Effect of High Gestational Weight Gain on Birth Weight and Cesarean Section Rate in Pregnant Women with a Normal Prepregnant Body Mass Index

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Objective : *To compare birth weight and cesarean section rates with high gestational weight gain and normal weight gain in nulliparous pregnant women with a normal prepregnant body mass index.*
Design : *A retrospective study.*
Setting : *Thammasat University Hospital.*
Methods : *A study was conducted comparing 330 nulliparous pregnant women with normal prepregnant body mass index who delivered a singleton live birth at Thammasat University Hospital. High gestational weight gain was defined as gestational weight gain greater than 16 kg. The incidence of cesarean rate, neonatal birth weight, selected labor and neonatal outcomes were assessed for the two groups. Statistical analysis was carried out with independent unpaired T-test for continuous variables and Chi-square test analysis for frequency data.*
Results : *No significant differences were found in cesarean section rates between the high weight gain group and the recommended weight gain group (31/196 ; 15.8 % and 23/134; 17.2 % respectively) .However, the average neonatal birth weight in the high weight gain group was significantly greater than the recommended group (3186.3 $\pm$ 394.1 g and 3062.1 $\pm$ 358.7 g respectively , p = 0.003). The length of labor and neonatal outcomes were comparable between two groups .*
Conclusion : *High gestational weight gain in pregnant women with a normal prepregnant body mass index was not associated with an increase in the cesarean delivery rate, but it did influence neonatal birth weight. To reduce the risks associated with delivery and their complications, an optimal gestational weight gain for Thai women should be proposed and more studies about gestational weight gain should be performed.*

Keywords : *High gestational weight gain, Birth weight, Cesarean section rate*

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Several anthropometrical characteristics of pregnant women such as advanced maternal age, obesity, high body mass index (BMI) and high weight gain during pregnancy are reported to play an important role in increasing both the cesarean section rate and complications during the prenatal period and labor[1-4]. Young and colleagues reported that primigravida pregnant women who had a prepregnant BMI more than 30 kg/m^2 would have a 6 times increased risk of cesarean delivery compared with those who had a prepregnant BMI less than 20 kg/m^2[5]. Also, pregnancy induced hypertension (PIH) and gestational diabetics are more common in women who have these risk factors. Gestational weight gain not only directly influences neonatal birth weight, but it may have an indirect effect on mode of delivery and neonatal complications as well[6].

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Maternal weight gain during pregnancy is one of the most important factors which are being used for monitoring pregnancy complications. Weight changes usually represent the nutritional status of pregnant women. Therefore, obstetricians measure body weight of pregnant women at every antenatal visit. The optimal weight gain in the second half of pregnancy is 1.8 kg per 4 weeks[7]. Weight loss or excessive weight gain usually causes frustration and concern to both pregnant women and their obstetricians.

The American College of Obstetric and Gynecology (ACOG) and the Institute of Medicine of National Academics (IOM) made recommendations concerning maternal weight gain by using prepregnant BMI[7,8]. Women who have a BMI between 19.6 and 25.4 kg/m^2 should have a weight gain between 11.5 and 16.0 kg. This recommendation proposes that a particular weight gain in women would lower the risks associated with pregnancy and labor. Despite several studies supporting this suggestion, some experts disagree[9-11].

Differences in lifestyle, body structure and diet, are significant factors in the nutritional status between people of western and eastern cultures. In Thailand, there are no studies or well-established recommendations concerning optimal weight gain during pregnancy and its effects on mode of delivery and neonatal outcomes.

Therefore, this study was conducted to evaluate the effects of gestational weight gain on neonatal weight and the cesarean section rate in Thailand. Only low risk nulliparous and normal BMI prepregnant women were chosen for this study.

Material and Method

This is a retrospective study, conducted by collecting medical records from patients who delivered at Thammasat University Hospital from May 1, 2001 to December 31, 2002. This study was approved by the Faculty ethics committee.

The inclusion criteria were low risk pregnant women with a single live fetus, prepregnancy BMI between 19.6 and 25.4 kg/m^2, at least 4 antenatal care (ANC) visits, no contraindications to vaginal delivery or oxytocin augmentation and no medical or surgical complications. Patients with diabetes and PIH were ineligible for participation in the study.

Anthropometrical data and other variable outcomes were collected and analyzed. Statistical analysis was carried out with an independent unpaired T-test for continuous variables and Chi-square test analysis for frequency data. Significance was set at a level of $p < 0.05$.

