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Association between prepregnancy body mass index, gestational weight gain, and perinatal outcomes

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Aim: We aimed to investigate the effects of prepregnancy body mass index (BMI) and excess gestational weight gain on maternal-fetal outcomes.

Materials and methods: Obstetrics records of 537 singleton pregnant women delivered at our institution were reviewed. According to BMI, the patients were divided into 3 groups, namely, Group 1: normal (BMI 20-24.9 kg/m\(^2\)) (n = 394); Group 2: overweight (BMI 25-29.9 kg/m\(^2\)) (n = 112); Group 3: Obese (BMI > 30 kg/m\(^2\)) (n = 31). According to gestational weight gain, the subjects were divided into 2 categories, namely, Group A: 8-15.9 kg weight gain (n = 326); Group B: >16kg weight gain (n = 211). The groups were compared on maternal data and perinatal outcomes.

Results: Based on the BMI, obese pregnant women faced the highest risk of preeclampsia (P = 0.005), gestational diabetes mellitus and hypertension (P < 0.001), macrosomia (P = 0.041), shoulder dystocia (P = 0.003), and cesarean delivery (P = 0.01). Rates of babies admitted to the neonatal intensive care unit were 13.6%, 6.4%, and 12.9% in group 1, 2, and 3, respectively (P = 0.041). According to gestational weight gain, macrosomia and birthweight were significantly higher in group B (>16kg weight gain) (P < 0.05).

Conclusion: Increasing BMI is associated with increased risk of gestational diabetes mellitus, hypertension, macrosomia, shoulder dystocia, and cesarean delivery. High birthweight was affected by high gestational weight gain. Before pregnancy, women with high BMI should be advised to lose weight and not to gain much weight during pregnancy.

Key words: Prepregnancy body mass index, gestational weight gain, perinatal outcomes

Gebelik öncesi vücut kitle indeksi ve gebelikte kilo almının perinatal sonuçlararasındaki ilişki

Amaç: Gebelik öncesi vücut kitle indeksinin (VKİ) ve gebelikte kilo alımının perinatal sonuçlarını etkisi araştırılmak.

Yöntem ve gereç: Hastanemizde takip olan ve tek bebek doğuran 537 gebelik çalışma alındı. VKI'ne göre hastalar 3 gruba ayrıldı. Grup 1: Normal (VKI: 20-24,9 kg/m\(^2\)) (n = 394); Grup 2: Kilolu (VKI: 25-29,9 kg/m\(^2\)) (n = 112); Grup 3: Obez (VKI > 30 kg/m\(^2\)) (n = 31). Gebelikte kilo alımı göre ise hastalar 2 gruba ayrıldı. Group A: 8-15,9 kg kilo alımı (n = 326), Group B: >16 kg kilo alımı (n = 211). Gruplar maternal data ve perinatal sonuçlar açısından karşılaştırıldı.

Bulgular: VKI'ne göre obez gebelerde preeklampsi (P = 0,005), gestasyonel diabetes mellitus ve hipertansiyon (P < 0,001), makrozomi (P = 0,041), omuz distosisi (P = 0,003), sezaryen ile doğum (P = 0,01) daha sık rastlandı. Yenidoğan yoğun bakım kabul sikliği grup 1, 2 ve 3de %13,6, %6,4 ve %12,9 olarak tespit edildi. (P = 0,041). Gebelikte kilo alımı göre grup B'de (>16 kg) bebek doğumu kilosu ve makrozomi anlamlı olarak yüksek bulundu (P < 0,05).

Sonuç: Yüksek VKI ile artmış gestasyonel diabetes mellitus riski, hipertansiyon, makrozomi, omuz distosisi ve sezaryen ile doğum riski arasında ilişki tespit edildi. İri bebek gebelikte fazla kilo almından daha çok etkilenmiş olarak bulundu. Gebelik öncesi, kilosu fazla olan hastalara kilo verilmesi ve gebelik boyunca daha az kilo almı tavlısı edilebilir.

Anahtar sözcükler: Gebelik öncesi vücut kitle indeksi, gebelikte kilo almı, perinatal sonuçlar
Introduction

The rising rate of obesity is a major public health concern in the world especially in the West, where 28% of pregnant women are overweight and 11% are obese (1). The complications associated with excessive weight gain in pregnancy are well known and include increased incidences of fetal macrosomia, prolonged labor, postdatism, fetal heart rate abnormalities, cesarean delivery, and postpartum infection (2-5).

Some studies have examined the relationship between gestational weight gain and risk of adverse pregnancy outcomes by adjusting for prepregnancy weight and other potential confounders. Other studies have focused on pregnant women stratified by prepregnancy weight categories but only for pregnant women delivered at a single institution (6). There is as yet no general agreement on the recommended weight gain for pregnant women in different prepregnancy body mass index (BMI) classes.

