MATERNAL BMI - HOW IT AFFECT OBSTETRIC BEHAVIOUR AND PREGNANCY OUTCOME

Dhrubajyati Saha, Pampa Roy, Arnab Kumar Koley, Apurba Saha, Babul Chandra Dey, Madhumoy Ari, Tapan Kumar Ganguly, Asish Kumar Mukhopadhyaya

ABSTRACT: OBJECTIVE: The present study was to find out effect of maternal body mass index (BMI) on obstetric behaviour and pregnancy outcome. METHOD: This was a hospital-based observational study, based on 636 primigravid women delivering singleton live baby in May 2012 to June 2013. We categorise the women into three groups. Obstetric and perinatal outcome were compared among three groups: underweight (BMI < 18.5 kg/m²), normal (18.5 - 24.9 kg/m²), and obese (BMI > 25 kg/m²). RESULTS: Obese women were more prone to adverse maternal and perinatal outcome such as prolong pregnancy, gestational diabetes mellitus, preeclampsia, intrauterine growth restriction, operative vaginal delivery, shoulder dystocia, induction of labour, caesarean section, postpartum haemorrhage, puerperal pyrexia, low birth weight baby, preterm baby, post maturity, macrosomia, and low Apgar score. No significance difference was found regarding anaemia in pregnancy, premature rupture of membrane comparing normal BMI pregnant mother. Underweight pregnant mother were more prone to develop anaemia in pregnancy, intrauterine growth restriction, premature rupture of membrane, postpartum haemorrhage, puerperal pyrexia, low birth weight baby, preterm baby and low Apgar score compared to normal BMI pregnant mother. CONCLUSION: Both overweight and underweight are the definite risk factor for adverse maternal and perinatal outcome. This may be due to altered metabolic state in those cases.


INTRODUCTION: In 2009, World Health Organization (WHO) announced obesity in pregnancy as one of the important non-communicable diseases that threaten maternal and child health [1]. The European Forum of National Nursing and Midwifery Associations also recognized this as a growing problem and it established the roles of health care personnel in early detection and giving interventions to prevent complications from high pre-pregnancy body mass index (PP-BMI) and obesity [2].

The prevalence of obesity in pregnancy has been increasing along with the prevalence of obesity in general population [3]. Recent reports showed that, in many developing countries, e.g. Bangladesh, Nepal, and India, the prevalence of overweight-obesity in women of reproductive age has risen steadily in the last two decades [38]. The obesity rate has rapidly increased in the general population and in women of childbearing age [4]. Obesity during pregnancy may cause adverse outcomes, not only in the mother but also in the child.

Many studies have found that gestational diabetes, preeclampsia, emergency caesarean section, postpartum haemorrhage, wound infections, preterm delivery, large for gestational age...
(LGA), and fetal death in utero (FDIU) were more common in obese mothers, implying that obesity during pregnancy is a major challenge for healthcare providers [5-7]. Maternal obesity may cause adverse outcomes in offspring in addition to neonatal complications. Recent studies have reported the interrelation between the pre-pregnancy weight of mothers and children’s obesity that occurred before the age of 9 years [8].

It has been suggested that pregnancies in underweight women are associated with several adverse outcomes including low birthweight, birth asphyxia, anaemia and increased perinatal mortality rates[9]. Pregnancy is key period when maternal underweight can indelibly “programme” fetal physiology and metabolism and consequently it can lead to systemic pathologies in later life including diabetes mellitus, cerebrovascular disease and hypertension [12]. Although the rationale for this hypothesis has been challenged [13].

In recent years, in connection with epidemic prevalence of overweight and obesity among society in developed countries, most researchers paid attention to examine the association between excessive pre-pregnancy weight and obstetric complications [10]. Controversy, maternal underweight can also influence on adverse perinatal outcomes [11].

Moreover the studies conducted so far are from western developed countries and there is a paucity of data from developing countries.

The aim of this study was to examine the association between BMI and obstetric and perinatal outcomes in primigravid women delivering singleton pregnancy.

**METHOD:** The study was an observational study conducted in the department of Obstetrics and Gynaecology in Burdwan Medical College, Burdwan. Total six hundred thirty six primigravid pregnant women with singleton pregnancy in the period of May 2011 to June 2013, delivering live baby in this hospital were taken as study population. Informed consent was taken from all the mothers and the study was approved by ethical committee of this institution. Women with multiple pregnancies, medical disorders were excluded from study.

Maternal BMI was calculated at first antenatal visit, within eight weeks of gestation. All anthropometric measurements (weight and height) were carried out by means standard methodology as described Lohman et al. Women were followed till delivery. Newborn baby weight was taken at the time of birth without any clothes. To remove intra-observer bias and instrumental bias, all measurements were taken by same measuring instrument/scale and by similar trained persons.

