02$ ) (Figure 1).

Gestational weight gain decreased with the increasing age of the mother (25% of women between 20 and 24.9 years versus 12.5% in women of > 35-years-old,  $P = 0.07$ ) (Figure 2).

As shown in Figure 3, 62.5% of nulliparous, 12.5% of primiparous and 25% of multiparous women had excessive weight gain in the 2<sup>nd</sup> trimester. Weight gain decreases with the increasing number of children (62.5% in nulliparous women vs. 25% in multiparous,  $P = 0.02$ )

GWG was significantly lower in older, more parous women, with age and parity strongly related ( $P = 0.01$ ,  $P = 0.07$ ) (Figures 2 and 3). Maternal weight gain during pregnancy decreased with increasing prepregnancy BMI, and obese women differed from their peers with a mean of 4 kg gained versus about 8 kg for the other women. Furthermore, obese

**Table 1:** Distribution of participants according to clinical characteristics and weight gain ( $n=116$ )

Category	Means±SD	Minimum	Maximum
Age (years)	30±5.00	20	42
20-34.9	81.03		
≥35	18.96		
Parity	1±0.99	0	4
Nulliparity	47 (40.52)		
Primiparity	36 (31.03)		
Multiparity	33 (28.48)		
Pregnancy term	27±1.13 weeks of amenorrhea	23	28
Initial weight (kg)	71±13.99	45	114
Height (m)	1.61±0.06	1.46	1.72
Prepregnancy BMI (kg/m <sup>2</sup> )	27.29±5.27	16.52	46.84
Weight gain (1 <sup>st</sup> trimester)	1.25±3.8	-15	9
Weight gain (2 <sup>nd</sup> trimester)	6.34±4.84	-4,1	17.2

SD: Standard deviation, BMI: Body mass index. Data are mean±SD or  $n$  (%) unless otherwise specified

**Table 2:** Distribution of participants according to weight gain in the 1<sup>st</sup> and 2<sup>nd</sup> trimesters of pregnancy by pre-pregnancy state weight

Pre-pregnancy state weight	Weight gain (mean±SD)	
	1 <sup>st</sup> trimester	2 <sup>nd</sup> trimester
Underweight	2.59±0.18	7.55±0.78
Normal	1.66±3.22	7.96±4.86
Overweight	1.1±3.47	6.04±5.06 ( $P=0.09$ )
Obese	0.83±4.81	4.58±4.14 ( $P=0.0017$ )

SD: Standard deviation

women were also less likely to be nulliparous than women with a normal BMI.

Breakfast is skipped by 64.5% of overweight pregnant women in the 1<sup>st</sup> trimester and 90% in the 2<sup>nd</sup> one. A percentage of 80.17% (of which 63.41% are overweight) and 69.83% (of which 59.26% are overweight) of pregnant women do not practice any physical activity.

## DISCUSSION

In this study, 62.5% of women with a normal prepregnancy BMI, 25% of overweight, and 12.5% of obese women had an excessive early GWG ( $P = 0.02$ ) greater than the 2009 IOM recommendations.

In 2009, the US IOM published revised guidelines for GWG. The goal of these guidelines is to optimize both maternal and child outcomes and to decrease the rates of both maternal postpartum and childhood obesity.<sup>[17]</sup> These guidelines do