Results

After reviewing hospital records, 330 patients were found who met the inclusion criteria. 195 women had gestational weight gain between 11.5 and 16.0 kg (the recommended gestational weight gain). The remaining 135 women gained more than 16.0 kg, which is considered a high gestational weight gain. The compared results are reported in Tables 1 to 3 below:

Table 1 shows the demographic characteristics of participants. There were no statistically significant differences in age, prepregnant weight and prepregnant BMI between two groups, except the height. The average height in the high weight gain group was significantly higher than those enrolled in the recommended weight gain group. Gestational weight gain in the high weight gain group averaged 6.9 kilograms higher than the other group.

Length of labor and neonatal outcomes are shown in Table 2. There were no statistically significant differences in the first stage, second stage and total length of labor between the two groups. Also, there was no statistically significant difference in the number of neonates with low APGAR scores at the first minute between the two groups. However the average neonatal birth weight in the high weight gain group was significantly greater than in the recommended weight gain group.

Table 3 shows details of the modes of delivery and the indications for cesarean sections. There were no significant differences in the number of normal deliveries and operative obstetrics. Also, there were no significant differences in the number of cesarean sections between two groups. Most indications were dystocia, which showed no statistically significant differences.

Table 1. Demographic characteristics

	High weight gain group (n = 135)	Recommended weight gain group (n = 195)	P value (< 0.05)
Age (year)	25.2 ± 4.2	24.6 ± 5.2	NS
Height (cm)	157.2 ± 5.0	155.8 ± 4.8	0.011
Prepregnant weight (kg)	53.2 ± 4.8	52.62 ± 4.5	NS
Prepregnant BMI (kg/m^2)	21.5 ± 1.4	21.7 ± 1.4	NS
Weight gain during pregnancy (kg)	20.1 ± 3.4	13.2 ± 1.6	0.0001

Table 2. Length of labor and neonatal outcomes

	High weight gain group (n = 135)	Recommended weight gain group (n = 195)	P value
Length of labor (min)			
First stage	589.9 ± 275.2	598.1 ± 279.4	NS
Second stage	29.6 ± 9.1	29.2 ± 31.5	NS
Total	613.2 ± 273.1	597.5 ± 298.5	NS
Neonatal outcomes			
Average neonatal birth weight (gram)	3186.3 ± 394.1	3062.1 ± 358.7	0.003
APGAR at 1 min < 7	3.7% (5/134)	2% (4/196)	NS

Table 3. Mode of delivery and indications for cesarean section

	High weight gain group (n = 135)	Recommended weight gain group (n = 195)	P value
Mode of delivery (%)			
Normal labor	67.9 (91/134)	69.9 (137/196)	NS
F/E or V/E	14.9 (20/134)	14.3 (28/196)	NS
Cesarean section	17.2 (23/134)	15.8 (31/196)	NS
Indications for cesarean section (%)			
Dystocia	78.3 (18/23)	74.2 (23/31)	NS
Fetal compromise	21.7 (5/23)	25.8 (8/31)	NS

F/E = forceps extraction V/E = vacuum extraction

Discussion

No significant differences were found in cesarean section rates between the high weight gain group and the recommended weight gain group. However, the average neonatal birth weight in the high weight gain group was significantly greater than the recommended group. The average neonatal birth weight in the high weight gain group was higher than the recommended weight gain group by 124.2 g. This finding was consistent with studies of Butte and Johnson, who reported that the higher the gestational weight gain, the higher the neonatal weight. Also, the fat weight retention in the postpartum period resulted from excessive gestational weight gain[12,13].

This study found that excessive weight gain did not directly correlate with and was not an important risk factor in an increased cesarean section rate. This finding was consistent with a report from Rhodes and colleagues that excessive weight gain was not a fundamental factor in higher cesarean rates[14]. The high cesarean rate might be influenced by BMI before pregnancy more than weight gain during pregnancy [15]. However, these results contrasted reports from Young and colleagues that cesarean rates in women with a normal BMI, who had a weight gain during pregnancy more than 35 lb or 14 kg, had an increased risk of cesarean delivery by almost two times (RR = 1.85) when compared with women who had a weight gain less than 30 lb or 13.6 kg[5].

Despite the fact that this study found that excessive weight gain was a contributing factor to a higher neonatal birth weight, it cannot explain the effect on the higher cesarean delivery rate. An attempt was made to control some risks factors for cesarean delivery, such as the medical and surgical complications. The cesarean rate still depended on other factors that were not controlled in this study, such as stress and emotional well-being during labor, labor pain, and individual decision-making strategies by different obstetrician.

Bianco and colleagues reported that high gestational weight gain did not have an effect on neonatal complications such as fetal distress, APGAR score, birth trauma and the rate of ICU admission[16]. The results of this current study showed similar results as Bianco, but a larger sample size and a longer follow-up is required to draw a stronger correlation.

