

Gestational Weight Gain and Its Relationship with Maternal Characteristics

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ABSTRACT: **Background:** Both high and insufficient weight gain during pregnancy have been associated with adverse outcomes for mothers and their offspring.

Objectives: To describe self-reported weight gain during pregnancy, assess the concurrence of this weight gain with issued recommendations, and investigate associations between lifestyle factors and weight gain.

Methods: In this cross-sectional study, 109 pregnant women hospitalized in one gynecological and obstetrics department completed questionnaires related to weight gain and lifestyle factors such as smoking, diet and exercise. Recommended weight gain was defined by the American Congress of Obstetricians and Gynecologists and was compatible with the Ministry of Health guidelines in Israel.

Results: Fifty-three participants (49%) reported weight gain above the recommendation, 31 (28%) met the recommendations and 25 (23%) reported weight gain below the recommendations. Characteristics associated with high weight gain included past smoking and/or age above 36 years and/or body mass index (BMI) above 25 kg/m². Only 34 women (31%) reported seeking professional nutritional counseling during pregnancy. An increased tendency to consult a nutritionist was reported among diabetic women.

Conclusions: Only a minority of women gained the recommended weight during pregnancy. High BMI and/or a history of smoking and/or older age were associated with weight gain above recommendations. Particular effort should be directed toward counseling women at high risk of weight gain during pregnancy.

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KEY WORDS: nutrition, pregnancy, body mass index (BMI), age, smoking

Normal pregnancy leads to an increase in body weight and fat deposition. High weight gain during pregnancy is associated with increased risks of unfavorable short- and long-term pregnancy outcomes [1-3]. High weight gain affects gene expression, enzyme activity, hormone levels and cell activity [4], and has been linked to preeclampsia, large-for-gestational-age (LGA) infants, gestational diabetes, caesarean delivery and early mortality [5,6]. An association has been demonstrated between

high weight gain during pregnancy and adult obesity [7], and morbidity and cardiovascular disease [8] in the offspring. Many women for whom weight gain during pregnancy exceeds recommendations do not return to their pre-pregnancy weight. Insufficient weight gain is associated with preterm birth, low birth weight, growth restriction and prematurity [9].

A study conducted in Switzerland [10] reported that only 30–40% of women gained weight as recommended. Other studies have shown that at least 30% of western women gain more weight during pregnancy than recommended by current guidelines [1,11]. Recommendations for gestational weight gain (GWG) published by the Israeli Ministry of Health [1] are similar to those published by the U.S. Institute of Medicine [12] and the American College of Obstetricians and Gynecology [2]. The guidelines recommend weight gain during pregnancy based on pre-gestational body mass index (BMI): 11.5–17.0 kg if pre-gestational BMI is within the normal range, 12.5–18.0 kg if pre-gestational BMI is low (< 18.5 kg/m²), and 5.0–9.0 kg if pre-gestational BMI is high (> 30 kg/m²). GWG has been shown to be associated with several factors, including physical activity, diet and age [13-17]. This study presents self-reported weight gain during pregnancy of women hospitalized in an obstetrics ward, and associations between weight gain and maternal lifestyle characteristics such as smoking, exercise, diet, nutritional counseling and alcohol consumption, as well as pregnancy factors such as number of previous abortions, drug use, gestational diabetes and hypertension.

PATIENTS AND METHODS

This study was approved by the ethics committee of Rambam Medical Center.

Pregnant women in their third trimester who were hospitalized in the Obstetrics and Gynecology Department of Rambam Medical Center were invited to participate in this cross-sectional study. Absence of data on last menstruation, height and weight (self-reported) was deemed exclusion criteria.

The women were hospitalized for various reasons, including preeclampsia, gestational diabetes, premature labor, fetal monitoring, infection, vaginal bleeding, cervical insufficiency and hypertension. Participants completed a questionnaire that accessed information about GWG, BMI, age, chronic diseases

including diabetes and hypertension, medications, smoking, alcohol consumption, exercise and nutritional counseling during pregnancy. We also compared the collected data with their electronic patient chart.

