Association of Body Mass Index in Early Pregnancy and Perinatal Outcome among Mothers Attending a Maternity (Christian) Hospital in Berhampur, Odisha: A Hospital Based Prospective Study

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Abstract
Background: *The outcome of pregnancy of mothers and the fetal outcome are influenced by maternal body mass index.*
Objective: *To study association of maternal BMI in early pregnancy with perinatal outcome.*
Method: *A hospital based prospective study was carried out in Christian Hospital Berhampur, Odisha. Total 210pregnant women who were in the first trimester of pregnancy were interviewed using a pre designed pretested questionnaire. Data on socio-demographic characteristics were collected and BMIs in the 1st trimester were calculated. The cases were followed-up till their delivery to note the perinatal outcomes. Data analysis was done by using appropriate statistical methods.*
Result: *Out of total, 23.8% were underweight, 10.5 % each were overweight and obese. The mean birth weight of newborns was 2.38kg in underweight mothers and 3.84kg for obese mothers. The mode of delivery was by LSCS in 63.6 % of obese women and 59.1% of overweight women. A significant association was observed between maternal BMI and mode of delivery (P=0.021), also between BMI and perinatal outcomes like admission into NICU &birth weight of baby (P<0.001).*
Conclusion: *Maternal BMI was associated with adverse maternal and pregnancy outcomes. Mothers with a BMI below normal had LBW babies and when BMI was above normal it was associated with delivery by LSCS and macrosmia in newborns. Thus it necessitates the importance of nutritional counselling in pre pregnancy period.*
Keywords: *Maternal, BMI, Obese, Perinatal Outcome, NICU.*

Introduction

Nutritional status of a women in her pregnancy is one of the main modifiable factors influencing pregnancy and perinatal outcome[1]. Weight gain in pregnancy is directly related to the birth weight of the foetus. Maternal malnutrition is the most important underlying determinant factor in adverse maternal and foetal outcome. In our country, due to extreme socio-economic status pattern underweight and obesity are prevalent among pregnant women.

An important predictor of the nutritional status of a pregnant mother is the Body Mass Index (BMI). The normal growth and development of the foetus

is dependent on many factors[2]. The low maternal BMI is associated with increased risk of abortions and intrauterine growth restriction, which may further cause low APGAR (Appearance, Pulse, Grimace, Activity, and Respiration) scores and increased prenatal deaths. Both lean and obese women carry a risk for adverse pregnancy outcome, therefore pregnant women should maintain a normal BMI to achieve a healthy pregnancy outcome[3]. Indeed, a low BMI and suboptimal weight gain during pregnancy are long-recognized risk factors for the delivery of infants too small for gestational age[4]. Booking BMI is of clinical interest since obese pregnant women face far greater risks of pregnancy complications like preeclampsia, gestational diabetes and macrosomia[5].

In pregnancy, BMI is calculated using pre pregnant weight. If this is unknown, the first weight measurement at prenatal care is used. The BMI is a simple index of the weight-for-height and it is calculated by dividing a person's weight in kilograms by the square of their height in meters (kg/m2). Maternal nutrition is a modifiable risk factor of public health importance that can be integrated into efforts to prevent adverse birth outcomes, particularly among economically developing/low-income population[6].

With this background, the present study was conducted with an objective to study the association of BMI in early pregnancy with perinatal outcome.

Material and Methods

The study was conducted in Christian Hospital Berhampur, Odisha from October 2016 –April 2017. Pregnant women attending the ante-natal clinic of the hospital for ante-natal check-up (ANC) who were in the first trimester of pregnancy and had planned to deliver in the same hospital were included in the study. A total of 365 ante natal cases formed the study population out of which 155 cases were excluded during follow up due to reasons like abortion, PIH, gestational diabetes, multiple pregnancy and those who did not come to same hospital for delivery. The final sample size was 210. The study participants were followed up till their admission into the labour room for delivery in the hospital.

The study was undertaken after taking ethical clearance from Institutional Ethics Committee. Permission was taken from the authorities before the start of the study. Informed consent was taken from all the study participants. All the participants were interviewed using a pre-designed pretested questionnaire. Gestational age was calculated from the last menstrual period. Data on socio-demographic characteristics was collected. After delivery in the hospital, the mode of delivery was noted along with the variables for fetal outcome such as birth weight of baby and admission into Neonatal Intensive-Care Unit (NICU) were recorded. All the women included in the study were counselled for attending ante natal clinics for follow- up visits as per schedule. All the babies were examined for any congenital anomalies.