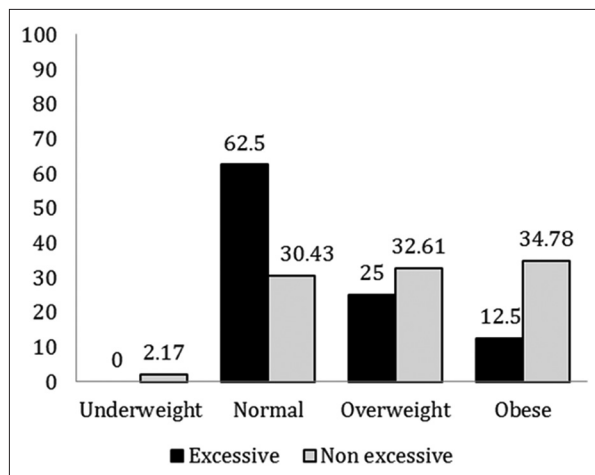


Figure 1: Prepregnancy state weight and 2<sup>nd</sup> trimester weight gain

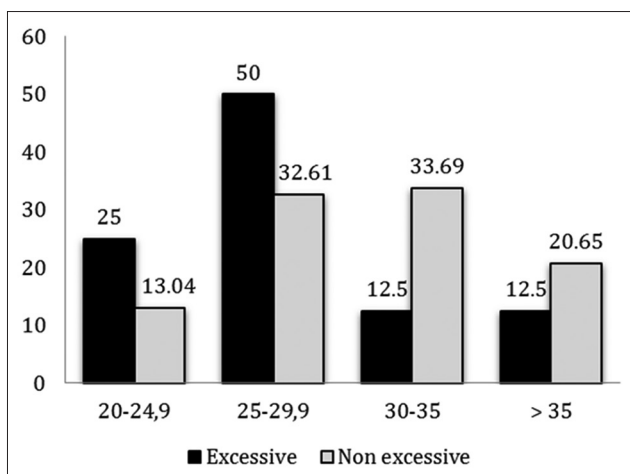


Figure 2: Distribution of pregnant women weight gain (2<sup>nd</sup> trimester) according to age

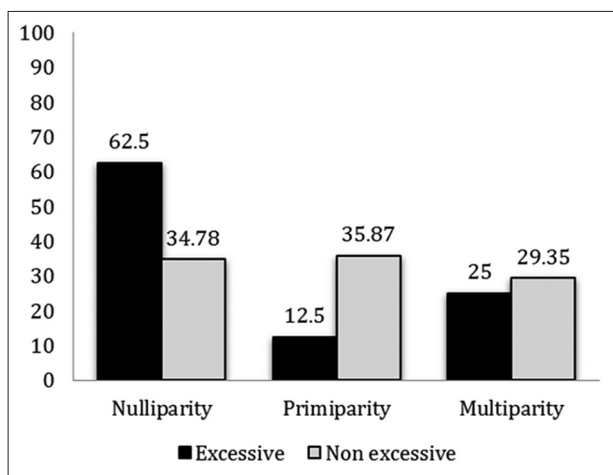


Figure 3: Distribution of pregnant women weight gain (2<sup>nd</sup> trimester) according to parity

not specifically address the timing of excessive weight gain during the pregnancy (early vs. late).

As obesity becomes more prevalent in pregnancy, it is increasingly important for clinicians to monitor GWG. Our

data suggest a divergence in weight gain patterns as early as 12-14 weeks. Women who exceeded pregnancy weight recommendations started to accelerate their weight gain at the beginning of the 2<sup>nd</sup> trimester and gained a majority of weight during that trimester. Women who gained >2 kg at 12-4 weeks were likely to exceed GWG (96% positive predictive value [PPV] [95% confidence interval (CI) 79 - 99%]).

All obese women had minimal weight gain to no weight gain until mid-pregnancy.<sup>[18]</sup> Another large study of over 58,000 women within a Danish National Birth Cohort showed a mean GWG for obese primiparous women of 11.3 kg and 9.9 kg for multiparous women. In this cohort, 45% of obese women gained less than 10 kg and the mean weight gain decreased with increasing BMI.<sup>[19]</sup>

Our results showed that weight gain in pregnancy was lower when prepregnancy BMI was elevated. In particular, women who were overweight or obese before pregnancy generally gained less weight during pregnancy and very few women had an excessive weight gain. However, during pregnancy, fat is stored to secure energy supply during fetal growth and lactation. In obese women, no additional storage is necessary, which suggests that pregnancy weight gain could be restricted because of physiological mechanisms. Our study was based on self-reported measures of weight before pregnancy whereas many studies have found that weight is more likely to be under-reported by women with a high prepregnancy BMI.<sup>[20]</sup> Such a bias would, therefore, impact on the calculation of GWG and lead to an over-estimation of weight gain in overweight and obese women.

To our knowledge, there is a study that examines gestational age-specific weight gain as a predictor for excessive GWG. Chmitorz et al.<sup>[21]</sup> which identified 2<sup>nd</sup> trimester-specific cutoffs as good predictors of excessive GWG in obese and overweight women (93.3% PPV [95%, CI: 90-96%]). Using 2<sup>nd</sup> trimester cutoffs they were able to predict total excessive GWG in >70% of the population.<sup>[21]</sup>

GWG was significantly less in older and more parous women, a finding consistent with the existing literature.<sup>[22]</sup> In this sample, GWG decreased with the increasing age of the mother (25% of women between 20 and 24.9 years vs. 12.5% in women of >35 years old,  $P = 0.07$ ). Furthermore, 62.5% of nulliparous, 12.5% of primiparous and 25% of multiparous women had excessive weight gain in the 2<sup>nd</sup> trimester. Weight gain decreases with the increasing number of children (62.5% in nulliparous women vs. 25% in multiparous,  $P = 0.02$ ).

