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IMPACT OF MATERNAL BODY MASS INDEX [BMI] ON NEONATAL BIRTH WEIGHT [BW]

Physiology

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ABSTRACT

Background: Birth weight (BW) of infant's is an important determinant of well-being. Several factors such as mother's sociocultural, demographic, education, pre-pregnancy body mass index (BMI), and gestational weight gain contribute to BW.

Aim: To study the impact of maternal BMI to the BW of their babies

Methodology: A 'prospective observational study. Total 120 women, aged 20-40 years, with singleton gestation and uncomplicated pregnancies were consecutively recruited during the antenatal visit before 8 weeks of gestation and followed till delivery. Relevant socio-demographic data including the BMI and BW of the Neonates were recorded using a structured questionnaire. Data was analyzed using SPSS version 21.

Results: Pregnant females were enrolled in the study with mean age 28.27±4.82 years. Mean BMI at first visit, 25.11+4.35 kg/m2. Mean birth weight of babies delivered, 2.50±0.57 kg. There was a significant correlation between maternal BMI at their first visit to the BW of the neonates ($P < 0.001$). showing that maternal BMI is directly related to the neonatal BW.

Conclusion: study shows a significant impact of maternal BMI on BW of the neonates

KEYWORDS

Birth weight; maternal body mass index; gestational weight gain

INTRODUCTION

The continuum of overweight and obesity is now the most common complication of pregnancy in many developed and some developing countries. In the United Kingdom, 33% of pregnant women are overweight or obese.[1]In India, 8% of pregnant women are obese and 26% are overweight.[2] low birth weight [3] is the leading cause of neonatal mortality and morbidity and childhood morbidity .[4]

Both pre-pregnancy body mass index (BMI) and gestational weight gain (GWG) are associated with the outcome of pregnancy. A large body of data links a high pre-pregnancy BMI with a number of fetal and maternal complications, including fetal death, preeclampsia, gestational diabetes, macrosomia, and complicated deliveries.[5] GWG has also been thoroughly studied as a predictor of adverse pregnancy outcomes. Low gain is associated with birth of a small-for-gestational age (SGA) infant[6] and preterm birth, whereas high gain is associated with greater risks of macrosomia[7], cesarean section[8], and excess postpartum weight retention.[9] In particular, it has been suggested that obese women may benefit from low GWG[10]. However, understanding these associations is also complex, because both BMI and GWG are closely linked to lifestyle factors, diseases, and genetic traits that are also correlated with the outcome of pregnancy. This in turn is found to influence the neonatal outcomes such as perinatal mortality, macrosomia, and congenital anomalies. [11,12] In addition, maternal obesity leads to higher cesarean sections and increased risk of anesthesia.

Birth weight (BW) is perhaps the most important and reliable indicator for neonatal and infant survival as well as their physical growth and mental development. It is the first weight of the fetus or newborn obtained after birth, preferably measured within the 1st hr. of life before significant postnatal weight loss has occurred. As a universal indicator, BW can be used to measure the health, nutrition, and socioeconomic status of population.[13] Several factors such as mother's genetic characteristics, sociocultural, demographic, behavioral factors, high body mass index (BMI), and gestational weight gain among others contribute to BW. Young maternal age, low maternal BMI, and poor weight gain in pregnancy are associated with both increased risk of low BW (LBW) and poor infant survival.

There are several studies which are showing that increase BMI is associated with high birth weight, whereas some studies are also available showing that higher BMI is associated with low birth weight. This study was performed to find out the impact of BMI of pregnant females on birth weight, in northern Indian population.

METHODOLOGY

The study was carried out at department of Physiology and antenatal clinic of the department of Obstetrics and Gynecology, King George's Medical University, Lucknow. A prospective observational study that involved pregnant women in the first trimester of pregnancy with singleton gestation as confirmed by ultrasound.

The calculated sample size was 62. However, to increase the power of the study, the maximum sample size was increased by 83. The women were counseled and written consent was obtained. A structured interviewer-administered questionnaire was filled for all the participants, to obtain information on age, educational status, parity, occupation, ethnic group, gestational age, and cell phone numbers. The height and baseline weight were measured for each woman, and BMI (kg/m2) was calculated at booking, and at subsequent visits. The weight was measured using a portable scale with minimal clothing and without footwear after correcting for zero error. The height was measured with the rigid stadiometer.

The women were categorized into four sub-groups according to their 1st trimester BMI as follows: Underweight (<18.5 kg/m2), Normal weight (18.5-23.0 kg/m2), Overweight (23.1-25.0 kg/m2), Obese (>25 kg/m2). The group with normal BMI (18.5-23.0 kg/m2) was used as the reference group for the analysis. The patients were followed up to

delivery, and the BW of the babies was recorded. The neonates were weighed immediately after delivery and length was measured with infantometer. The women who had a stillbirth and pregnancy complicated by hypertension, diabetes, and multiple pregnancies were excluded from the study. Furthermore, patients with chronic illnesses, or who were chronic alcoholics were also excluded from the study. The BWs of the neonates were classified as ≤2 kg, 2.01-2.50 kg, 2.51-3.50 kg, >3.50 kg. Data entry and analysis were done using SPSS, version21

RESULTS

At the time of enrollment in the study, all the pregnant females were in the age group (range 20-40 years) with mean age, 28.27±4.82 year, Range of height, weight and BMI of the females enrolled in the study ranged from 139-165 cms, 40-80 kgs, 16.65-36.73 kg/m2 respectively while mean values of above anthropometric variables were 149.07+5.64 cms, 55.46+8.29 kg and 25.11+4.35 kg/m2.