BMI was calculated by using WHO formula[7] (weight in kg/height in meter2) and cases were classified into four groups accordingly.

The cases were classified as:

Underweight: BMI <18.5kg/m2

Normal: 18.5-24.9kg/m2

Overweight: 25-29.9kg/m2

Obese: >30kg/m2

The collected data was entered into Microsoft Excel & analysed using statistical package for social sciences (SPSS) version 16 software. To test the association Chi-square test was used for categorical variables and $P < 0.05$ was considered statistically significant.

Results

Table-1. Socio-demographic characteristics of study population:

Factors	number	%
Age of mothers in years		
<20	38	18.1
21- 30	106	50.5
31- 40	66	31.4
Residence		
urban	98	46.7
rural	112	53.3

Religion		
Hindu	112	53.3
Christian	63	30.0
Muslim	35	16.7
Education		
Primary or below	48	22.9
secondary	88	41.9
Higher secondary and above	74	35.2

Out of total 210 women, more than 50 % were in the age group 21-30 years. 18.1% were less than 20 years old. About 53 % came from rural areas. Majority (53.3%) were Hindus. Regarding education, 22.9% were educated up to primary or below, 40.9% secondary and 35.2% higher secondary and above [Table-1].

Figure-1. Distribution of study population according to BMI
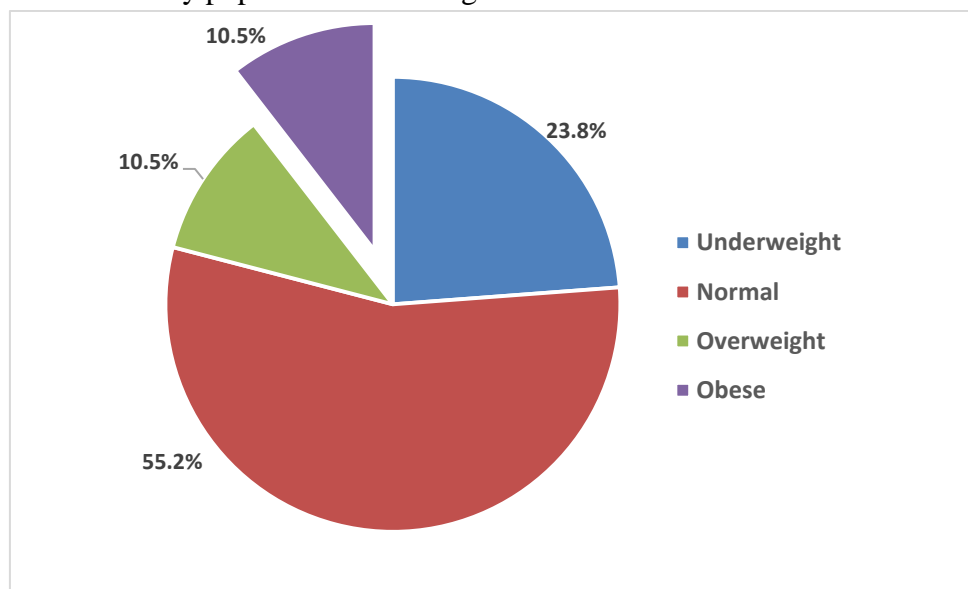
Among the study population, 55.2% had normal BMI, 23.8% were under weight, 10.5 % each were overweight and obese [Figure-1].

Table-2. Distribution of 1st trimester maternal BMI and new-born birth weight.

BMI	Underweight	Normal	overweight	Obese
	<18.5	18.5- 24.9	25- 29.9	30 or more
Birth weight(kg) (Mean± SD)	2.38±0.45	2.86±0.52	3.37±0.59	3.84±0.76

The mean birth weight of babies born to mothers having a normal BMI was 2.86±0.52kg. However the mean was 2.38kg in underweight mothers and 3.84kg for obese mothers [Table-2].

