A Study to Assess the Effect of Maternal Obesity on Pregnancy Outcome in a Tertiary Medical Centre of South Bihar

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ABSTRACT

BACKGROUND

World health organization (WHO) declares obesity as a pandemic issue, having high prevalence in females, especially in the childbearing age than in males. Pregnancies complicated by obesity has been identified as early as 1945. Pre-pregnancy obesity endangers both maternal and fetal well-being. Increasing body mass index (BMI) is associated with increased adverse obstetric and fetal outcomes. Pre-pregnancy obesity and excessive gestational weight gain are parts of maternal obesity during pregnancy. Prenatal maternal obesity and excessive gestational weight gain also improve placental nutrition transfer to the developing foetus and foetal development. The purpose of this study was to evaluate the association between early pregnancy BMI and maternal complications as well as labour outcome.

METHODS

A prospective observational study comprising 250 antenatal women with singleton uncomplicated pregnancies, booked at Narayan Hospital, Rohtas, South Bihar within the first 12 weeks of gestation were selected for the study. The following inclusion and exclusion criteria were considered. With the help of a predesigned questionnaire, basic information including weight and height was collected in the first check up and BMI was calculated accordingly. BMI was calculated using the formula weight (kg)/height 2 (m2).

RESULTS

The mean age of mothers was 25.98 ± 3.92 years. Mothers who underwent caesarean section had BMI of 27.36 ± 5.768 and for normal vaginal delivery mothers it was 27.94 ± 6.076, whereas for mother who had undergone forceps delivery, BMI was 30.60 ± 3.864 whereas for other assisted vaginal delivery it was 29.75 ± 7.246. There is mild correlation of BMI of mother to the birth weight of baby. On applying regression analysis, we found mild correlation with R square 0.134. There was no correlation of BMI of mother to the hospital stay of their children.

CONCLUSIONS

We concluded that however statistically there is no significant association between obesity and numerous maternal and perinatal risks in obese pregnant women but it poses a considerable challenge to the obese patient in successful completion of pregnancy.

KEYWORDS

Obesity, BMI, Pregnancy Outcome, NICU, Mode of Delivery

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BACKGROUND

As per the World Health Organization, obesity is significantly affecting majority of the population of world and one of the major health challenges of the twenty first century. As per the WHO, in 2016, across Europe, 24.5 % of women aged 18 years old were obese.[1] In some countries, including India, the epidemic of obesity is seen alongside continuing problems of undernutrition, creating a double burden.[2] WHO declares obesity as a pandemic issue, having high prevalence in females, especially in the childbearing age than in males. Pregnancies complicated by obesity has been identified as early as 1945. Pre-pregnancy obesity endangers both maternal and fetal well-being. Increasing BMI is associated with increased adverse obstetric and fetal outcomes.[3] Obesity puts mother and foetus at risk of complications including gestational diabetes mellitus (GDM), hypertensive disorders of pregnancy (HDP), preterm labour, dysfunctional labour, caesarean sections, postpartum infections, and deep vein thrombosis, according to several studies in India. Obese women's neonates were also large for gestational age, macrosomic, and had a higher rate of birth injuries, shoulder dystocia, prematurity, late foetal deaths, and congenital malformations.[4]

Maternal obesity during pregnancy includes pre-pregnancy obesity and excessive gestational weight gain. Both pre-pregnancy maternal obesity and excessive gestational weight gain increase the placental transfer of nutrients to the developing fetus and fetal development.[5] Pregnancy results in critical changes in weight at a time when women have relatively greater contact with healthcare professionals and are highly motivated to improve their health. This could represent a window of opportunity for interventions to reduce obesity and to identify those who would benefit from primary prevention strategies for cardiovascular disease.[6] The exact mechanism, that how maternal obesity affects baby is not known but a plethora of explanation had submitted regarding the explanation. One of the well believed explanation is epigenetics, which is characterised as mechanisms that do not require a change in deoxyribonucleic acid (DNA) sequence to maintain long-term gene expression stability. DNA methylation, histone modification (acetylation, SUMOylation, ubiquitination, and methylation), and non-coding ribonucleic acid (RNAs) are all examples of epigenetic processes. Early embryogenesis in mammals is a crucial time for epigenome establishment.