With this in mind, in this study we aimed to investigate the effects of prepregnancy body mass index and gestational weight gain on obstetric outcomes.

Materials and methods

The study was designed to be a retrospective analysis at the Department of Obstetrics and Gynecology, Fatih University Medical Faculty between 2005 and 2007. Singleton pregnant (n = 537) who were followed up and delivered at our institution were reviewed. Based on the prepregnancy BMI, subjects were divided into 3 groups, namely, Group 1: normal (BMI 20-24.9 kg/m^2) (n = 394); Group 2: overweight (BMI 25-29.9 kg/m^2) (n = 112); Group 3: Obese (BMI > 30 kg/m^2) (n = 31) (7). According to gestational weight gain, the patients divided into 2 categories, namely, Group A: 8-15.9 kg weight gain (n = 326) and Group B: >16 kg weight gain (high weight gain) (n = 211) (8).

Body mass index was calculated using the formula weight/height^2 (kg/m^2). The groups were compared on maternal data, mode of delivery, pregnancy outcomes, such as incidence of gestational diabetes mellitus, gestational hypertension, preeclampsia, preterm delivery, and perinatal outcomes, such as birth trauma, birthweight, and frequency of admission to neonatal intensive care unit (NICU).

Statistical analyses were performed using SPSS 11.5 (SPSS Inc., Chicago, IL, USA). Whether the continuous variables were normally distributed or not were determined using the Shapiro-Wilk test. While continuous data are expressed as mean ± standard deviation or median (minimum-maximum), where applicable, nominal data are shown as number of cases and percentage (%). The differences among groups regarding age were evaluated by One-Way ANOVA; Kruskal Wallis test was applied for the comparisons of gravidity, parity, gestation at delivery, and birthweight. When the P value from ANOVA or Kruskal Wallis test statistics are statistically significant, determining which group differs from which others, post hoc Tukey or Kruskal-Wallis multiple comparison tests were used, where applicable. Nominal data were analyzed using Pearson’s chi-square or Fisher’s Exact test, where appropriate. A P value less than 0.05 was considered statistically significant. Comparison of continuous variables according to gestational weight gain were made using Student’s t-test or Mann-Whitney-U test, and categorical comparisons were evaluated using chi-square or Fisher’s exact probability test. A P value of <0.05 was accepted as statistically significant.

Results

The records of 537 pregnant patients who had been followed up and gave birth in the Obstetrics and Gynecology Department of Fatih University Hospital were reviewed. Three hundred ninety four patients (73.37%) had normal BMI (20-24.9 kg/m^2), 112 (53.1%) were overweight (BMI 25-29.9 kg/m^2), and 31 (5.77%) were obese (BMI > 30 kg/m^2). Table 1 shows the maternal data regarding BMI. According to gestational weight gain, maternal data are shown in Table 2.

Table 3 shows the pregnancy and neonatal outcomes according to BMI. Gestational diabetes mellitus, gestational hypertension, preeclampsia, macrosomia, shoulder dystocia, cesarean delivery rates, and NICU were statistically higher in the obese
When we categorized the subjects according to gestational weight gain, the outcomes showed some differences. Three hundred twenty three (60.7%) of the patients gained between 8-15.9 kg and 211 (39.29%) of them gained >16 kg during pregnancy. Table 4 shows the perinatal outcomes according to gestational weight gain. Macrosomia, birth weight, and NICU were statistically higher in group B (>16 kg weight gain). Some obstetric outcomes, such as preeclampsia, gestational diabetes mellitus, and hypertension, were similar between group A and B.

### Discussion

Obesity is a condition more prevalent in women; 28% of pregnant women are overweight and 11% are obese (1).

Definitions of overweight, obesity, and underweight vary in different reports. In earlier research, the relationships between maternal height and weight with pregnancy complications were extensively explored, but recently BMI is widely accepted as a better measure of over- or underweight (1). In our study we searched the effects of prepregnancy body mass index and gestational weight gain on perinatal outcomes. We analyzed if there were differences between the effects of prepregnancy BMI and gestational weight gain on obstetric outcomes. Some results were similar but few differences were observed. Birthweight was significantly affected by excessive gestational weight gain, whereas in the groups composed based on BMI the birthweight was similar. Cedergen (8) studied the effects of low and high gestational weight gain on obstetrics and neonatal outcomes in different maternal BMI classes.
They concluded that the effects of high or low gestational weight gain differ depending on maternal BMI. In their data, increasing BMI showed decreasing gestational weight gain. Therefore, we should consider both prepregnancy BMI and gestational weight gain during follow-up in pregnancy. High prepregnancy BMI and high gestational weight gain may have more adverse obstetrics outcomes.