Table-3. Association of maternal BMI with Mode of delivery

Mode of delivery	Underweight	Normal	Overweight	Obese	Total (210)	P- value
	Number (%)					
NVD	21(42.0)	37(31.9)	2(9.1)	4(18.2)	64	
Assisted	16(32.0)	30(25.9)	7(31.8)	4(18.2)	57	0.021*
LSCS	13(26.0)	49(42.2)	13(59.1)	14(63.6)	89	

The mode of delivery was by LSCS in 63.6 % of obese women and it was 59.1 % of overweight women. The association between BMI and mode of delivery was found to be statistically significant (P=0.021) [Table-3].

Table- 4. Association of maternal BMI with fetal outcome

Perinatal outcome	Underweight	Normal	Overweight	Obese	Total (210)	P- value
	Number (%)					
NICU admission						
No	48(25.8)	108(58.1)	18(9.7)	12(6.5)	186	
Yes	2(8.3)	8(33.3)	4(16.7)	10(41.7)	24	<0.001*
Birth weight of baby						
<2.5 kg	12(24.0)	32(64.0)	4(8.0)	2(4.0)	50	
2.5- 3.9 kg	38(25.3)	82(54.7)	16(10.7)	14(9.3)	150	<0.001*
4 kg or more	0(0)	2(20)	2(20)	6(60)	10	

A significant association was observed between perinatal outcomes such as NICU admission and birth weight of baby and maternal BMI. As shown in the table-4, 41.7% of the new born babies who got admitted to NICU were delivered from obese mothers. Similarly 60% of the babies having birth weight of 4kg or more were having obese mothers [Table-4].

Discussion

The present study was conducted to study the association between early pregnancy BMI and perinatal outcome.

The mean birth weight of babies born to mothers having a normal BMI was more than the mean birth weight of babies in underweight mothers. Underweight mothers tended to have more LBW babies. In a study by Kader et al similar findings were obtained where it was seen BMI < than 18.5 was a predictor of LBW babies[8]. Han et al in a systematic review and meta-analyses observed that that singletons born to underweight women have higher risks of preterm birth (overall, spontaneous and induced) and LBW than those born to women with normal weight[9]

BMI provides a reliable indicator of body fat for most people and is used to screen for weight categories that may lead to problems[7]. It is an inexpensive and easy-to-perform method of screening for weight category, for example under-weight, normal or healthy weight, overweight, and obesity[10]. The critical relevance of mothers nutritional status was emphasized by the fact that in all the EAG including Assam state, mothers who were underweight were more likely to have LBW babies than normal weight[11].

The mode of delivery in the present study was by LSCS in 63.6 % of obese women and it was 59.1 % in overweight women. The association between BMI and mode of delivery was found to be statistically significant. The risk of caesarean section increased from 30.9% in women with BMI < 25 to 56.9% in women with BMI ≥ 35 in a study among nulliparous women which was according to the researchers attributable to a variety of factors, including delay in the first stage of labor, unsuccessful induction of labor, fetal macrosomia, fetal distress and the obstetrician's decision[12]. A prior study conducted by Mantakas et al on overweight nulliparous women also showed that the cesarean section rate rose from 18.2% in women with a normal BMI (20 to 25) to 40.6% in the morbidly obese women (BMI > 40). Increasing degrees of obesity was associated with increase in the incidence of caesarean section, fetal birth weight and adverse pregnancy outcomes[13].

A significant association was observed between perinatal outcomes like NICU admission and birth weight of baby and maternal BMI. It was found that 41.7% of the new born babies who got admitted to NICU were delivered from obese mothers. Babies having birth weight of 4kg or more were more common in obese mothers. Other studies also corroborated this finding[3]. Earlier studies show that pregnancies amongst overweight or obese women are more likely to result in fetal distress, low APGAR scores large birth weight infants[14]. There was higher incidence of NICU admissions in babies of overweight and obese mothers and the reasons for admissions were weak cry, nasal flaring, grunting, chest retraction and

transient tachypnea. Dereure et al in their study also observed that the admission rates of babies born to overweight mothers had a higher rate of admission to neonatal intensive care units[15].

Conclusion

Maternal BMI was associated with adverse pregnancy outcomes in women. Mothers with a BMI below normal had LBW babies and when BMI was above normal it was associated with delivery by LSCS and macrosmia in newborns. This necessitates the importance of nutritional counselling in pre pregnancy period for a normal BMI especially in the first trimester.

Acknowledgements

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