The placenta and offspring's epigenetic landscape may be affected by maternal obesity. Ge et al. in their study found that DNA methylation in differential methylation regions of Peg3 is altered in spermatozoa of offspring from obese mothers, but is not affected in spermatozoa of offspring from diabetic mothers.[7] Epigenetic changes in the foetus caused by maternal obesity-related factors in the womb may have long-term effects and contribute to metabolic disorders later in life. Given the well-documented connection between obesity in pregnant women and adverse pregnancy and long-term results, there is a need for quality clinical care based on best evidence-based practise.

Several studies have shown that guidelines can enhance health-care processes and patient outcomes, but they are often of poor quality due to contradictory recommendations, insufficient consideration of specific patient characteristics, low-quality evidence supporting the recommendations, lack of clarity, and ineffective management of possible conflicts of interest. With the above background, this study was conducted having following objectives -

Objectives

1. To study the association between early pregnancy BMI and maternal complications.
2. To determine the association between early pregnancy BMI and labour outcome.

METHODS

A prospective observational study comprising 250 antenatal women with singleton uncomplicated pregnancies, booked at Narayan Hospital, Rohtas, South Bihar within the first 12 weeks of gestation were selected for the study and the study was concocted for 6 months i.e. from September 2020 to May 2021. The following inclusion and exclusion criteria were considered.

Inclusion Criteria

1. Pregnant women attending obstetrics department with single pregnancy were included.

Exclusion Criteria

1. Patients with pre–existing medical disorders like chronic hypertension, overt diabetes, over hypothyroidism and connective tissue disorders such as systemic lupus erythematosus (SLE).
2. No antenatal visits in the first trimester of pregnancy

Informed consent was taken. With the help of a predesigned questionnaire, basic information including weight and height was collected in the first check-up and BMI was calculated accordingly. BMI was calculated using the formula weight (kg)/height 2 (m2). Patients were classified into four groups: underweight (BMI < 18.5 kg/m 2), normal (BMI 18.5 - 24.9 kg/m 2), overweight (BMI 25 - 29.9 kg/m 2) and obese (BMI 30 and above).

The primary maternal outcomes observed were HDP, GDM, and caesarean section, with instrumental deliveries, multiple gestations, preterm labour, antepartum haemorrhage (APH), maternal accidents and so on as secondary outcomes. Miscarriages, birth asphyxia, and neonatal intensive care unit (NICU) admissions were the primary foetal/perinatal outcomes, while congenital abnormalities, shoulder dystocia, hyperbilirubinaemia, and other newborn outcomes were also measured. The incidences of different maternal, foetal, and neonatal outcomes were determined.

Statistical Analysis

Data was entered in Microsoft Excel and statistical analysis was done with the help of statistical package for social sciences (SPSS) 20 software and Microsoft Excel. Appropriate statistical test was used as required.

RESULTS

Age Group	No	%
< 20 year	7	2.8
20 - 24 year	86	34.4
25 - 29 year	110	44
30 - 35 year	47	18.8
Total	**250**	**100**

Table 1. Distribution of Study Subjects as per Maternal Age

Table 1 shows distribution of study subjects as per maternal age. Maximum 44 % of study subjects were in the age group 25 - 29 years, 34.4 % study subjects were in the age group 20 - 24 years, whereas only 2.8 % study subjects were < 20 years. The mean age of mothers 25.98 ± 3.92 years.

Table 2 shows distribution of study subjects as per maternal BMI. Maximum 49.2 % mothers were obese having BMI 30 and above and 6.4 % study subjects. None of the mothers were underweight whereas 44.4 % mothers were having normal BMI 18.5 - 24.9.

