Maternal weight gain and correlation with birth weight infants

S. Lumbanraja\textsuperscript{a}, D. Lutan\textsuperscript{a}, I. Usman\textsuperscript{a,}\textsuperscript{*}

\textsuperscript{a} Department of Obstetrics and Gynecology, Universitas Sumatera Utara, Medan, Indonesia

Abstract

Objective: Maternal weight gain affect the infant birth weight. Aim of this study was to describe maternal weight gain during all trimester of pregnancy and its correlation with the birth weight.

Methods: Pregnant women who got antenatal care in Adam Malik General Hospital and Sundari Hospital, underwent body weight measurement during routine examination at first, second and third trimester and also at delivery time at those hospital. Baby birth weight also measured after delivery.

Results: Maternal weight gain increased its peak point at the second and third trimester with overall total weight gain ranged at 5 – 20 kg during pregnancy. Baby birth on normal weight ranged at 2500 – 4000 grams (SD + 399,86). Maternal weight gain was more higher in the primi gravida group compared with multi and grandemulti gravida groups. There is correlation between maternal weight gain with baby birth weight with \( p = 0.03 \) (\( p<0.05 \), CI 95%), even the correlation was weak.

Conclusion: Maternal weight gain in the second and third trimester showed statistically significance difference with baby birth weight. Adequate total maternal weight gain based on IOM recommendation considered for resulting a better outcome and better birthweight of the babies.

Keywords: Maternal weight, infant birth weight, body mass index

Introduction

The gestational period determine the quality of human resources and depend on the intra uterine condition. Healthy pregnant women with a good nutritional status certainly improves the outcome of baby. Low birth weight rate in developing countries were higher four
times than developed countries. More than 9 million babies die each year, 98% occur in developing countries and most of them caused by low birth weight. Therefore, optimal maternal weight gain is essential for better outcome.

In 1987, The Global Safe Motherhood Initiative was launched for improving the coverage of Antenatal Care and counseling around the world. This Program concentrated on Nutritional status and Maternal weight gain during pregnancy. Institute of Medicine (IOM) in 2009, issued a new revision of maternal weight gain recommendation from the earlier version of 1990 according to Body Mass Index (BMI) pre-pregnancy.

Aims of the present study were 1). To compare maternal weight gain in all trimester and total weight gain during pregnancy, 2). To evaluate the relationship between total maternal weight gain and infant birth weight.

**Patients and Methods**

**Patients**

Pregnant women who were getting ante natal care in Adam Malik General Hospital and Sundari Hospital between August 2012 and January 2013 were eligible for this study. All eligible patients were on delivery time got body weight measurement before and 24 hours after baby birth. And then, maternal weight gain during first, second, and third trimester were collected from the Antenatal record from outpatient care.

**Statistical Analysis**

All data were analyzed with the Statistical Package for the Social Sciences. Correlation between maternal weight gain and infant birth weight were computerized by using Pearson test. P values < 0.05 were considered significant.

**Results**

**Patients Characteristics**

104 eligible pregnant women were get ante natal care and delivered at Adam Malik General Hospital and Sundari Hospital in Medan.

Table 1 showed distribution of subject based on age, parity, pre-pregnancy body weight, height, body mass index and gestational age. As results, most of subjects were on 20-35 years with normoweight in body mass index. Most of them were on 38 weeks of gestational age.

**Table 1**

Patients Characteristics

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Total (n=104)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;20</td>
<td>7 (6.7%)</td>
</tr>
<tr>
<td>20-35</td>
<td>84 (80.8%)</td>
</tr>
<tr>
<td>&gt;35</td>
<td>13 (12.5%)</td>
</tr>
</tbody>
</table>
Parity
- Primi: 44 (42.3%)
- Multi: 59 (56.7%)
- Grandemulti: 1 (1.0%)