The population was initially analyzed by high-risk and non-high-risk pregnancy. High risk was defined as the presence of one or more of the following conditions: diabetes, hypertension, bleeding, hyperemesis gravidarum, a decrease in fetal movements and preeclampsia [18]. Women with non-high-risk pregnancies were hospitalized for reasons such as caesarian section, nephritis, pruritus and diarrhea. No statistically significant difference in weight gain was found between the high-risk and non-high-risk sub-populations, thus the data were analyzed for the group as a whole.

Categories of weight gain were:

- Not exceeding or falling short by more than 20% of recommendations
- More than 20% above recommendations
- More than 20% below recommendations

STATISTICAL ANALYSIS

Data were examined for normal distribution, and the appropriate statistical test was selected accordingly. Continuous and categorical parameters were compared between independent groups, using the independent Student *t*-test and chi-square test, respectively. Correlations between continuous variables were tested using Spearman's correlation. $P < 0.05$ was considered statistically significant.

RESULTS

Of 179 women hospitalized in the gynecology and obstetrics ward at Rambam Medical Center who were invited to partici-

Table 1. Pre-gestational BMI and weight gain. Data are presented as percentages (numbers)

Weight gain	Total (%)	Pre-gestational BMI (kg/m ²)			
		< 18.5	18.5–24.9	25–29.9	30–39.9
Above the recommendations	53 (49%)	0	20 (36%) $P = 0.002$	24 (86%) $P = 0.00$	9 (43%) $P = 0.603$
As recommended	31 (28%)	1 (20%) $P = 0.326$	24 (44%) $P = 0.10$	2 (7%) $P = 0.003$	4 (19%) $P = 0.054$
Below the recommendations	25 (23%)	4 (80%) $P = 0.018$	11 (20%) $P = 0.009$	2 (7%) $P = 0.144$	8 (38%) $P = 0.109$

BMI = body mass index

pate in this study, 144 agreed to participate. Data were missing for 35 women; thus 109 patients were included in the analysis. The mean age was 31.4 ± 5.3 years. Figure 1 shows medical and lifestyle information as reported by the study participants.

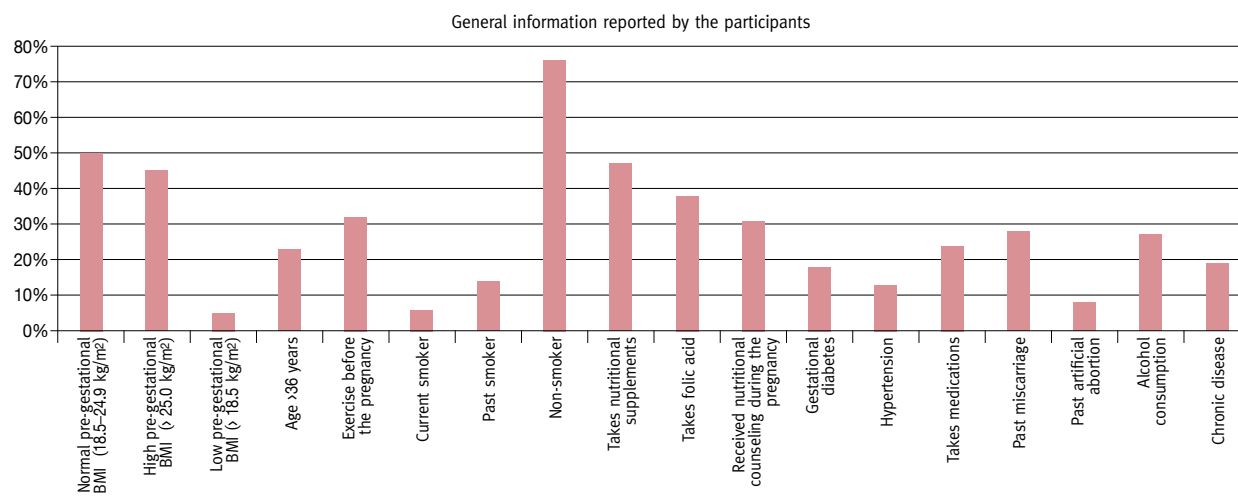
GESTATIONAL WEIGHT GAIN AND BMI

Fifty-five women (50%) reported normal BMI before pregnancy (18.5–24.9 kg/m²), 5 (5%) reported a BMI below 18.5 kg/m², 28 (26%) reported a high BMI (24.9–29.9 kg/m²) before the pregnancy and 21 (19%) reported a very high BMI (29.9–39.9 kg/m²) before the pregnancy. Table 1 shows weight gain according to pre-gestational BMI. As pre-gestational BMI increased, the proportion of women who gained weight as recommended decreased (P trend = 0.01).