BMI	No	%
Underweight (BMI < 18.5 k/m 2)	0	0
Normal (BMI 18.5 - 24.9)	111	44.4
Overweight (BMI 25 - 29.9)	16	6.4
Obese (BMI 30 and above)	123	49.2
Total	**250**	**100**

Table 2. Distribution of Study Subjects as per Maternal BMI

	BMI			
Mode of delivery	Mean	N	Std. Deviation	ANOVA TEST applied. F value- 1.24, P – 0.29 Non-significant
Caesarean	27.36	103	5.768	
Forceps	30.60	10	3.864	
Normal vaginal delivery	27.94	129	6.076	
VBAC	29.75	8	7.246	
Total	**27.86**	**250**	**5.928**	

Table 3. Association of Maternal BMI and Mode of Delivery

Table 3 shows association of maternal BMI and mode of the delivery. Mothers who underwent caesarean section had BMI of 27.36 ± 5.768, For normal vaginal delivery mothers, it was 27.94 ± 6.076, whereas for mother who had undergone forceps delivery, BMI was 30.60 ± 3.864 whereas for other assisted vaginal delivery, it was 29.75 ± 7.246. On comparing these values by applying analysis of variance (ANOVA) test, we found that there is statistically no significant association between BMI and mode of delivery with F value - 1.24 and P value - 0.29.