There is evidence that physical activity along with dietary modification and weight monitoring can decrease GWG.<sup>[23,24]</sup> A meta-analysis by Streuling et al.<sup>[23]</sup> examined 12 randomized trials assessing the impact of a physical activity intervention on GWG. Studies included had participants exercise at least 3 times a week for 20-60 min starting in the 1<sup>st</sup> or

2<sup>nd</sup> trimester. Physical activity included aerobics, running, cycling, water aerobics, and muscle strengthening. Women who engaged in any physical activity during pregnancy had a significantly lower GWG compared to those who did not (mean difference  $-0.61$  kg; 95% CI:  $-1.17, -0.06$ ). Although exercise overall reduced total GWG the meta-analysis did not find a dose-dependent effect of exercise on GWG.

Studies have shown that both zero weight gain and weight loss are associated with decreased rates of preeclampsia, cesarean delivery, large for gestational age infants, operative vaginal deliveries, and admission to neonatal intensive care units.<sup>[25,26]</sup>

A limitation of our study is the use of self-reported weights of participants. This is important because self-reported weights may cause misclassification of GWG. Obese women tend to under-report weight, and therefore, over-estimate GWG.<sup>[27]</sup> Measured prepregnancy weight may not be universally available and 1<sup>st</sup> trimester weight is often considered acceptable. Our methodology of calculating total GWG using either a self-reported weight or documented 1<sup>st</sup> trimester weight reflects how clinicians examine GWG in a real world setting.

## CONCLUSION

In our cohort, we found that women at risk for exceeding GWG goals are normal and underweight women before pregnancy rather than overweight and obese ones, less aged (<35 years old), nulliparous and primiparous women comparing with multiparous ones. This finding should encourage health professionals to better inform pregnant women about the importance of weight gain adapted to their BMI.

However, as less than a third of women currently meet the recommended GWG limits by the IOM, it is important, in a health public point of view, to set up programs to help pregnant women to comply with these recommendations.

Future research should focus on interventions that provide education regarding food choices and encourage women to engage in physical activity early in pregnancy. These interventions should specifically target women who gain more weight at the beginning of the 2<sup>nd</sup> trimester.

## REFERENCES

1. Flegal KM, Carroll MD, Kit BK, Ogden CL. Prevalence of obesity and trends in the distribution of body mass index among US adults, 1999-2010. *JAMA*. 2012;307(5):491-7.
2. CDC. Pregnancy Nutrition Surveillance Nation. Summary of Trends in Maternal Health Indicators; 2011. Available from: [http://www.cdc.gov/pednss/pnss\\_tables/tables\\_numeric.htm](http://www.cdc.gov/pednss/pnss_tables/tables_numeric.htm). [Last retrieved on 2014 Feb 25].