This study used the definition of The National Heart, Lung and Blood Institute in 1998 to classify pre-pregnancy BMI [14]. Nevertheless, low BMI group was also supplemental defined for the analysis as pre-pregnancy BMI < 18.5 kg/m2. Women were grouped into 3 groups

1) Low BMI: BMI < 18.5 kg/m2;
2) Normal BMI: BMI 18.5 - 24.9 kg/m2 (Control);
3) Overweight: BMI >25 kg/m2;

The pre-pregnancy variables included age, parity and socioeconomic status. The antepartum variables analysed were gestational diabetes, Preeclampsia, anaemia, prolonged pregnancy, Intrauterine growth restriction. Intrapartum variables studied were Induction of labour, Mode of delivery (vaginal delivery/caesarean section), instrumental vaginal delivery and shoulder dystocia. Postpartum variables were Postpartum haemorrhage, Pyrexia.
The neonatal variable studied were Low birth weight baby (<2000gms), Preterm, Post maturity, Macrosomia (>4000gms) and Low APGAR score (<7).

Study analysis were done by following the standard statistical procedure and using statistical software SPSS -19. Data was presented in the form of table and p value was calculated by chi-square test.

RESULTS: Among 636 women 150 were underweight (BMI<18.5), 250 women were normal (BMI18.5-24.9) and 236 were overweight. All the 3 grouped were compared and statistically analysed for obstetric behaviour and pregnancy outcomes. The mean age, parity and socioeconomic status were comparable in all three groups.

Table 1:

<table>
<thead>
<tr>
<th></th>
<th>Group A(n=75)</th>
<th>P value among A&amp;B</th>
<th>Group B(n=125)</th>
<th>P value among B&amp;C</th>
<th>Group C(n=118)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI (Mean±SD)</td>
<td>17.78±.531</td>
<td>.0001</td>
<td>23.065±.871</td>
<td>.0001</td>
<td>27.57±1.83</td>
</tr>
</tbody>
</table>

Among ante partum variable a significant higher rate of prolong pregnancy (p<.001), Gestational diabetes mellitus (p=.003), preeclampsia (p <.001) and IUGR (p<.001) were found in overweight group compare to control. No significant differences were found in cases of anaemia and premature rupture of membrane in overweight group as compare to control. IUGR(p<.001), anaemia (p=.001) are significantly higher in underweight pregnant mother as compared to normal BMI pregnant mother but no significant difference was found in prolonged pregnancy, preeclampsia.

Table 2:

<table>
<thead>
<tr>
<th></th>
<th>Group A(n=150)</th>
<th>P value among A&amp;B</th>
<th>Group B(n=250)</th>
<th>P value among B&amp;C</th>
<th>Group C(n=236)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prolong pregnancy</td>
<td>0(0%)</td>
<td>.054</td>
<td>12(4.8%)</td>
<td>.0001</td>
<td>60(25.4%)</td>
</tr>
<tr>
<td>Gestational diabetes mellitus</td>
<td>0(0%)</td>
<td>.176</td>
<td>0(0%)</td>
<td>.003</td>
<td>16(6.8%)</td>
</tr>
<tr>
<td>Preeclampsia</td>
<td>0(0%)</td>
<td></td>
<td>6(2.4%)</td>
<td>.0001</td>
<td>72(30.5%)</td>
</tr>
<tr>
<td>Anaemia</td>
<td>90(60%)</td>
<td>.001</td>
<td>92(36.8%)</td>
<td>.451</td>
<td>76(32.2%)</td>
</tr>
<tr>
<td>IUGR</td>
<td>72(48%)</td>
<td>.0001</td>
<td>8(3.2%)</td>
<td>.0001</td>
<td>40(16.9%)</td>
</tr>
</tbody>
</table>

Among intrapartum variable (table 3) a significant higher rate of operative vaginal delivery (p<.001), shoulder dystocia (p=.003), induction of labour (p<.001) and caesarean section (p<.001) and decrease spontaneous vaginal delivery were found in overweight women compare to normal BMI mother. However significant difference in regard to premature rupture of membrane were not present in overweight pregnant mother compare to control. Underweight women were more prone to premature rupture of membrane (p<.001), but no significant difference is found in relation to spontaneous (p=.087), operative vaginal delivery (p=.505), induction of labour (p=.702), caesarean section (p=.103) in comparison to normal BMI pregnant mother.
Table 3:

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<tr>
<th></th>
<th>Group A (n=150)</th>
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<th>Group C (n=236)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROM</td>
<td>60(40%)</td>
<td>.0001</td>
<td>24(9.6%)</td>
<td>.568</td>
<td>28(11.9%)</td>
</tr>
<tr>
<td>Spontaneous vaginal delivery</td>
<td>132(88%)</td>
<td>.087</td>
<td>196(78.4%)</td>
<td>.0001</td>
<td>44(18.6%)</td>
</tr>
<tr>
<td>Operative VD</td>
<td>12(8%)</td>
<td>.505</td>
<td>14(5.6%)</td>
<td>.0001</td>
<td>56(23.7%)</td>
</tr>
<tr>
<td>Shoulder dystocia</td>
<td>0(0%)</td>
<td></td>
<td>0(0%)</td>
<td>.003</td>
<td>16(6.8%)</td>
</tr>
<tr>
<td>Induction of labour</td>
<td>12(8%)</td>
<td>.702</td>
<td>24(9.6%)</td>
<td>.0001</td>
<td>96(40.7%)</td>
</tr>
<tr>
<td>Caesarean section</td>
<td>12(8%)</td>
<td>.103</td>
<td>40(16%)</td>
<td>.0001</td>
<td>136(57.6%)</td>
</tr>
</tbody>
</table>

Among postpartum variable significantly higher number of both, overweight and underweight pregnant mother had post partum haemorrhage (<.001) and puerperal pyrexia (p value of A & B, B & C are .0001 and .010 respectively) compare to control.

Table 4:

<table>
<thead>
<tr>
<th></th>
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<th>Group B (n=250)</th>
<th>P value among B&amp;C</th>
<th>Group C (n=236)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Postpartum Haemorrhage</td>
<td>60(40%)</td>
<td>.0001</td>
<td>6(2.4%)</td>
<td>.0001</td>
<td>40(16.9%)</td>
</tr>
<tr>
<td>Puerperal Pyrexia</td>
<td>36(24%)</td>
<td>.0001</td>
<td>8(3.2%)</td>
<td>.010</td>
<td>28(11.9%)</td>
</tr>
</tbody>
</table>

Low birth weight baby, preterm delivery, Apgar score (<7 at 5 minutes) were significantly more in both overweight and underweight women in contrast to control. Postmaturity Syndrome, Macrosomia were significantly more in overweight mother compare to control (p<.001) but post maturity not so significant in underweight pregnant mother (p>.05)

Table 5:

<table>
<thead>
<tr>
<th></th>
<th>Group A (n=150)</th>
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<th>Group B (n=250)</th>
<th>P value among B&amp;C</th>
<th>Group C (n=236)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low birth weight(&lt;2kg)</td>
<td>108(72%)</td>
<td>.0001</td>
<td>22(8.8%)</td>
<td>.0001</td>
<td>80(33.9%)</td>
</tr>
<tr>
<td>Preterm</td>
<td>78(52%)</td>
<td>.0001</td>
<td>30(12%)</td>
<td>.0001</td>
<td>72(30.5%)</td>
</tr>
<tr>
<td>Post maturity</td>
<td>0(0%)</td>
<td>.054</td>
<td>12(4.8%)</td>
<td>.0001</td>
<td>52(22%)</td>
</tr>
<tr>
<td>Macrosomia (&gt;4kg)</td>
<td>0(0%)</td>
<td></td>
<td>0(0%)</td>
<td>.0001</td>
<td>24(10.2%)</td>
</tr>
<tr>
<td>APGAR score(&lt;7)</td>
<td>60(40%)</td>
<td>.0001</td>
<td>40(16%)</td>
<td>.0001</td>
<td>100(42.4%)</td>
</tr>
</tbody>
</table>

DISCUSSION: Our study revealed that both overweight and underweight women have increased risk of adverse obstetric outcomes. Overweight women (BMI>25.0) had a markedly increased risk for gestational diabetes (p=.003), preeclampsia (.0001), prolong pregnancy (p.0001), intrauterine
growth restriction (.0001), induction of labour (p=.0001), caesarean section (p=.0001), postpartum haemorrhage (p=.0001), low birth weight baby (p=.0001), preterm (p=.001), postmaturity syndrome (p=.0001), fetal macrosomia (p=.0001) and low APGAR score (.0001) compared to normal BMI pregnant mother. Voigt et al. analysed German perinatal statistics and demonstrated higher rates of hypertension, preeclampsia, gestational diabetes, fetal macrosomia, fetal structural anomalies, and low neonatal APGAR score in obese than in normal weight women [27]. Bhattacharya et al., who compared 1,857 obese pregnant women with 14,076 normal pregnant women, reported that obese pregnant women had significantly higher frequencies of preeclampsia, gestational hypertension, emergency caesarean section, preterm delivery at less than 33 weeks of gestation, and birth weight over 4,000 g [28]. Murakami et al. concluded that pre-pregnancy BMI and perinatal outcomes showed a U-shaped interrelation.