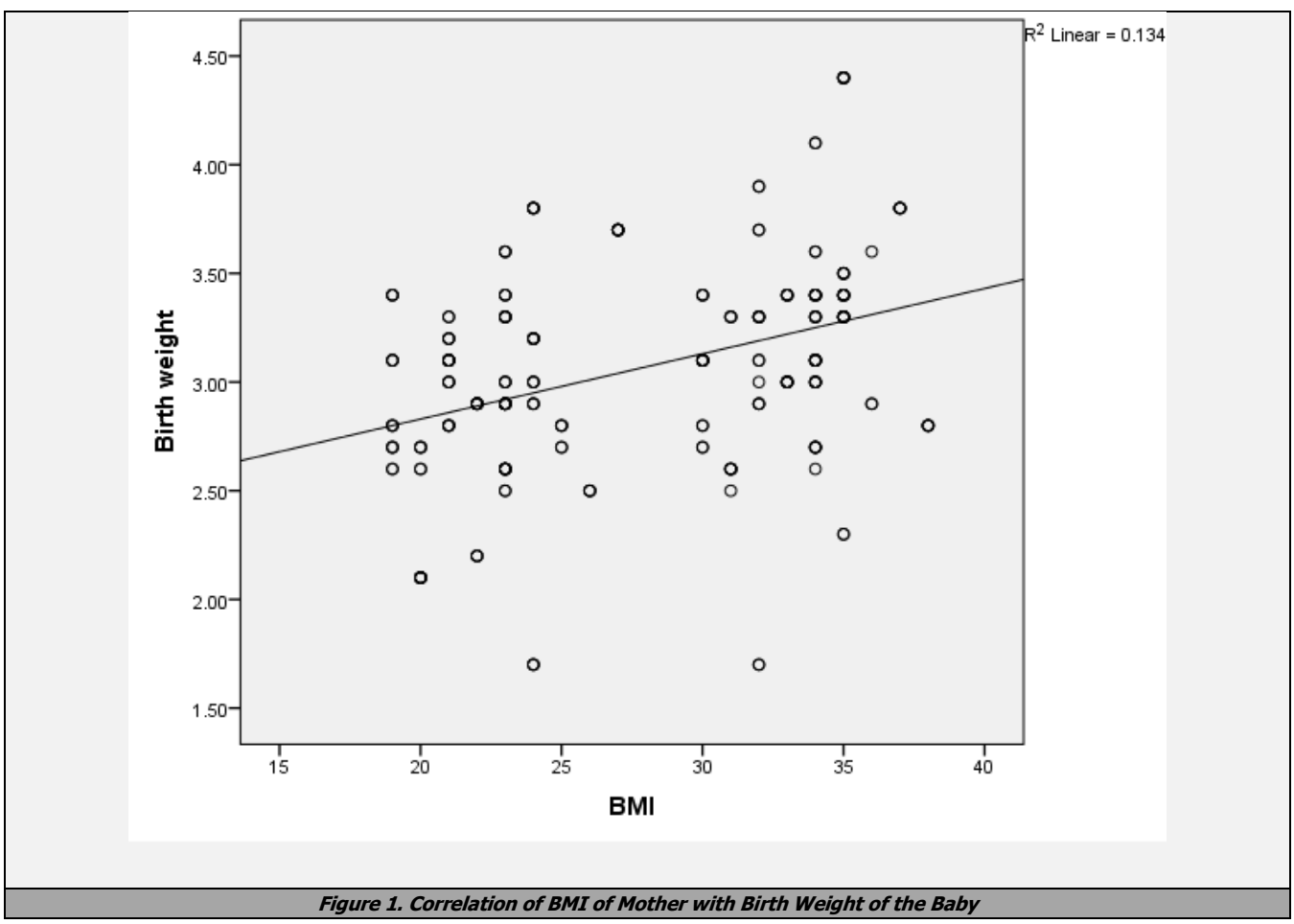

Figure 1. Correlation of BMI of Mother with Birth Weight of the Baby

Fig 1 shows correlation of BMI of mother with birth weight of the baby. There is mild correlation of BMI of mother to the birth weight of baby. On applying regression analysis, we found mild correlation with R square 0.134.

BMI	APGAR < 7	APGAR ≥ 7	Total	
Underweight (BMI < 18.5 kg/m 2)	0	0	**0**	Chi square - 0.05 P value - 0.82 Non-significant
Normal (BMI 18.5 - 24.9)	2	109	**111**	
Overweight (BMI 25 - 29.9)	0	16	**16**	
Obese (BMI 30 and above)	2	121	**123**	
Total	**4**	**246**	**250**	

Table 4. Association of BMI of Mother with APGAR Score

Table 4 shows association of BMI of mother with APGAR score of baby. We have graded children with less than 7 APGAR score and more than or equal to 7 APGAR score. A total of 4 children had APGAR score less than 7 out of which 2 had normal BMI whereas rest 2 had BMI above 25. Out of 246 children having APGAR ≥ 7, 109 children had BMI less than 25 whereas 137 children had BMI more than 25. On comparing the two groups, we found that the chi square was 0.05 with P value of 0.82 and no significant difference.

Table 5 shows association of BMI of mother with requirement of NICU admission of baby. Out of 250 study subjects, only 35 children need NICU admission whereas rest 215 study subjects do not need NICU admission. Out of 35 children who needs NICU admission, 21 children were obese having BMI 30 and above whereas rest 14 children had BMI in normal range i.e., 18.5 - 24.9. Out of 215 children who do not need NICU admission, 97 children had normal BMI whereas 118 children had BMI above 25. On comparing the two groups, we found that chi square was 0.05 with P value of 0.82 with no significant difference.

BMI	NICU Admission no	NICU Admission yes	Total	
Underweight (BMI < 18.5 kg/m2)	0	0	**0**	
Normal (BMI 18.5 - 24.9)	97	14	**111**	Chi square - 0.32,
Overweight (BMI 25 - 29.9)	16	0	**16**	P value - 0.57
Obese (BMI 30 and above)	102	21	**123**	Non-significant
Total	**215**	**35**	**250**	

Table 5. Association of BMI of Mother with NICU Admission

Fig 2 shows correlation of BMI of mother to hospital stay of study subjects. Here in present study we found no correlation of BMI of mother to the hospital stay of their children. On applying regression analysis, we found R square 0.002 with no correlation.