Table 1: Demographic Profile of Mothers enrolled in the study (n=83)

SN	Characteristics	Mean ±SD;(range)
1.	Mean Age ± SD,(Range) in years	28.27+4.82 ;(20-40)
2.	Mean Height ±SD, (range) (cm)	149.07+5.64 ;(139-165)
3.	Mean Weight ±SD, (range) (kg)	55.46+8.29; (40-80)
4.	Mean BMI ±SD, (range) (kg/m2)	25.11+4.35 ;(16.65-36.73)

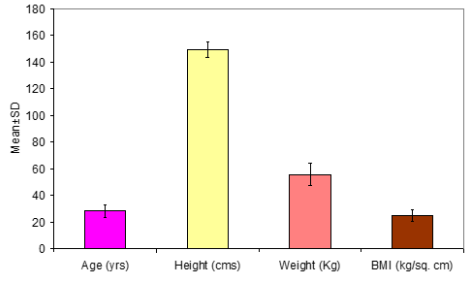

Fig. 1: Bar Diagram depicting mean age, height, weight and BMI of study population

Majority of the females enrolled in the study were Obese & overweight (43+10) i.e. (63.8%), as per criteria for Asian population. Only 4 (4.8%) females were Underweight and rest 26 (31.3%) were normal weight. Mean maternal weight of pregnant females at enrolment was 55.46±8.29 kg which on second visit increased to 58.58±7.92 kg and on third visit to 62.18±7.60 kg.

Table 2: Maternal Weight at enrolment and different follow-up intervals during pregnancy

SN	Time interval	Mean	+SD	Min	Max
Maternal Weight (kg)					
1.	At enrolment (before 8 wk)	55.46	8.29	40	80
2.	At second visit (20wk)	58.58	7.92	43	82
3.	At third visit (32wk)	62.18	7.60	47	85

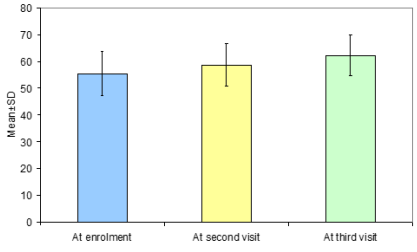

Fig. 2: Maternal Weight at enrolment and different follow-up intervals

Among the 83 mothers that delivered ≤2 kg (18, 21.7%), 2.01-2.50 kg (33, 39.8%) ,2.51-3.50 kg (28,33.7%) ,>3.50 kg (4,4.8%)18 (21.7%) .

Table 3:Association of Maternal BMI with neonatal birth weight

Variable	Under weight (n=4)		Normal weight (n=26)		Over-weight (n=10)		Obese (n=43)		Statistical significance	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	'F'	'p'
Birth weight(kg)										
<2	0	0.0	3	11.5	2	20.0	13	30.2	30.5	<0.001
2.01-2.5	3	75.0	3	11.5	8	80.0	19	44.2		
2.51-3.5	1	25.0	17	65.4	0	0.0	10	23.3		
Variable	Under weight (n=4)		Normal weight (n=26)		Over-weight (n=10)		Obese (n=43)		Statistical significance	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	'F'	'p'
>3.5	0	0.0	3	11.5	0	0.0	1	2.3		

Mean birth weight of babies delivered to the pregnant females enrolled in the study was 2.50±0.57 kg. Birth weight of majority of the babies was ≤2.50 kg (n=51; 61.5%).

There was significant association (P<0.001) found between high maternal first trimester BMI and the delivery of LBW neonates (<2.50kg). Furthermore, average weight mothers delivered significantly larger neonates compared to mothers of higher weight as shown in Figure 3. This was found to be statistically significant with Analysis of Variance F value 30.56, P < 0.001.

DISCUSSION

The mean BMI of the pregnant women 25.11+4.35 kg/m2 suggests a tendency towards obesity. An important finding in this study is a high rate of obesity (BMI >25 kg/m2) within the reproductive age group. Mean birth weight of babies delivered to the pregnant females enrolled in the study was 2.50±0.57 kg. Birth weight of majority of the babies was ≤2.50 kg (n=51; 61.5%). Proportion of neonates with birth weight >2.5 kg was significantly higher among normal weight females (76.9%) as compared to Underweight (25.0%), Overweight (0.0%) and Obese (25.6%). There was a significant association between high 1st trimester maternal BMI and the delivery of LBW neonates (P < 0.001). Furthermore, the incidence of LBW neonates (LBW i.e., <2.50kg) was higher in overweight and obese subjects than the average weight women.

In a study 14 corroborate with our study, stress levels are significantly higher in the overweight and obese mothers than in the mothers who are underweight or normal weight. They found that weight gain during pregnancy in the overweight and obese groups was significantly lower than in the underweight and normal groups, due to increased level of stress. In their study, they found that the average duration of pregnancy in obese mothers was significantly shorter than the average duration of pregnancy in mothers of normal weight, leading to high rates of preterm and LBW delivery in the obese group.

Whereas a study15 which is not in concordance with the present study found that underweight women gaining less weight than recommended were shown to be at two-fold risk of delivering low birth weight infants. Their results showed that though the risk for low birth weight in underweight women was high, it was not statistically significant. Due to increased systemic inflammation and placental insufficiency there is low weight gain in case of overweight and obese women.

CONCLUSION

Increasing BMI is associated with greater risk of pregnancy complications. Obese women had the highest rate whereas normal weight women had the less chance of low-birth-weight rate. Normal weight women had the lowest risk of both cesarean deliveries and low-birth weight deliveries.

LIMITATIONS

Due to small sample size of this study, the results could not be

authenticated for height, weight, waist circumference, hip circumference and birth weight of baby. Hence, more studies are required with larger sample size from different cross sections of society to determine the co-relation of above parameters with BMI, and the exact cut-off values of these parameters. This information may be helpful in future for screening of pregnant females with high risk of maternal and neonatal outcomes

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