They observed that overweight and obese women were at a higher risk of caesarean section, preeclampsia, and gestational diabetes than normal weight women, but underweight women showed a higher risk of low birth weight infants, thereby elevating the rate of infant hospitalization [29]. Robinson [34] and Leonie [35] showed in two separate studies that obese women are at high risk for pre-eclampsia which is in line with the results of this study.

Comparison of induction of labour study showed that lower BMI was associated with lower induction of labour and overweight women showed significant increase rate. This is similar to results of Ushakiran [36]. Similar to our study, Ushakiran and colleagues et al found that post-date delivery increased in women with BMI > 30. BMI in the first trimester was related to birth weight and maximum rate of macrosomic was found in, overweight group and macrosomic was minimal in underweight pregnant woman. Similar to our study many previous studies have reported that in addition to maternal and neonatal complications, the rate of caesarean section increases in obese pregnant women [30-32]. Poobalan et al. conducted a meta-analysis on a cohort study performed from 1996 to 2007 and found that the risk of caesarean section was higher in overweight or obese women than in women with normal BMI. Many reports have indicated that the higher rate of caesarean section in obese pregnant women is due to neonate size; however, in the absence of macrosomia, this increased risk may be due to the increase in soft tissue in the pelvis that narrows the pelvic outlet and the negative effect of poor pelvic and abdominal tone on fetal position [33].

We found that underweight women showed increased risk for anaemia in pregnancy (p=.001), IUGR (p=.0001), PROM (p=.0001), postpartum haemorrhage (p=.0001), puerperal pyrexia (.0001), preterm delivery (p=.0001) and low birth weight infants (.0001) in comparison to normal weight patients. Our analysis confirms previous reports [17-19].

Compared with normal weight pregnant, in women with underweight pregnant mother, we also showed no increase in frequency of gestational diabetes mellitus, operative vaginal delivery (p=.505), caesarean section (p=.103) and preeclampsia (p=.176), which is reflected in literature [24]. Although Villena- Heinsen et al. observed significant increase in incidence of PIH [18]. Simultaneously in carried out study we observed decreased incidence of post maturity (p=.054) and macrosomic neonates. Other authors made similar observations [24, 25, 26].

The biologic mechanisms underlying the association between maternal undernutrition status and slower fetal growth and development remain speculative [20, 21]. Ross et al. found that women with underweight had a smaller plasma volume, lower cardiac output, increases in peripheral vascular resistance, and lower rennin-aldosterone response in pregnancy compared with
normal-weight women. It seems probable that such inadequate maternal hemodynamic adjustments may be associated with uteroplacental insufficiency and the increased prevalence of small for gestational age babies observed [22, 23].

The underlying biological mechanisms for the positive association between obesity and the risk of delivering prematurely are not understood. Heavy individuals often have sedentary lifestyles, which have been associated with increased risk of preterm birth [15]. The strong relation between obesity and maternal complications of pregnancy (gestational diabetes, preeclampsia, eclampsia) could potentially explain the higher rates of fetal macrosomia, caesarean delivery, and very early delivery for obese and overweight women in our study. However, increased risk of adverse outcomes remained after excluding women with pre-gestational or gestational diabetes or hypertension.

Our findings are of public health importance. Our results reinforce current recommendations to avoid excessive weight gain or malnutrition during adolescence and early adulthood, (16) before a first pregnancy. Maternal overweight and underweight is one of the few risk factors for poor gestational outcomes amenable to modification before a pregnancy, and this study further strengthens the arguments for weight control to improve the health status of populations.

Conclusion - This research demonstrates that maternal BMI is an important risk factor of adverse maternal and neonatal outcome. An increased BMI increases the incidence of preeclampsia, induction of labour, caesarean section, pre term labour and macrosomia and low maternal weight was associated with increased prevalence of preterm delivery and low birth weight .Therefore, we advice pregnant woman to gain a normal BMI of 18.5-24.9kg/m², before and during pregnancy, for instance by consulting their physician or a dietician prior to getting pregnant. Additionally, there is a need to conduct a large-scale multicenter study to compile guidelines for the optimal weight gain range using the modified BMI classification for population of developing countries.

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Date of Submission: 06/08/2013.
Date of Peer Review: 07/08/2013.
Date of Acceptance: 20/08/2013.
Date of Publishing: 27/08/2013.