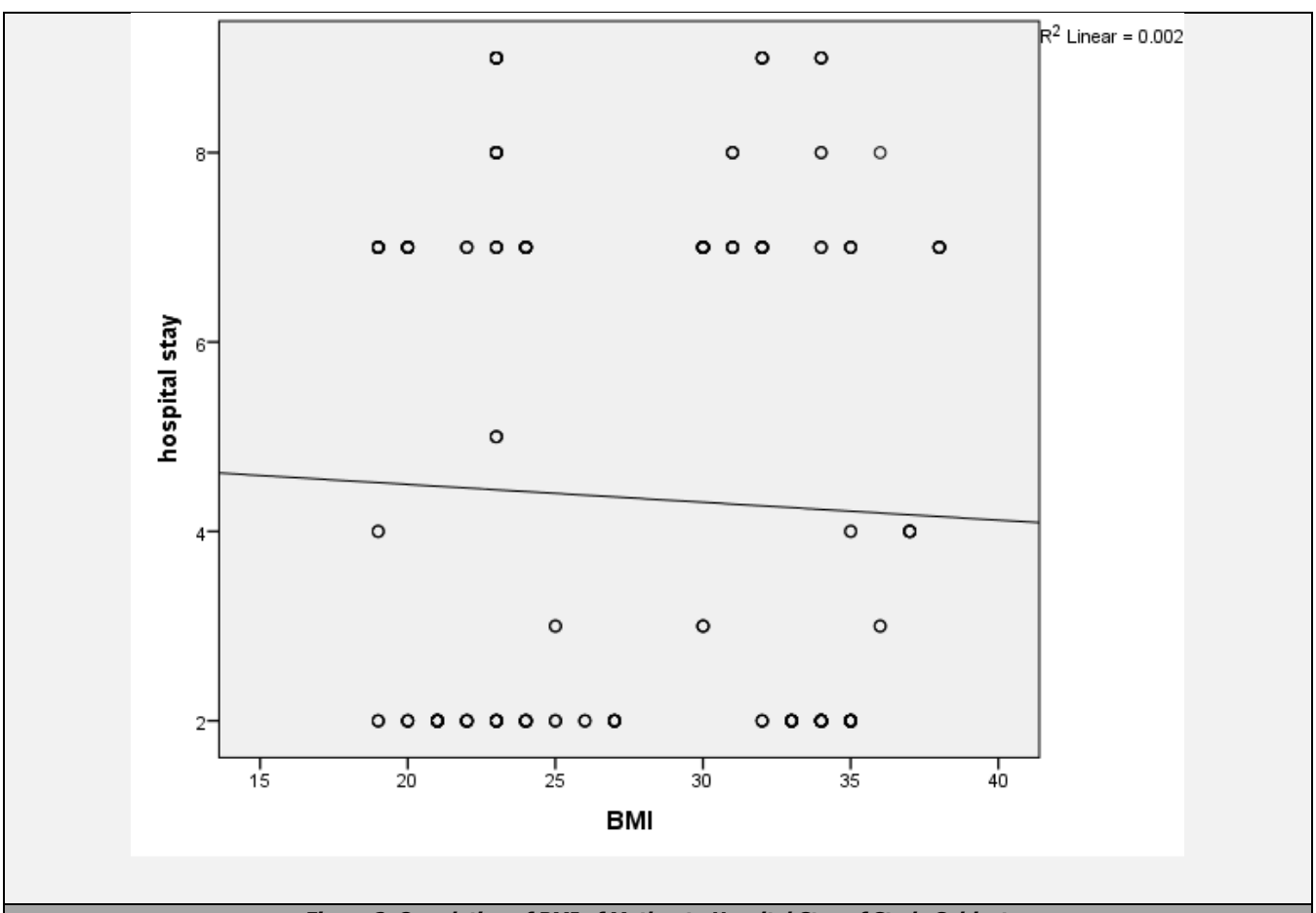

Figure 2. Correlation of BMI of Mother to Hospital Stay of Study Subjects

DISCUSSION

Lifestyle-related factors such as sedentary behaviour, maternal smoking/alcoholism, and late-term pregnancies are on the rise in today's world, negatively impacting pregnancy outcomes. Obesity, the most common of these, makes childbearing and childbirth more difficult, with long-term consequences. Obese patients may have a positive outcome with adequate antenatal and intranatal treatment.