WEIGHT GAIN ACCORDING TO AGE

Of women younger than 36 years, 37 (45%) gained more weight than recommended, 28 (34%) gained weight as recommended, and 18 (22%) gained less weight than recommended. In contrast, 16 women (64%) aged 36 years or older gained more than the recommended weight. Among these older women, 3 (12%)

Figure 1. Medical and lifestyle Information reported by the study participants. Data are presented as percentages (numbers). Data were missing for some of the parameters; BMI = body mass index



gained weight as recommended and 6 (24%) gained less weight than recommended. The proportion of women younger than age 36 years who gained weight as recommended was significantly greater than the proportion of women above age 36, 34% and 12%, respectively ($P = 0.045$).

DIABETES, HYPERTENSION AND WEIGHT GAIN

In this study 21 women (19%) had chronic illnesses; 20 (18%) had gestational diabetes and 14 (13%) had gestational hypertension. For 8 women (7%), data were missing. Among women with gestational hypertension, only 32 (29%) gained weight as recommended, compared to 57 women (52%) without gestational hypertension ($P = NS$).

WEIGHT GAIN ACCORDING TO SMOKING, ALCOHOL CONSUMPTION AND EXERCISE

Among women with a history of smoking, the proportion who gained more weight than the recommendations was significantly greater than among women who had never smoked, 73% and 42%, respectively ($P = 0.034$). No statistically significant difference was found between alcohol consumption before pregnancy and the proportion who gained more than the recommended weight, 45% and 43%, respectively. Statistically significant differences in attaining recommended weight gain were not found between women who reported not exercising and those who reported exercising during or before pregnancy [Figure 2].

DIABETES, NUTRITIONAL COUNSELING AND SELF-PERCEPTIONS OF PROPER EATING

The proportions of women who gained more than the recommended weight were similar to those women with and without diabetes [Figure 3]. Of the study participants 34 (31%) reported receiving professional nutritional counseling. Data were missing for 13 (12%). The women who received nutritional counseling gained weight as recommended, compared to only 29

(27%) of those who did not receive professional nutritional counseling, and 51 (47%) who did not get professional counseling gained more than the recommended weight, compared to 41 (38%) of those who did receive counseling ($P = NS$). Among the women with diabetes, 14 (70%) received professional nutritional counseling compared to (n=20) 22% of non-diabetic women ($P < 0.001$). The majority of participants (n=64, 59%) stated that they thought they were eating as recommended. Of women who believed that they maintained a proper diet, 24 (34%) gained weight as recommended, compared to 9 (20%) of those who believed they did not ($P = NS$).

DISCUSSION

The importance of diet and nutrition for a healthy life is well recognized and has received increasing attention in recent years, especially with regard to pregnancy. The American College of Obstetricians and Gynecologists and the Ministry of Health in Israel update their recommendations for pregnancy weight gain every few years. To the best of our knowledge, this is the first study that describes weight gain and healthy lifestyle in pregnant women in Israel.

Among women hospitalized in an obstetrics ward during their third trimester, a high proportion gained more than the recommended weight. This is despite the fact that the majority of women believed they were eating according to recommendations. Factors found to be associated with more than recommended weight gain were past history of smoking and/or age older than 36 years and/or high pre-gestational BMI. Less than one-third of the women reported seeking professional nutritional counseling during pregnancy, although an increased tendency to consult a nutritionist was reported among women with diabetes. No association was found

Figure 2. Weight gain during pregnancy, according to reported exercise. Data are presented as percentages (numbers)

