MATERNAL BMI- HOW IT AFFECT OBSTETRIC BEHAVIOUR AND PREGNANCY OUTCOME

Dhrubajyati Saha[1], Pampa Roy[2], Arnab Kumar Koley[3], Apurba Saha[4], Babul Chandra Dey[5], Madhumoy Ari[6], Tapan Kumar Ganguly[7], Asish Kumar Mukhopadhyaya[8]

HOW TO CITE THIS ARTICLE:
Dhrubajyati Saha, Pampa Roy, Arnab Kumar Koley, Apurba Saha, Babul Chandra Dey, Madhumoy Ari, Tapan Kumar Ganguly, Asish Kumar Mukhopadhyaya. "Maternal BMI- how it affect obstetric behaviour and pregnancy outcome". Journal of Evolution of Medical and Dental Sciences 2013; Vol2, Issue 35, September 2; Page: 6622-6630.

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<18.5kg/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, post partum haemorrhage, puerperal pyrexia, low birth weight baby, preterm baby, post maturity, macrosomia and low Apgar score and no significance difference were 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, post partum haemorrhage, puerperal pyrexia, low birth weight baby, preterm baby and low Apgar score compare 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.

KEY WORD: Overweight-Underweight-BMI- Pregnancy-Maternal and Perinatal outcome.

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:

	Group A(n=75)	P value among A&B	Group B(n=125)	P value among B&C	Group C(n=118)
BMI (Mean±SD)	17.78±.531	.0001	23.065±.871	.0001	27.57±1.83

Among ante partum variable a significant higher rate of prolong pregnancy (p<.001), Gestational diabetes (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:

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

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:

	Group A(n=150)	P value among A&B	Group B(n=250)	P value among B&C	Group C(n=236)
PROM	60(40%)	.0001	24(9.6%)	.568	28(11.9%)
Spontaneous vaginal delivery	132(88%)	.087	196(78.4%)	.0001	44(18.6%)
Operative VD	12(8%)	.505	14(5.6%)	.0001	56(23.7%)
Shoulder dystocia	0(0%)		0(0%)	.003	16(6.8%)
Induction of labour	12(8%)	.702	24(9.6%)	.0001	96(40.7%)
Caesarean section	12(8%)	.103	40(16%)	.0001	136(57.6%)

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 .0001and.010 respectively)compare to control.

Table 4:

	Group A(n=150)	P value among A&B	Group B(n=250)	P value among B&C	Group C(n=236)
Postpartum Haemorrhage	60(40%)	.0001	6(2.4%)	.0001	40(16.9%)
Puerperal Pyrexia	36(24%)	.0001	8(3.2%)	.010	28(11.9%)

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:

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

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/m^2, 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.

REFFERENCE:

1. World Health Organization (2012) ECOSOC high-level segment 2009. Discussion paper: Non communicable dis- eases, poverty and the development agenda. http://www.who.int/nmh/publications/discussion_paper_ncd_en.pdf
2. World Health Organization (2012) Ninth annual meeting of the European Forum of National Nursing and mid- wifery Associations and WHO. Report on a WHO meet- ing March 2005. http://www.euro.who.int/__data/assets/pdf_file/0013/102226/E86646.pdf
3. Alexandra, P., Vassilios, B., Alexandra, V., George, K., Vassiliki, L. and Chryssa, B. (2011) Population-based trends of pregnancy outcome in obese mothers: What has changed over 15 years. Obesity, 19, 1861-1865. doi:10.1038/oby.2010.317
4. Vahratian A: Prevalence of overweight and obesity among women of childbearing age: results from the 2002 National Survey of Family Growth. Maternal Child Health J 2009, 13:268-273.
5. Sebire NJ, Jolly M, Harris JP, Wadsworth J, Joffe M, Beard RW, Regan L, Robinson S: Maternal obesity and pregnancy outcome: a study of 287,213 pregnancies in London. Int J Obes Relat Metab Disord 2001, 25:1175-1182.
6. Schrauwers C, Dekker G: Maternal and perinatal outcome in obese pregnant patients. J Matern Fetal Neonatal Med 2009, 22:218-226.