3. American College of Obstetricians and Gynecologists. Obesity in pregnancy. ACOG Committee Opinion 549. Washington, DC: ACOG; 2013.
4. Institute of Medicine. Weight Gain During Pregnancy: Reexamining the Guidelines. Washington, DC: National Academies Press; 2009.
5. Royal College of Obstetricians and Gynaecologists. CMACE/RCOG Joint Guideline: Management of Women with Obesity in Pregnancy. London: Royal College of Obstetricians and Gynecologists; 2010.
6. American College of Obstetricians and Gynecologists. ACOG Committee opinion No. 549: Obesity in pregnancy. *Obstet Gynecol*. 2013;121(1):213-7.
7. Davies GA, Maxwell C, McLeod L, Gagnon R, Basso M, Bos H, et al. SOGC Clinical Practice Guidelines: Obesity in pregnancy. No. 239, February 2010. *Int J Gynaecol Obstet*. 2010;110(2):167-73.
8. Durie DE, Thornburg LL, Glantz JC. Effect of second-trimester and third-trimester rate of gestational weight gain on maternal and neonatal outcomes. *Obstet Gynecol*. 2011;118(3):569-75.
9. Hedderson MM, Gunderson EP, Ferrara A. Gestational weight gain and risk of gestational diabetes mellitus. *Obstet Gynecol*. 2010;115(3):597-604.
10. Buchanan TA, Xiang AH. Gestational diabetes mellitus. *J Clin Invest*. 2005;115(3):485-91.
11. Svensson H, Wetterling L, Bosaeus M, Odén B, Odén A, Jennische E, et al. Body fat mass and the proportion of very large adipocytes in pregnant women are associated with gestational insulin resistance. *Int J Obes (Lond)*. 2016;40(4):646-53.
12. Rasmussen KM, Catalano PM, Yaktine AL. New guidelines for weight gain during pregnancy: What obstetrician/gynecologists should know. *Curr Opin Obstet Gynecol*. 2009;21(6):521-6.
13. Herring SJ, Oken E, Rifas-Shiman SL, Rich-Edwards JW, Stuebe AM, Kleinman KP, et al. Weight gain in pregnancy and risk of maternal hyperglycemia. *Am J Obstet Gynecol*. 2009;201(1):61 e1-7.
14. Brown JE, Murtaugh MA, Jacobs DR Jr, Margellos HC. Variation in newborn size according to pregnancy weight change by trimester. *Am J Clin Nutr*. 2002;76(1):205-9.
15. Edwards LE, Hellerstedt WL, Alton IR, Story M, Himes JH. Pregnancy complications and birth outcomes in obese and normal-weight women: Effects of gestational weight change. *Obstet Gynecol*. 1996;87(3):389-94.
16. Claesson IM, Josefsson A, Cedergren M, Brynhildsen J, Jeppsson A, Nystrom F, et al. Consumer satisfaction with a weight-gain intervention programme for obese pregnant women. *Midwifery*. 2008;24(2):163-7.
17. Rasmussen KM, Abrams B, Bodnar LM, Butte NF, Catalano PM, Maria Siega-Riz A. Recommendations for weight gain during pregnancy in the context of the obesity epidemic. *Obstet Gynecol*. 2010;116(5):1191-5.
18. Hutcheon JA, Platt RW, Abrams B, Himes KP, Simhan HN, Bodnar LM. Pregnancy weight gain charts for obese and overweight women. *Obesity*. 2015;23(3):532-5.
19. Nohr EA, Vaeth M, Baker JL, Sorensen TI, Olsen J, Rasmussen KM. Pregnancy outcomes related to gestational weight gain in women defined by their body mass index, parity, height, and smoking status. *Am J Clin Nutr*. 2009;90(5):1288-94.
20. Rowland ML. Self-reported weight and height. *Am J Clin Nutr*.

- 1990;52(6):1125-33.
21. Chmitorz A, von Kries R, Rasmussen KM, Nehring I, Ensenauer R. Do trimester-specific cutoffs predict whether women ultimately stay within the Institute of Medicine/National Research Council guidelines for gestational weight gain? Findings of a retrospective cohort study. *Am J Clin Nutr.* 2012;95(6):1432-7.
  22. Chasan-Taber L, Schmidt MD, Pekow P, Sternfeld B, Solomon CG, Markenson G. Predictors of excessive and inadequate gestational weight gain in Hispanic women. *Obesity (Silver Spring).* 2008;16(7):1657-66.
  23. Streuling I, Beyerlein A, Rosenfeld E, Hofmann H, Schulz T, von Kries R. Physical activity and gestational weight gain: A meta-analysis of intervention trials. *BJOG.* 2011;118(3):278-84.
  24. Streuling I, Beyerlein A, von Kries R. Can gestational weight gain be modified by increasing physical activity and diet counseling? A meta-analysis of intervention trials. *Am J Clin Nutr.* 2010;92(4):678-87.
  25. Blomberg M. Maternal and neonatal outcomes among obese women with weight gain below the new Institute of Medicine recommendations. *Obstet Gynecol.* 2011;117(5):1065-70.
  26. Kiel DW, Dodson EA, Artal R, Boehmer TK, Leet TL. Gestational weight gain and pregnancy outcomes in obese women: How much is enough? *Obstet Gynecol.* 2007;110(4):752-8.
  27. Mandujano A, Huston-Presley L, Waters TP, Catalano PM. Women's reported weight: Is there a discrepancy? *J Matern Fetal Neonatal Med.* 2012;25(8):1395-8.

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