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RESEARCH ARTICLE

A study of body mass index in pregnancy and its correlation with maternal and perinatal outcome

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ABSTRACT

Objective: The aim of this study is to correlate the body mass index (BMI) in pregnancy with maternal and perinatal outcome. **Method**: The present study was conducted in 100 women attending antenatal outpatient department (OPD) from January 2015 to June 2016. The above women were placed in standard BMI categories and their obstetric and perinatal outcome variables were evaluated. **Results**: In this study we observed, increased rate of lower segment caesarian section (LSCS) (41.67%), hypothyroidism (12.5%), gestational diabetes mellitus (20.83%) and gestational hypertension (20.83%) with high BMI group compared to normal. Increased rate of anemia was observed with underweight group (56.25%). The rate of neonatal intensive care unit (NICU) admission was more (37.5%) in underweight group compared to normal (8.34%). **Conclusion**: High BMI is associated with increased incidence of hypothyroidism, gestational diabetes mellitus, gestational hypertension, instrumental delivery and caesarean delivery. There is a significant association of underweight BMI with anemia and low birth weight.

Keywords: BMI, obesity, high BMI, underweight.

Excessive weight is a major health problem in all affluent societies. Obesity continues to rise in prevalence around the globe. The global epidemic of obesity continues to grow at an alarming rate, crossing boundaries of age, race and gender. Indeed, it is now so common that it is replacing the more traditional public healthcare concerns like under nutrition and infectious disease as one of the most significant contributors to ill health [1]. The prevalence of obesity is increasing in pregnancy[2], and has prompted the American College of Obstetricians and Gynecologists (ACOG) to recommend that the body mass index (BMI) should be recorded for all women at the initial prenatal visit, and that information concerning the maternal and fetal risks of a very elevated BMI in pregnancy should be provided[3]. WHO in 2009 announced obesity in pregnancy as one of the important non communicable diseases that threaten maternal and child health [4].

Maternal obesity has been associated with adverse perinatal outcomes. Obese pregnant women are at increased risk of gestational diabetes, preeclampsia, infection, operative vaginal delivery, and caesarean delivery[5-9]. They are also at increased risk for wound infection and endomyometritis[10]. Their offspring are at

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increased risk for birth defects, macrosomia, and morbidity associated with subsequent childhood obesity [9,11,12]. In developing country like India, they also face problem of malnutrition and complications related to underweight like anemia, premature rupture of membranes, low APGAR scores, low birth weight babies, preterm delivery and increased perinatal mortality [13-15]. National health goals stated that goal of healthy people 2000 was to reduce the prevalence of overweight people to 20 percent or less by the end of the 20th century. This goal was not achieved, but by 2000, more than half of the population became overweight[16]. These emphasize the need for the present study. The purpose of this study is to correlate the BMI in pregnancy with maternal and perinatal outcome.

Materials and Methods

It was a prospective observational study conducted on 100 pregnant women attending antenatal outpatient at ESIC MC PGIMSR, Bengaluru from January 2015 to June 2016 who fulfill inclusion and exclusion criteria.

Inclusion criteria: 1) Age of 18 – 35 years, 2) Singleton pregnancy, 3) Spontaneous conception, 4) 1st trimester visit for confirmation of pregnancy.

Exclusion criteria: 1) Women with multiple pregnancies, 2) Women with chronic diseases such as hypertension, diabetes, thyroid disorder and bronchial asthma, 3) Women with previous cesarean section, 4) Women with uterine and fetal congenital anomalies. Women were informed about the study and purpose of study in detail. A detailed history regarding name, age, and obstetric score were taken. Estimated gestational age were calculated based on the last menstrual period and 1st trimester ultrasound studies. Baseline weight and height were recorded during the initial visit in the first trimester and the basal BMI was calculated using the formula weight in kilograms divided by height in meters square[kg/m^2]. The above women were placed in standard BMI categories and patients were followed up throughout the pregnancy and the obstetric and neonatal outcome variables were evaluated. Any abnormal observations or if the patient developed any complication at any time of the study it was documented. Management of the complication was implemented. Statistical analysis was done using SPSS version 17. Categorical variables were reported using number and percentages. P value <0.05 was considered statistically significant.