7. Leung TY, Leung TN, Sahota DS, Chan OK, Chan LW, Fung LW, Lau TK: Trend in maternal obesity and associated risks of adverse pregnancy outcomes in a population of Chinese women. BJOG 2008, 115:1529-1537.
8. Gale CR, Javaid MK, Robinson SM, Law CM, Godfrey KM, Cooper C: Maternal size in pregnancy and body composition in children. J Clin Endocrinol Metab 2007, 92:3904-3911.
9. Spinillo A, Capuzzo E, Piazzi G, Ferrari A, Morales V, DiMario M. Risk for spontaneous preterm delivery by combined body mass index and gestational weight gain patterns. Acta Obstet Gynecol Scand 1998; 77:32±36.
10. Galtier-Dereure F., Boegner C., Bringer J. (2000) Obesity and pregnancy: complications and cost. Am. J. Clin. Nutr. 71(suppl): 1242S-1248S.
11. Kirchengast S., Hartmann B. (1998) Underweighted women are at high risk for maternal and perinatal outcome. Ann. Hum. Biol.25: 17-28.
12. Langley-Evans S. C. (2001). Fetal programming of cardiovascular function through exposure to maternal undernutrition. Proc. Nutrit. Soc. 60: 505-513.
13. Susser M., Levin B. (1999) Ordeals for the fetal programming hypothesis. Brit. Med. J. 318: 855-856.
14. Cunningham, F.G., Leveno, K.J., Bloom, S.L., Hauth, J.C., Rouse, D.J. and Spong, C.Y. (2010) Williams obstetrics. 23rd Edition, Mc Graw-Hill, New York
15. Misra DP, Strobino DM, Stashinko EE, Nagey DA, Nanda J. Effects of physical activity on preterm birth. Am J Epidemiol. 1998; 147:628–635.
16. Willett WC, Dietz WH, Colditz GA. Guidelines for healthy weight. N Engl J Med. 1999; 341: 427–434.
17. Cnattingius S., Bergström R., Lipworth L. et al. (1998) Pre-pregnancy weight and the risk adverse pregnancy outcomes. N. Engl. J. Med. 338: 147-152.
18. Villena-Heinsen C., Luxner K., Friedrich M. et al. (1998) Pregnancy and labor in underweight pregnant patients. Z. Geburtshilfe. Neonatol. 202: 115-120.
19. Sebire N. J., Jolly M., Harris J. et al. (2001) Is maternal underweight really a risk for adverse pregnancy outcome? A population- based study in London. Brit. J. Obstet. Gynaecol. 108: 61-66.
20. Mathews F., Yudkin P., Neil A. (1999) Influence of maternal nutrition on outcome of pregnancy: prospective cohort study. Brit. Med. J. 319: 339-343.
21. Ramakrishnan U. (2004) Nutrition and low birth weight: from research to practice. Am. J. Clin. Nutr. 79: 17-21.
22. Rosso P., Donoso E., Braun S. et al. (1992) Hemodynamic changes in underweight pregnant women. Obstet. Gynecol. 79: 908- 912.
23. Salas S. P., Rosso P. (1998) Reduced plasma volume and changes in vasoactive hormones in underweight pregnant women. Rev. Med. Chile 126: 504-510
24. Sebire N. J, Jolly M., Harris J. et al. (2001) Is maternal underweight really a risk for adverse pregnancy outcome? A population- based study in London. Brit. J. Obstet. Gynaecol. 108: 61-66.
25. Kanadys W. M. (1998) Pre-pregnancy weight, gestational weight gain and birth weight. Ginekol. Pol. 69: 1223-1227.

