



# ORIGINAL RESEARCH PAPER

# Gynaecology

## IMPACT OF BODY MASS INDEX ON PREGNANCY OUTCOME: A PROSPECTIVE COHORT STUDY

**KEY WORDS:** Body Mass Index, Pregnancy, Obesity

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### ABSTRACT

**BACKGROUND:** Obesity is an emerging problem in the society. Adverse pregnancy outcomes have been noted in women with abnormal BMI..

**OBJECTIVE:** This study was designed to assess the adverse effects of abnormal BMI on pregnancy in singleton gestation.

**METHODS:** A prospective cohort study was carried out in our tertiary care teaching hospital wherein the pregnancy outcomes of 180 women with singleton gestation were followed up. BMI was calculated at the initial antenatal visit.

**RESULTS:** There was a significant risk ( $p < 0.05$ ) of overweight and obese women having a positive family history for gestational diabetes, gestational hypertension, induced labor, operative deliveries, macrosomia, prolonged hospital stay and babies with Apgar<7 AT 5', NICU admissions with prolonged stay and significant risk of maternal anaemia and low birth weight babies in the underweight category.

**CONCLUSION:** Women in the reproductive age group should maintain a normal BMI in order to achieve a healthy pregnancy.

### INTRODUCTION:

Recent research has focused on the detrimental effects of obesity on pregnancy. Obesity, the most common metabolic disorder is defined as excessive body fat to an extent that is highly likely to impair health and increase morbidity and mortality. (BMI) also known as the Quetlet index is the most frequently applied indicator of obesity and is calculated as weight in kilograms divided by the height in square meters ( $\text{kg}/\text{m}^2$ ).

Many of the medical complications that occur in pregnancy has been attributed to the increasing incidence of obesity among women of reproductive age group. With the emergence of the theory of developmental origin of adult disease, it has been found that a woman is at risk of metabolic syndrome even before she is born. Hence, it becomes an obstetrician's duty to enlighten women in the reproductive age group on the importance of achieving a normal BMI, essentially pre-conceptionally.

Although much of research has been done in the Caucasian population, there is a scarcity of data in India.

Pregnancy is a period during which obesity can be effectively tackled as the expectant mother is usually more motivated to accept lifestyle modifications. The aim of this prospective study was to find the association between different antenatal, intra partum and immediate postpartum as well as perinatal complications associated with abnormal BMI class. Much literature is not available regarding complications that occur during pregnancy in underweight mothers as there is of the perils associated with obesity.

Hence, we have studied outcome of pregnancy in the 4 categories of body mass index- underweight, normal, overweight and obese.

### MATERIALS AND METHODS:

A prospective cohort study was conducted during a period of 18 months on 180 gravid women between the age of 18 to 39 years with singleton gestation who consent to be part of the study and who have their first antenatal checkup before 16 weeks of gestation at the outpatient department of obstetrics and gynecology in a tertiary care setup.

Patients fulfilling the above criteria are classified according to BMI which was calculated as weight in kilograms divided by the height in square meters and grouped according to the WHO classification as Underweight, Normal, Overweight and Obese. They were followed up during subsequent antenatal checkup until delivery and during their post natal period at the hospital.

Women with Multiple pregnancies, h/o Hypertension, Diabetes Mellitus, Chronic Renal Failure or other systemic disease or if delivery planned elsewhere and those who do not consent to be part of the study were excluded.

The sample size required in this prospective cohort study with unequal allocation of subjects for a power of 80% and an alpha error of 5% is 1:4 allocation exposed cases (overweight and obese) 36 and unexposed cases (normal and underweight) 144. Sample size was calculated using n Master sample size calculator software.

Gestational age was calculated according to the Last Menstrual Period. In case of discrepancy, early USG date was taken. Standard definitions were used to categorise.

### ETHICAL CONSIDERATION:

Approval from the Institutional Ethics Committee was obtained. Written Informed consent was taken from every participant. Patients with risk factors were closely monitored and given prompt treatment. No additional cost was incurred.

### DATA ANALYSIS:

Data was entered into Microsoft excel and analysed using SPSS software version 20. Chi- square/ Fischer exact test was used to find the association of BMI on maternal and perinatal outcome. Strength of association was measured using relative risk. Women in normal range of BMI are used as reference group for analysis. A total of 180 patients were included in the study of which one woman had an early miscarriage, hence final data analysis was done on 179 pregnant women.

### RESULTS:

41.1.% women were aged between 21 – 25 years. 23.3% were underweight, 11.1% overweight and 8.9% were obese. Remaining 56.7% belonged to normal BMI category. We did not find any association between parity and incidence of obesity. 25% of our total study group had a positive family history of either diabetes, hypertension or obesity. 50 % of overweight and 43.8% of obese women had a positive family history.

We did not find any statistically significant association between body mass index and infertility. Only 7.8% of total study group had been treated for infertility of which 18.8 % were obese and 15% overweight.

We found a strong association between higher body mass index and development of gestational diabetes. In our study, **55 %** of overweight and **43.8%** of obese women developed gestational

diabetes (**RR=3.88**) which was significant (**p<0.001**).

Of the 18 patients in overweight and obese category who had gestational diabetes, 12 of them had no family history of either hypertension diabetes or obesity. Thus in 66 % of the exposed group, obesity was an independent risk factor for development of diabetes.

Obesity has been linked with hypertensive disorders in pregnancy, micro/ macro albuminuria, endothelial dysfunction and increased plasminogen activator inhibitor-1.<sup>1</sup> In our study, **43.8%** in obese category had gestational hypertension and **30 %** of the overweight group as compared to 9.8% and 4.9% in the underweight and normal BMI category respectively (**RR=2.9, p<0.001**).