The BMI is a simple index of the weight-for-height and it was calculated by dividing a person's weight kilograms by square of their height in meters [kg/m^2]. The women were categorized into four groups according to their BMI as per WHO classification (Table 1).

Table 1: BMI (WHO Classification)

Groups	BMI
Underweight (group 1)	less than or equal to 18.5kg/m^2
Normal (group 2)	>18.5 -24.9 kg/m^2
Overweight (group 3)	25-29.9 kg/m^2
Obese (group 4)	30-34.9 kg/m^2

Results

In this study we observed normal BMI: 36% (n=36), underweight : 16% (n=16), overweight : 38% (n=38) and obese BMI: 10% (n=10). Majority of study population 66% (n=66) were in the age group between 23 – 29 years (table 2). Most of women 68% (n=68) in study were primigravida (table 2). Among 36 women with normal BMI, 2.77% (n=1) had hypothyroidism, out of 38 women with overweight 7.8% (n=3) had hypothyroidism, out of 10 women with obese BMI 30% (n=3) had hypothyroidism (table 3). The overall incidence of hypothyroid in our study was 7%. Increased rate of hypothyroidism was seen in obese 30% (n=3) and overweight 7.8% (n=3) compared to normal 2.77% (n=1).

Table 2: Distribution according to age and parity

Variables		Under weight No (%)	Normal N (%)	Overweight N (%)	Obese N (%)	Total N (%)
Age in years	18-22	3(18.75%)	7(19.44%)	9(23.68%)	2(20%)	21
	23-29	9(56.25%)	26(72.22%)	25(65.78%)	6(60%)	66
	30-35	4(25%)	3(8.33%)	4(10.52%)	2(20%)	13
	Total	16	36	38	10	100(100%)
Parity	Primi	6(37.5%)	27(75%)	28(73.68%)	7(70%)	68
	1	8(50%)	6(16.66%)	7(18.42%)	2(20%)	23
	2	2(12.5%)	3(8.34%)	3(7.89%)	1(10%)	9
	Total	16	36	38	10	100(100%)

Table 3: Maternal outcome with each BMI category

Variables	Hypothyroid N (%)	GDM N (%)	GHTN N (%)	Anemia N (%)
Under weight	0 (0%)	0(0%)	0(0%)	9(56.25%)
Normal	1(2.77%)	3(8.34%)	3(8.34%)	10(27.77%)
Over weight	3(7.89%)	7(18.42%)	7(18.42%)	6(15.78%)
Obese	3(30%)	3(30%)	3(30%)	1(10%)

P value of 0.015 signifying that in obese and overweight groups there was statistically significant increase in incidence of hypothyroidism.

Similarly, among 36 women with normal BMI, 8.34% (n=3) had gestational diabetes mellitus (GDM), out of 38 women with overweight 18.42% (n=7) had GDM and out of 10 women with obese BMI 30 % (n=3) had GDM (table 3). The overall incidence of GDM in present study was 13%. Increased rate of GDM was seen in obese 30% (n=3), overweight 18.42% (n=7) compared to normal 8.34% (n=3) (P-Value: 0.084). So, statistically significant increase in incidence of GDM was observed in high BMI groups.

In case of blood pressure, 36 women with normal BMI, 8.34% (n=3) had gestational hypertension (GHTN), out of 38 women with overweight 18.42% (n=7) had GHTN, out of 10 women with obese BMI 30% (n=3) had GHTN (table 3). Thus the overall incidence of gestational hypertension in present study was 13% and increased rate of GHTN in obese 30% (n=3), overweight 18.42% (n=7) compared to normal 8.34% (n=3). P value of 0.084 signifying that there was statistically significant increase in incidence of GHTN in high BMI group.