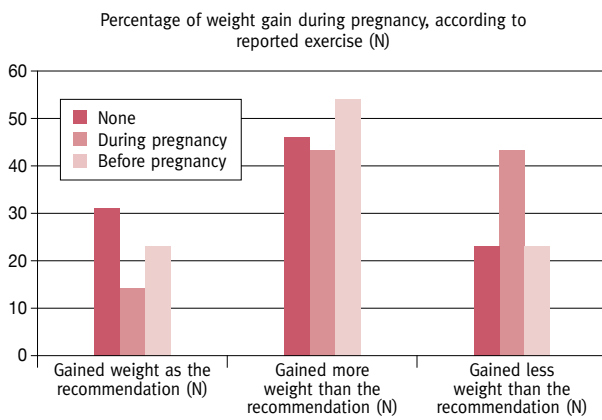
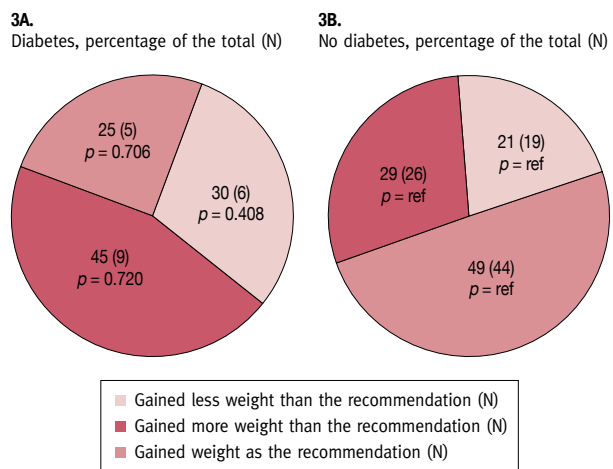


Figure 3. Diabetic women and weight gain as percentage of the total [A] women with diabetes [B] women without diabetes



between recommended weight gain and reported exercise during or before pregnancy.

These data concur with other reports that showed that a high proportion of women gained more than the recommended weight during pregnancy [15,25]. Our finding of less weight gain among younger pregnant women concurs with other studies [19], as do our findings of abnormal BMI baseline [20–24] and a history of smoking as factors associated with weight gain [14] beyond the recommendation.

It is possible that women who smoked in the past may have less awareness of good health practices and therefore gain more weight during pregnancy; this may also be true for women with a higher pre-gestational BMI. We did not ask women who reported past smoking whether they stopped smoking prior to or during the pregnancy.

CONCLUSIONS

Baseline BMI above 25 kg/m² and/or a history of smoking and/or age older than 36 years were identified as factors that were associated with more than the recommended weight gain during pregnancy. We expect that nutritional counseling during pregnancy may be beneficial, particularly for women with these characteristics. Dietary counseling and education about health behavior is important and necessary to increase the compliance to the dietary recommendations among women.