Pre-pregnancy body weight (kg)
- Mean: 53.06 ± 7.09

Height (cm)
- Mean: 155.85 ± 5.8

Body Mass Index
- Mean: 21.78 ± 2.06

Gestational Age
- 37 weeks: 5 (4.8%)
- 38 weeks: 54 (51.9%)
- 39 weeks: 31 (29.8%)
- 40 weeks: 14 (13.5%)

Table 2 showed relations of age and maternal weight gain each trimester. As results, maternal weight gain in third trimester have statistically significance difference between pregnant women from 20-35 years group, with p-value 0.01; 5.45 (p-value < 0.05, CI 95%). On the other hand, no statistically significance difference between maternal weight gain in the first and second trimester between age group with p-value 0.150, and 0.415 respectively (p-value < 0.05, CI 95%).

Table 2
Relationship between maternal weight gain each trimester

<table>
<thead>
<tr>
<th>Trimester</th>
<th>&lt;20 (SD)</th>
<th>20-35 (SD)</th>
<th>&gt;35 (SD)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>First</td>
<td>0.43(1.13)</td>
<td>0.93(0.91)</td>
<td>0.92(0.93)</td>
<td>0.150</td>
</tr>
<tr>
<td>Second</td>
<td>5.00(2.84)</td>
<td>5.33(1.93)</td>
<td>4.50(2.96)</td>
<td>0.415</td>
</tr>
<tr>
<td>Third</td>
<td>4.64(2.17)</td>
<td>5.75(2.19)</td>
<td>5.45(2.05)</td>
<td>0.014</td>
</tr>
</tbody>
</table>
Table 3
Maternal weight gain each trimester

<table>
<thead>
<tr>
<th>Body weight (Kg)</th>
<th>Minimal</th>
<th>Maximal</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trimester I</td>
<td>0</td>
<td>3,50</td>
<td>0,90</td>
<td>0,92</td>
</tr>
<tr>
<td>Trimester II</td>
<td>0</td>
<td>10,00</td>
<td>5,21</td>
<td>2,14</td>
</tr>
<tr>
<td>Trimester III</td>
<td>0,5</td>
<td>10,50</td>
<td>5,45</td>
<td>2,24</td>
</tr>
<tr>
<td>Total increase in Weight</td>
<td>5</td>
<td>20,00</td>
<td>11,56</td>
<td>3,50</td>
</tr>
</tbody>
</table>

*Kruskall-Wallis test*  *p* = 0.0001

Table 3 showed maternal weight gain in each trimesters. As results, there is statistically significance difference between maternal weight gain in each trimester with Kruskall-Wallis test obtained *p*<0,0001. In overall pregnancy, total maternal weight gain ranged at 5-20 kg (11,56 ± 3,5)

Table 4
Average of total maternal weight gain and baby birth weight according to gestational age

<table>
<thead>
<tr>
<th>Gestational Ages</th>
<th>Maternal weight gain (Kg) Mean</th>
<th>Anova Test</th>
<th>Birth weight (gr) Mean</th>
<th>Anova Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>37 week</td>
<td>13</td>
<td>3430.0</td>
<td>426.61458</td>
<td>0.113</td>
</tr>
<tr>
<td></td>
<td>Std. Deviation 2.72</td>
<td>2850.00</td>
<td>380.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Minimum 9.5</td>
<td>0.351</td>
<td>0.113</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Maximum 17.0</td>
<td>3068.52</td>
<td>316.57011</td>
<td></td>
</tr>
<tr>
<td>38 week</td>
<td>11.23</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Std. Deviation 3.43</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 4 showed average total maternal weight gain and baby birth with gestational age when delivery. As results, no statistically significance difference with ANOVA test between both of gestational age and total maternal weight gain with p-value 0,351 (p>0,05), and gestational age and baby birth weight with p-value 0,113 (p>0,05). On the other hands, we found statistically significance difference between baby birth weight and gestational age at 37 and 38 weeks with p-value 0,023 (p<0,05).

Table 5
Relationship between maternal weight gain with parity in each trimesters.