Table 4: Mode of delivery with each BMI category

Mode of delivery	VD	LSCS	INS	Total
Under weight	14(87.5%)	2(12.5%)	-	16
Normal	29(80.55%)	6(16.66%)	1(2.77%)	36
Over weight	22(57.89%)	14(36.84%)	2(5.26%)	38
Obese	1(10%)	6(60%)	3(30%)	10
Total	66	28	6	100

VD= Vaginal Delivery, INS= Instrumental

Among 16 women with underweight group 56.25% (n=9) had anemia, out of 36 women with normal BMI 27.77% (n=10) had anemia, out of 38 women with overweight 15.78%(n=6) had anemia, out of 10 women with obese BMI 10%(n=1) had anemia (table 3). The incidence of anemia in present study was 26%. Increased rate of anemia in underweight 56.25% (n=9) compared to normal 27.7% (n=10) (P-Value: 0.0114). In present study 66% of women had vaginal delivery, among them underweight group contribute 87.5% (n=14), normal group were 80.55% (n=29) and overweight were 57.89% (n-22). Among 28% of women with LSCS underweight group were 12.5% (n=2), normal group were 16.66% (n=6) and overweight were 36.84% (n=14) (table 4). Among 6% of women with instrumental delivery with normal BMI were 2.77% (n=1), overweight were 5.26 % (n=2), obese were 30% (n=3). Thus, significant increase in instrumental delivery as BMI increases (P-Value: 0.013) was observed. Increased rate of LSCS was seen in obese group 60% (n=6) and overweight group 36.84% (n=14) (P Value – 0.013). Increased rate of vaginal delivery in underweight group 87.5% (n=14) (P value 0.013). So, significant linear trend in the decrease in normal delivery as BMI increases was observed. In present study, majority of babies birth weight 40% (n=40) were in between 2.6 to 3 kg. Mean weight of babies in the study was 2.80 Kg (table 5). Study

Table 5: Neonatal outcome

Variables		Underweight N (%)	Normal N (%)	Overweight N (%)	Obese N (%)	Total N
Birth weight in Kg	<2.5	13(81.25%)	11(30.55%)	6(15.78%)	-	30
	2.6-3.0	3(18.75%)	19(52.77%)	15(39.47%)	3(30%)	40
	3.1-3.5	-	5(13.88%)	14(36.84%)	4(40%)	23
	≥3.6	-	1(2.77%)	3(7.89%)	3(30%)	7
	Total	16	36	38	10	100
APGAR Score at 5 minute	5-7	12(75%)	1(2.77%)	2(5.26%)	2(20%)	17
	≥ 8	4(25%)	35(97.22%)	36(94.73%)	8(80%)	83
	Total	16	36	38	10	100
NICU admission	None	10(62.5%)	33(91.66%)	37(97.36%)	10(100%)	90
	Yes	6(37.5%)	3(8.34%)	1(2.63%)	-	10
	Total	16	36	38	10	100

also shows that majority of underweight women were significantly associated with low birth weight, as BMI increases birth weight increases.

In case of APGAR score, 17% (n=17) score between 5-7, 83% (n=83) score > 8, average APGAR SCORE at 5 MINUTE was 8.43 (table 5). In this study, the NICU admission was 37.50% (n=6) in underweight, 8.34% (n=3) in normal and in high BMI 2.63% (n=1) with P value of 0.0002. So, there was statistically significant increase in NICU admission with low BMI.