The aim of this study was to see if there was an association between maternal obesity and the outcome of the pregnancy. Obesity has reached epidemic proportions around the world. It's becoming more widely accepted as a pregnancy risk factor. The average age of the mothers was 25.98 ± 3.92 years, with the youngest participant being 18

years old and the oldest being 35 years old. About 81.2 percent of the participants were under 30 years old. Study by Efan MA et al. (2021)[8] showed that the mean age of the women was 30.5 (6.1) years, study by Imran kutchi (2020)[4] showed that there was no difference in age distribution of both the groups, average maternal age in obese group was 26.55 years (SD 3.71) and in non-obese group, it was 26.44 years (SD 3.77) with P value > 0.05. Mendes MS and Matozinhos[9] recorded that minimum age was 15 years and maximum being 40 years with mean age being 27.5 years, which is almost 8 times coinciding with the present study while Goons et al.[10] obesity and overweight status were found to be significantly associated with age, women aged 31 and above were more likely to be obese which is not coinciding with present study where about 81.2 % participants were less than 30 years.

Obesity is becoming a global health issue that affects both mother and child's health. Prior to pregnancy, the target should be to lose weight as much as possible. All pregnant women should have their BMI measured, preferably using their pregnancy weight, as women with a BMI over 30 are considered to be at higher risk. 49.2 percent of mothers were obese having BMI 30 and above, 6.4 percent of study participants were underweight whereas 44.4 percent of the mothers had a typical BMI of 18.5 - 24.9. Imran et al. in their study revealed that the average BMI in the obese group was 29.16 kg/m2 (SD 3.74), while it was 22.05 kg/m2 in the non-obese group (SD 2.04).

Study by Sujit Pandey et al.[11] (2018) showed that among 55 cases, 27 fall under obesity class 1, 11 ladies with complication and among 28 ladies under obesity class 2, 22 had complication. Study by Nadia Adwani et al.[12] Two-thirds of women were in class 1 obesity (BMI 30 - 34), while 7.5 % of them in obesity class 3 (BMI more than 40). This may be because they have selected only obese subjects in their study.

Obesity raises the likelihood of both elective and emergency caesarean delivery, and the risk grows as the mother's weight rises. The increased risk of caesarean delivery is due to obesity-related pregnancy complications, macrosomia, and increased preterm birth. In present study, mothers who underwent caesarean section had BMI 27.36 ± 5.768. For normal vaginal delivery mothers, it was 27.94 ± 6.076, On ANOVA test, we found that there is statistically no significant association between BMI and mode of delivery with F value of 1.24 and P value of 0.29. Other study done on this topic such as Chauhan et al.[13] as compared to present study the caesarean section rate is slightly lower and rate of vaginal birth is higher in their series. While Mandal et al.[14] the rate of caesarean section in their study population was 36 % and the instrumental delivery rate was 12.32 %. Study by Junita et al.[15] shows, obese subjects remained at a higher risk for caesarean delivery than control (OR 1.98, CI 1.516 – 2.580, P < 0.001). In a study done by Salmon et al.[16] a higher ratio of caesarean section was found at a higher degree of obesity (obese I 37.2 %; obese II 43.4 %; and obese III/morbid 52.2 %).