In this current study, excessive weight gain did not have an effect on the length of labor in the first or the second stages, as well as in the total length of labor. These findings conflicted with Purfield's studies that reported high weight gain had a correlation with a prolonged second stage and higher obstetric operations[17]. In Purfield's study, a different cutoff level was used, in that excessive weight gain was considered more than 25% of prepregnancy weight.

In defining proportional weight gain, Shepard used total weight gain during pregnancy divided by prepregnancy weight. This might be an important indicator that relates to cesarean rates more than gestational weight gain. Gestational weight gain cannot evaluate or estimate the effect of size and baseline of pregnant women. They proposed that the optimal proportional weight gain is 16-25% for the best outcomes of pregnancy and labor[18,19].

During the postpartum period, weight would decrease rapidly in the first month, and then decrease by about 0.9 kg a month on average. 80% of pregnant women will return to baseline weight after 18-24 months after delivery[20]. Excessive weight gain before delivery might affect the body weight during the postpartum period[21].

This study has several limitations. Firstly, the ANC record might not be representative of the actual

body weight. Secondly, there was a small sample size. Lastly, a long term follow up for complications in newborn and mothers is needed.

In conclusion, no differences in cesarean section rates were found. However, neonatal weight was affected by high gestational weight gain. There is a need for further studies and a recommendation for ideal gestational weight gain to improve obstetrical care for the Thai population.

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ผลของน้ำหนักตัวที่เพิ่มขึ้นในระหว่างการตั้งครรภ์ที่เกินกว่าเกณฑ์มาตรฐาน ต่อน้ำหนักทารกแรกคลอดและอัตราการผ่าตัดคลอดในสตรีที่มีดัชนีมวลกายปกติ

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วัตถุประสงค์ : เพื่อศึกษาผลของน้ำหนักตัวที่เพิ่มขึ้นระหว่างการตั้งครรภ์ ที่เกินกว่าเกณฑ์มาตรฐาน ต่อน้ำหนักของทารกแรกคลอดและอัตราการผ่าตัดคลอดในสตรีครรภ์แรกที่มีดัชนีมวลกายปกติ

รูปแบบการศึกษา : การศึกษาย้อนหลัง

วิธีการศึกษาวิจัย : ได้รวบรวมข้อมูลจากเวชระเบียนของสตรีครรภ์แรกที่มาคลอดในโรงพยาบาลธรรมศาสตร์เฉลิมพระเกียรติ จำนวน 330 ราย โดยทุกรายมีอายุครรภ์ครบกำหนด และดัชนีมวลกายอยู่ในเกณฑ์ปกติ สตรี 195 รายมีน้ำหนักตัวที่เพิ่มขึ้นในระหว่างการตั้งครรภ์อยู่ในเกณฑ์มาตรฐาน (11.5 - 16.0 กิโลกรัม) จำนวน 135 ราย มีน้ำหนักตัวที่เพิ่มขึ้นในระหว่างการตั้งครรภ์เกินกว่าเกณฑ์มาตรฐาน คือมากกว่า 16 กิโลกรัม ได้เปรียบเทียบน้ำหนักทารกแรกคลอด อัตราการผ่าตัดคลอด และระยะการคลอดของสตรีทั้งสองกลุ่ม

ผลการศึกษา : น้ำหนักเฉลี่ยของทารกแรกคลอดในสตรีกลุ่มน้ำหนักตัวที่เพิ่มขึ้นในระหว่างการตั้งครรภ์ที่เกินกว่าเกณฑ์มาตรฐานสูงกว่าสตรีกลุ่มที่มีน้ำหนักตัวเพิ่มขึ้นในระหว่างการตั้งครรภ์ในเกณฑ์มาตรฐาน อย่างมีนัยสำคัญทางสถิติ (3186.3 $\pm$ 394.1 กรัม และ 3062.1 $\pm$ 358.7 กรัม ตามลำดับ ที่ $p = 0.003$) แต่ไม่พบความแตกต่างระหว่างอัตราการผ่าตัดคลอดของสตรีทั้งสองกลุ่ม (31/196 ; 15.8 % และ 23/134; 17.2 % ตามลำดับ) สำหรับระยะเวลาของการคลอดระหว่างสตรีทั้งสองกลุ่ม ไม่แตกต่างกัน

สรุป : น้ำหนักตัวที่เพิ่มขึ้นที่เกินกว่าเกณฑ์มาตรฐานในสตรีตั้งครรภ์ ไม่มีผลต่ออัตราการผ่าตัดคลอด แต่มีผลต่อน้ำหนักทารกแรกคลอด