Discussion

In present study, 100 singleton pregnant women attending antenatal OPD at ESIC MC PGIMSR Bengaluru were included who met the inclusion and exclusion criteria. They were divided into 4 BMI groups, out of 100 women, 16% (n=16) were in underweight group with BMI <18.5kg/m^2, 36% (n=36) were in normal group with BMI 18.5-24.9kg/m^2. Overweight group were 38% (n=38) with BMI 25-29.9kg/m^2 and obese were 10% (n=10) with BMI >30kg/m^2. Anjana Sharma[17] et al in their study found that 14.79% were in underweight and 51.78% belonged to the normal weight category, while 21.04% , 10.71% women were from the overweight, obese categories respectively. Yazdani[18] et al found that 12.8% were underweight, 41.2% were normal, 35.6% were overweight and 9.8% were obese.

In the present study hypothyroid was found in 7% (n=13), which correlates result of 6.5% in Sahu[19] et al , 7.4% in Taghavi[20] et al and 9% in Sapana et al [21]. Present study shows statistically significant increase incidence of hypothyroidism (P=0.015) as BMI increases. Boas Forman[22] et al and Mbah[23] et al also reported higher incidence of hypothyroidism with high BMI. In present study GDM was found in 13% (n=13) which correlates with 16.5% of Seshiah V[24] et al. Study done in TN[25] revealed that 17.8% GDM were in urban, 13.8% were in semi urban, 9.9% were in rural areas. Kumari[26] et al comparing obese and non obese found that GDM incidence was 24.5% in obese. Rajesh Rajput[27] et al found that 22% of GDM were in obese. In the present study 30% of obese patients had GDM. So, there was statistically increased incidence in GDM in high BMI.

In present study GHTN was found in 13% (n=13), among them 30 % (n=3) were in obese, 18.42 % (n=7) were in overweight and 8.34% (n=3) were in normal BMI group. So there was statistically significant increase in incidence of GHTN with rising BMI with P value of 0.084. Kumari[27] et al found 28.8% of GHTN in obese with 2.9% in the non obese with a significant correlation of high BMI with GHTN.

In this study anemia was found in 26% (n=26). Prevalence of anemia in developing countries is 33 – 75% as per WHO. Our study correlates with Emmanuel[28] et al (21.7%). In present study 56.25% (n=9) were in underweight, 15.78% (n=6) were in overweight and 10% (n=1) in obese women had anemia, shows statistically increase in incidence of anemia as BMI decreases with P value of 0.011. Qin Yu[29] et al in their study found inverse association between overweight, obese and anemia in Chinese women.

In this study 36.84% (n=14) of overweight, 60% (n=6) of obese and 16.66% (n=6) of normal BMI women were undergone LSCS. So there was statistically significant increase in LSCS as BMI increases with p value of 0.0131. Poobalan[30] et al in their study found that incidence of LSCS was higher in overweight or obese women than with normal BMI. Jang DG[31] et al in his study revealed similar type of findings. In present study, there was significant increased in instrumental delivery in high BMI cases. Johnson[32] et al also stated that obesity causes increased incidence of operative vaginal deliveries.

In present study 30% of babies had weight <2.5kg, 40% of babies with weight 2.6-3kg, 23% of babies with weight 3.1-3.5 kg and 7% of with weight >3.6 kg. In our study lower BMI was significantly associated with low birth weight and as BMI increases there was increase in birth weight of baby, correlating with studies of Frederick[33] et al.

The average APGAR SCORE at 5 min was 8.44. Present study failed to establish a significant correlation between BMI and APGAR score. This corresponds with Tatiana Papazian[34] et al who found similar findings that pre-pregnancy BMI was not predictor of poor APGAR.

In this study 37.5% (n= 6), 8.34% (n=3) and 2.63% (n=1) were in underweight, normal and overweight group baby required NICU admission respectively which shows significant increase in NICU admission as BMI decrease and it correlates with the study of Kalk P [35] et al.

Conclusion

The study of maternal BMI shows strong associations with pregnancy complications and outcomes. High BMI is associated with increased incidence of hypothyroidism, gestational diabetes mellitus, gestational hypertension, instrumental delivery and caesarean delivery. There is a significant association of underweight BMI with anemia and low birth weight.

Conflict of interest: None. **Disclaimer:** Nil.

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