The endocrine role of adipose tissue may be one reason for this result. Hormones produced by adipose tissue, such as leptin and adiponectin, are essential in metabolism, inflammatory responses, and mediating insulin-related tissue interactions. Obese women secrete different hormones than women with a normal BMI (adiponectin secretion is lower in obese patients, angiotensin and tumour necrosis factor (TNF) - are higher and can cause high blood pressure and thrombosis, and higher leptin secreted from adipose tissue can affect placental secretion). Endothelial dysfunction, leads to worse obstetric results such as preeclampsia and foetal distress, two of the most common causes of preterm labour and/or caesarean delivery.

In this current research, there is mild correlation of BMI of mother to the birth weight of baby. On applying regression analysis, we found mild correlation with R square 0.134. Study by Junita et al.[15] shows babies born from subjects in this study had birth weight within the normal range, albeit slightly larger than the population.

Total 4 children had APGAR score less than 7 out of which 2 had normal BMI whereas rest 2 had BMI above 25. On comparing the two groups we found that chi square was 0.05 with P value of 0.82 with no significant association between BMI of the mother and APGAR score of baby. Study by Junita et al.[15] showed (average APGAR score of infants at minute 1 in our study was 8 (0 – 9) and at minute 5 was 9 (0 – 10). In the Hung and Hsieh study, the same trend was also found with only 6 out of 267 babies (2.2 %) who had an APGAR score < 7 at minute 1, while at minute 5, there were no babies with an APGAR score < 7.[13]

In the present study, out of 250 study subjects, only 35 children needed NICU admission whereas rest 215 study subjects did not need NICU admission. Out of 35 children who needed NICU admission, 21 children were obese having BMI 30 and above whereas rest 14 children had BMI in normal range i.e. 18.5 - 24.9. Out of 215 children who did not need NICU admission, 97 children had normal BMI whereas 118 children had BMI above 25. On comparing the two groups we found that chi square was 0.05 with P value of 0.82 with no significant difference. Study by Sujit pandey et al. [11]showed that among the study population, 56.36 % had complications. There was statistically significant difference observed between maternal obesity and fetal complications. Study by Imran Kutchi et al.[4] showed that there was a significant increase in risk among obese mothers compared to non-obese mothers for foetal and perinatal complications like miscarriages {OR 4.85, (95 % CI 1.02,23.03)}, and neonatal intensive care unit admissions {OR 3.26, (95 % CI 1.21,8.75) study by Jessica et al.[17] Using data from 196,670 participants within 25 cohort studies, the absolute risk for any adverse outcome, that is, the presence of 1 or more of pre-eclampsia, gestational hypertension, GDM, caesarean delivery, preterm birth, SGA or LGA increased across pre-pregnancy BMI, which was largely independent of gestational weight gain (GWG). The lowest absolute risks were found for women who had a low to normal BMI $\leqslant$ 25 kg/m2, with a moderate to high GWG, whereas higher absolute risks were found for women with a BMI $\geqslant$ 30 kg/m2 and high GWG.

In our present study, we found no correlation of BMI of mother to the hospital stay of their children. On applying regression analysis, we found R square of 0.002 with no correlation. Other study done on this topic such as study by Mamun AA et al.[18] showed multivariable analyses for the

association of pre-pregnancy BMI categories with length of postnatal hospital stay in the age adjusted model, concluded that an obese mother approximately stayed for 0.30 (0.10, 0.49) days longer in hospital postnatally compared to mothers with a healthy BMI. Adjustment for potential confounders or mediators, especially adjustment for pregnancy complications and caesarean delivery, reduced the association between obesity and adverse pregnancy outcome.

CONCLUSIONS

There is no significant association between obesity and numerous maternal and perinatal risks in obese pregnant women but it poses a considerable challenge to the obese patients in successful completion of pregnancy. In addition, massive obesity among women of child bearing age is associated with a number of health risks later in life. This stresses the importance of concentrating on trying to reduce the increasing incidence of obesity in fertile women.

Data sharing statement provided by the authors is available with the full text of this article at jebmh.com.
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