26. Ekblad U., Grenman S. (2001) Maternal weight, weight gain during pregnancy and pregnancy outcome. Int. J. Gynecol. Obstet. 73: 101-107.
27. Briese V, Voigt M, Wisser J, Borchardt U, Straube S: Risks of pregnancy and birth in obese primiparous women: an analysis of German perinatal statistics. Arch Gynecol Obstet 2010.
28. Bhattacharya S, Campbell DM, Liston WA, Bhattacharya S: Effect of body mass index on pregnancy outcomes in nulliparous women delivering singleton babies. BMC Public Health 2007, 7:168-176.
29. Murakami M, Ohmichi M, Takahashi T, Shibata A, Fukao A, Morisaki N, Kurachi H: Pre-pregnancy body mass index as an important predictor of perinatal outcomes in Japanese. Arch Gynecol Obstet 2005, 271:311-315.
30. Margerison Zilko CE, Rehkopf D, Abrams B: Association of maternal gestational weight gain with short- and long-term maternal and child health outcomes. Am J Obstet Gynecol 2010, 202:574.e1-8.
31. Dempsey JC, Ashiny Z, Qiu CF, Miller RS, Sorensen TK, Williams MA: Maternal pre-pregnancy overweight status and obesity as risk factors for cesarean delivery. J Matern Fetal Neonatal Med 2005, 17:179-185.
32. Magriples U, Kershaw TS, Rising SS, Westdahl C, Lckovics JR: The effect of obesity and weight gain in young women on obstetric outcomes. Am J Perinatol 2009, 26:365-371.
33. Magriples U, Kershaw TS, Rising SS, Westdahl C, Lckovics JR: The effect of obesity and weight gain in young women on obstetric outcomes. Am JPerinatol 2009, 26:365-371.
34. Robinson HE, Dconnell CM, Joseph KS, Mcleod NL: Maternal outcomes in Pregnancies complicated by obesity. Obstetric & Gynecology 2005, 160(6):1357-1364.
35. Leonie KC, Johannes BP, Allan MC, McIntyre D: The prevalence and impact of overweight and obesity in an Australian obstetric population. M.J.A2006, 184(2):56-59
36. UshaKiran TS, Hemmadi S, Bethel J, Evans J: Outcome of pregnancy in a women with an increased body mass index. An International Journal of Obstetrics and Gynecology 2005, 112(6):768-772.
37. Seligman LC, Duncan BB, Branchtein L, Laio DS, Mengue SS, Schmidt MI: Obesity and gestational. Weight gain: Cesarean delivery and labor complications. Rev Saude Publica 2006, 40(3):457-65.
38. Balarajan Y, Villamor E: Nationally representative surveys show recent increases in the prevalence of overweight and obesity among women of reproductive age in Bangladesh, Nepal, and India. J Nutr 2009, 139:2139-2144.

AUTHORS:

1. Dhrubajyati Saha
2. Pampa Roy
3. Arnab Kumar Koley
4. Apurba Saha
5. Babul Chandra Dey
6. Madhumoy Ari
7. Tapan Kumar Ganguly
8. Asish Kumar Mukhopadhyaya

PARTICULARS OF CONTRIBUTORS:

1. Senior Resident, Dept. of OBG, Chittaranjan Seva Sadan.
2. Senior Resident, Dept. of Paediatrics, B.C. Roy Post Graduate Institute of Peadiatric Sciences
3. Senior Resident, Dept. of OBG, Chittaranjan Seva Sadan.
4. Senior Resident Dept. of OBG, Chittaranjan Seva Sadan.
5. Medical Officer, Dept. of OBG, Jangipur sub-divisional Officer.
6. Junior Resident, Dept. of OBG, Burdwan Medical College.
7. Senior Resident, Dept. of OBG, Burdwan Medical College.
8. HOD and MSVP, Dept. of OBG, Chittaranjan Seva Sadan.

NAME ADRRESS EMAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Dhrubajyati Saha,
C/O Gouranga Lal Saha,
North Habra, P.O. Road,
P.O. – Habra, North 24, pgns,
West Bengal, Pin – 743263.
Email – dhrubajyati1984@gmail.com

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