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References

- Head of the Service for Evaluating Pregnancy Women's Food—Ministry of Health Israel. http://www.health.gov.il/Subjects/pregnancy/during/Pages/proper_nutrition_during_pregnancy.aspx. (Last accessed 15 March 2016).
- American College of Obstetricians and Gynecologists. ACOG Committee opinion no. 548: weight gain during pregnancy. *Obstet Gynecol* 2013; 121 (1): 210.
- Nohr EA, Vaeth M, Baker JL, Sorensen TI, Olsen J, Rasmussen KM. Combined associations of prepregnancy body mass index and gestational weight gain with the outcome of pregnancy. *Am J Clin Nutr* 2008; 87 (6): 1750-9.
- Gibney MJ, Margets BM, Kearney JM, Arab L. Public Health Nutrition: The Nutrition Society Textbook Series. Hoboken: Wiley-Blackwell, 2004: 302-316.
- Kiel D, Dodson E, Artal R, Boehmer T, Leet T. Gestational weight gain and pregnancy outcomes in obese women: how much is enough? *Obstet Gynecol* 2007; 110: 752-8.
- Gunderson E.P. Child bearing and obesity in women: weight before, during, and after pregnancy. *Obstet Gynecol Clin North Am* 2009; 36 (2): 317.
- Rooney BL, Schauburger CW. Excess pregnancy weight gain and long-term obesity: one decade later. *Obstet Gynecol* 2002; 100 (2): 245-52.
- Gillman MW. Developmental origins of health and disease. *N Engl J Med* 2005; 353 (17): 1848-50.
- Mamun AA, O'Callaghan M, Callaway L, Williams G, Najman J, Lawlor DA. Associations of gestational weight gain with offspring body mass index and blood pressure at 21 years of age. *Circulation* 2009; 119: 1720-7.
- Frischknechta F, Brühwilera H, Raiob L, Lüschera KP. Changes in pre-pregnancy weight and weight gain during pregnancy: retrospective comparison between 1986 and 2004. *Swiss Med Wkly* 2009; 139: 52-5.
- Viswanathan M, Siega-Riz AM, Moos K, et al. Outcomes of maternal weight gain. *Evid Rep Technol Assess (Full Rep)* 2008; 168: 1-223.
- Rasmussen KM, Yaktine AL. Weight gain during pregnancy: reexamining the guidelines. National Academies Press, Washington (DC), 2009: 1-25.
- Troe EJ, Raat H, Jaddoe VW, et al. Smoking during pregnancy in ethnic populations. *Nicotine Tob Res* 2008; 10 (8): 1373-84.
- Adegbeye AR, Rossner S, Neovius M, Lourenço PM, Linné Y. Relationships between prenatal smoking cessation, gestational weight gain and maternal lifestyle characteristics. *Women Birth* 2010; 23 (1): 29-35.
- Dudenhausen JW, Grünebaum A, Kirschner W. Prepregnancy body weight and gestational weight gain—recommendations and reality in the USA and in Germany. *Am J Obstet Gynecol* 2015; 213 (4): 591-2.
- Haakstad LA, Voldner N, Henriksen T, Bø K. Physical activity level and weight gain in a cohort of pregnant Norwegian women. *Acta obstetrica et gynecologica Scandinavica* 2007; 86 (5): 559-64.
- Popa AD, Popescu RM, Botnariu GE. Adequate weight gain in pregnancy: an analysis of its determinants in a cross-sectional study. *Srp Arh Celok Lek* 2014; 142 (11-12): 695-702.
- Robinson JN, Norwitz ER. Preterm birth: risk factors for preterm labor and delivery. In CJ Lockwood, VA Barss (eds), UpToDate®, Wolters Kluwer, Alphen aan den Rijn, The Netherlands, 2003.
- Dai Z, Li M, Rui L, Sun X, Pang X, Zhou L, Zeng G. Evaluation of pre-pregnancy weight and gestational weight gain among urban and rural women from southwestern China. *Wei sheng yan jiu (Journal of Hygiene Research)* 2014; 43 (4): 546-9. (Chinese)
- Iyoke CA, Ugwu GO, Ezugwu FO, Lawani OL, Onyebuchi AK. Retrospective cohort study of the effects of obesity in early pregnancy on maternal weight gain and obstetric outcomes in an obstetric population in Africa. *Int J Womens Health* 2013; 5: 501-7.
- Farajzadegan Z, Bahrami D, Jafari N. weight gain during pregnancy in women attending a health center in Isfahan City, Iran. *Int J Prev Med* 2012; 3 (10): 682-6.
- Ogunyemi D, Hullett S, Leeper J, Risk A. Prepregnancy body mass index, weight gain during pregnancy, and perinatal outcome in a rural black population. *J Matern Fetal Med* 1998; 7 (4): 190-3.
- Abrams B, Carmichael S, Selvin S. Factors associated with the pattern of maternal weight gain during pregnancy. *Obstet Gynecol* 1995; 86 (2): 170-6.
- Ogden C.L, Carroll M.D, Curtin L.R. Prevalence of Overweight and Obesity in the United States, 1999–2004. *JAMA* 2006; 295 (13): 1549-55.
- Chu SY, Callaghan WM, Bish CL, D'Angelo D. Gestational weight gain by body mass index among US women delivering live births, 2004–2005: fueling future obesity. *Am J Obstet Gynecol* 2009; 200 (3): 271.

“Unless someone like you cares a whole awful lot, nothing is going to get better. It's not”

Dr. Seuss (1904–1991), pen name for American writer and cartoonist Theodore Geisel, most widely known for his children's books (e.g., *Green Eggs and Ham*, *The Cat in the Hat*, *The Lorax*, *One Fish Two Fish Red Fish Blue Fish*), characterized by imaginative characters, rhyme, and frequent use of anapestic meter. His works have prompted 11 television specials, 4 feature films, a Broadway musical and 4 television series. During World War II, he worked in an animation department of the United States Army, where he wrote *Design for Death*, a film that later won the 1947 Academy Award for Documentary Feature. Geisel's birthday, March 2, has been adopted as the annual date for 'National Read Across America Day', an initiative on reading created by the National Education Association