Over the past decades the guidelines for ideal weight gain have been periodically questioned and revised (9). Previous gestational weight gain guidelines were restrictive, reflecting concerns about preeclampsia, labor and delivery complications, and weight retention after pregnancy (10). Subsequent guidelines were revised upward to minimize mortality and morbidity risks for low birth weight (LBW).
The current guidelines provide gestational weight gain ranges based on prepregnancy BMI and were recommended by the Institute of Medicine (IOM) to limit adverse pregnancy outcomes (10). However, the current IOM guidelines for obese women (prepregnancy BMI greater than or equal to 30.0 kg/m$^2$) do not provide an upper limit on gestational weight gain, only advising women to gain at least 15 lb (6.75 kg), and do not distinguish between the different levels of obesity as defined by the National Institutes of Health (NIH) (12).

The effect of maternal underweight on obstetric performance is less clear. While some researchers (13,14) have found increased incidences of preterm delivery, low birth weight, and increased perinatal loss in these women, others (15) have reported a protective effect of maternal underweight on certain pregnancy complications and interventions (1). In our retrospective analysis, there were not sufficient number of underweight women or women with low gestational weight gain. Therefore, the subjects were divided into 2 groups based on gestational weight gain and 3 groups based on BMI.

To conclude, in line with previous studies (6,8), our study showed that high prepregnancy BMI had adverse obstetric outcomes, such as increased risk of gestational diabetes, gestational hypertension, preeclampsia, macrosomia, and cesarean delivery, and increased frequency of admission to neonatal intensive care. It appears that higher prepregnancy BMI had more adverse effects on obstetrics outcomes in our study. We should consider both prepregnancy BMI and gestational weight gain during follow-up in pregnancy and before pregnancy; women with high BMI should be advised to lose weight and not to gain much weight during pregnancy.

There is as yet no general agreement on the recommended weight gain for pregnant women in different prepregnancy BMI classes. Further prospective studies with large populations are needed for ideal weight gain in pregnancy due to different prepregnancy BMI classes.

Table 4. Pregnancy and neonatal outcomes according to gestational weight gain.

<table>
<thead>
<tr>
<th></th>
<th>Group A (8-15.9 kg weight gain)</th>
<th>Group B (&gt;16 kg weight gain)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n = 326)</td>
<td>(n = 211)</td>
<td></td>
</tr>
<tr>
<td>Preeclampsia</td>
<td>5(1.53%)</td>
<td>6(2.84%)</td>
<td>0.2</td>
</tr>
<tr>
<td>Gestational diabetes mellitus</td>
<td>22(6.74 %)</td>
<td>17(8.05%)</td>
<td>0.5</td>
</tr>
<tr>
<td>Hypertension</td>
<td>22(6.74%)</td>
<td>19(9%)</td>
<td>0.3</td>
</tr>
<tr>
<td>Macrosomia (&gt;4000 g)</td>
<td>34(10.42%)</td>
<td>41(19.43%)</td>
<td>0.003*</td>
</tr>
<tr>
<td>Shoulder dystocia</td>
<td>4(1.2%)</td>
<td>5(1.53%)</td>
<td>0.2</td>
</tr>
<tr>
<td>Delivery &lt;37 weeks</td>
<td>33(10.12%)</td>
<td>11(5.21%)</td>
<td>0.3</td>
</tr>
<tr>
<td>Meconium stained fluid</td>
<td>22(6.74%)</td>
<td>17(8.05%)</td>
<td>0.5</td>
</tr>
<tr>
<td>Induction of labor</td>
<td>172(52.7%)</td>
<td>128(60.6%)</td>
<td>0.05</td>
</tr>
<tr>
<td>Birth trauma</td>
<td>15(4.6%)</td>
<td>16(7.58%)</td>
<td>0.2</td>
</tr>
<tr>
<td>-Caput succadeum</td>
<td>12(3.68%)</td>
<td>12(5.68%)</td>
<td>0.2</td>
</tr>
<tr>
<td>-Cephal hematoma</td>
<td>1(0.3%)</td>
<td>2(0.94%)</td>
<td>0.3</td>
</tr>
<tr>
<td>-Fracture of clavica</td>
<td>2(0.6%)</td>
<td>2(0.94%)</td>
<td>0.6</td>
</tr>
<tr>
<td>Frequency of admission to NICU</td>
<td>8(2.45%)</td>
<td>12(5.68%)</td>
<td>0.04*</td>
</tr>
<tr>
<td>Gestation at delivery (weeks)</td>
<td>39 (28-42)</td>
<td>39 (33-42)</td>
<td>0.134</td>
</tr>
<tr>
<td>Cesarean delivery</td>
<td>160(49%)</td>
<td>107(50.7%)</td>
<td>0.7</td>
</tr>
<tr>
<td>Birthweight (g)</td>
<td>3350 (1210-4550)</td>
<td>3400 (2100-4820)</td>
<td>0.061</td>
</tr>
</tbody>
</table>
References