<table>
<thead>
<tr>
<th>Parity</th>
<th>Primi (SD)</th>
<th>Multi (SD)</th>
<th>Grande multi (SD)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trimester</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First</td>
<td>0.86(0.92)</td>
<td>0.91(0.93)</td>
<td>2.0</td>
<td>0.444</td>
</tr>
<tr>
<td>Second</td>
<td>5.51(2.13)</td>
<td>5.01(2.15)</td>
<td>3.5</td>
<td>0.365</td>
</tr>
<tr>
<td>Third</td>
<td>6.08(2.18)</td>
<td>5.03(2.18)</td>
<td>2.0</td>
<td>0.018</td>
</tr>
</tbody>
</table>
Table 5 showed relationship between maternal weight gain with parity in each trimesters. As results, there is no statistically significance difference with maternal weight gain with parity in each trimester with p-value 0,44; 0,36; and 0,018 respectively (p>0,05, CI 95%).

Table 6
Maternal weight before and 24 hours after delivery

<table>
<thead>
<tr>
<th></th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before delivery</td>
<td>48,0</td>
<td>83,0</td>
<td>64,75</td>
<td>8,85</td>
</tr>
<tr>
<td>24 hours after</td>
<td>42,0</td>
<td>78,5</td>
<td>59,92</td>
<td>8,81</td>
</tr>
</tbody>
</table>

*paired t-test, p = 0.0001*

Table 6 showed significance difference between maternal body weight before and 24 hours after delivery with average differences of 4.83 Kg from paired t-test with p-value < 0.05.

Table 7
Infant birth weight

<table>
<thead>
<tr>
<th></th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infant</td>
<td>2500.0</td>
<td>4000.0</td>
<td>3119</td>
<td>399.86</td>
</tr>
</tbody>
</table>

Table 8
Correlation between total maternal weight gain and infant birth weight
From this study, babies were born at normal weight ranged at 2500-4000 grams as seen in Table 7. Table 8 showed that there is significant correlation between total maternal weight gain with baby birth weight with p-value 0,03 (p<0,05) but shows a weak correlation (r=0,2).

Discussion

Women with normal body mass index before pregnancy promised a better outcome for pregnancy itself, also for the outcome of baby birth. Pregnant women with inadequate maternal weight gain were often result on low baby birth weight and increase perinatal morbidity and mortality. On the other hands, over increase of maternal weight gain also resulted on poor fetal outcome and affect the methods of delivery later.

Our study shows that patient with normal body mass index before pregnancy resulted in adequate baby birth weight, as far poor prognosis can be alleviated. Our study showed that maternal weight gain increase significantly during second and third trimester, with total maternal weight gain ranged at 5-20 kg.

This maternal weight gain was proper with the IOM recommendation about maternal weight gain during pregnancy. Ota, et al (2011), and Yang, et al (2005) found the same result with our study. Maybe, it is because of decreasing emesis symptoms in second trimester and also increasing of uterine size and volume, so does the other maternal organic tissues. Maternal weight gain also affected by Leptin, a protein-like produced by adipose tissue that regulate appetite and body weight.

There is significance difference of maternal weight gain before and 24 hours after delivery. Based on parity, it seems that maternal weight gain showed significance changes in primigravida in the third trimester. Higher parity showed higher maternal weight gain compared with other groups.

Finally, our study showed there is correlation among total maternal weight gain with baby birth weight with p-value = 0,03 (p<0,05, CI 95%), but poor correlation (r=0,2). Total maternal weight gain seems predict birth weight of baby. Unfortunately, baby birth weight not only influenced by maternal weight gain, but also amniotic fluid increases, placental tissue, maternal oedema, and maternal tissue enlargement.
In conclusion, our study shows that maternal weight gain should be based on IOM recommendation and also consider optimal maternal age in order to get sufficient baby birth weight. Adequate maternal weight gain resulted on low morbidity and mortality in fetal and also maternal.

References

32. Chang M, Kuo C, Chiang K. The Effects of Pre-pregnancy Body Mass Index and Gestational Weight Gain on Neonatal Birth Weight in Taiwan. International Journal of Nursing and Midwifery 2010, 2(2);28-34