We had only 1 patient in the underweight group who had still birth of a baby with multiple anomalies. We had 1 patient each in normal weight and overweight category who had abruptio placentae. Association of BMI with still birth/ anomalies or antepartum haemorrhage was not statistically significant in our study.

Labor had to be induced in 68 of our 179 patients. **60%** of those in the overweight group and **31.3%** of obese women were induced as compared to 29.4% in the normal BMI class which was statistically significant (**p=0.014**).

In our analysis, a significant (**p= 0.002**) number of overweight and obese women had caesarean delivery when compared to normal BMI class. 15% of overweight women had an instrumental delivery. The Relative Risk of having an instrumental delivery or Caesarean section with increasing BMI was found to be **1.39**. 78% of underweight and 63.7% of normal BMI women had normal vaginal delivery.

We found that **46.3%** of underweight women had birthweight of less than 2.5 kg and **20%** of overweight women had macrosomic babies. The largest birthweight we had was 5.11 kg who was born by Caesarean section to a mother who was overweight. She did not have diabetes in pregnancy.

We did not find any significant association with BMI class and PROM, shoulder dystocia or perineal tear.

None of our patients developed DVT but 3 patients who developed wound infection following Caesarean section were in the overweight or obese category, the difference was not statistically significant. (**p= 0.063**). The low incidence of wound infection and DVT could be attributed to the adherence to asepsis, antibiotic and thromboprophylaxis in high risk individuals.

More than 50 % of women in obese class had a hospital stay of more than 3 days, although this might have been partly because of prolonged NICU admission of their babies. We did not find any significant association between BMI and unsuccessful breast feeding.

**59.5%** of underweight women in our study developed antenatal anemia (**p=0.002**), **46.3%** had birthweight less than 2.5 kg (**p=0.004**). However, rates of preterm deliveries were not statistically significant in the underweight group in our study.

Studies have shown that maternal obesity is related to increased admission rates to NICU.<sup>2</sup>

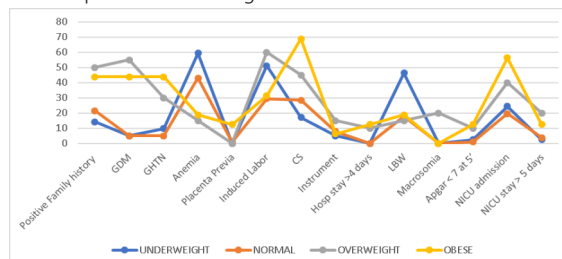
**46.3%** underweight women delivered babies with birthweight less than 2.5 kg which was significant (**p=0.004**) and **20 %** of babies of overweight mothers were macrosomic (**p<0.001**). A significant number of babies born to overweight and obese mothers had an Apgar < 7 at 5' (**p= 0.022**). **More than 50 %** of infants of obese mothers and **40 %** of those belonging to overweight class had NICU admission (**p=0.008**) and a significant number of babies had NICU stay for more than 5 days (**p=0.026**).

This was probably because infants of diabetic mothers and babies < 2kg were admitted to NICU as per protocols.

Outcome	UNDERWEIGHT (%)	NORMAL (%)	OVER WEIGHT (%)	OBESE (%)	p value
Positive Family history	14.3	21.6	50	43.8	0.005*
Infertility treatment	4.8	5.9	15	18.8	0.126
GDM	4.9	4.9	55	43.8	<0.001*
GHTN	9.8	4.9	30	43.8	<0.001*
Anemia	59.5	43.1	15	18.8	0.002*
Placenta Previa	0	1	0	12.5	0.045*
Abruption	0	1	5	0	0.414
Induced Labor	51.2	29.4	60	31.3	0.014*
PROM	22	12.7	10	18.8	0.446
CS	17.1	28.4	45	68.8	0.002*
Instrument	4.9	7.8	15	6.3	0.002*
Shoulder dystocia	0	0	5	0	0.201
PPH	2.4	2.0	10	12.5	0.066
Wound infection	0	0	22.2	9.1	0.063
Hosp stay >4 days	0	0	10	12.5	0.001*
Preterm delivery	17.1	8.8	20	18.8	0.221
LBW	46.3	17.6	15	18.8	0.004*
Macroso mia	0	0	20	0	<0.001*
Stillbirth& NTD	2.4	0	0	0	0.430
Apgar < 7 at 5'	2.4	1	10	12.5	0.022*
NICU admission	24.4	19.6	40	56.3	0.008*
NICU stay > 5 days	2.4	3.9	20	12.5	0.026*
Breast feeding	87.8	92.2	90	87.5	0.742

**Table1: Data Showing Outcome In Each Bmi Category And Significance**

GDM- Gestational Diabetes Mellitus, GHTN- Gestational Hypertension, NTD- Neural Tube Defect, LBW- Low Birth Weight, PROM- Premature Rupture Of Membrane, CS- Cesarean Section, PPH- Post partum hemorrhage



**Fig1: Graphical Representation Of Relation Of Bmi Class With Pregnancy Outcome**

## DISCUSSION:

Being a developing country, we can find poverty and malnourishment amidst affluence and over nutrition in India. With the current lifestyle of having technology at one's fingertips, women are prone to gaining weight thus falling prey to a spectrum of diseases like metabolic syndrome, polycystic ovarian disease and associated disorders. Also of concern is the intergenerational

propagation of obesity has resulted in obesity being a vicious cycle. As more complications have been observed in pregnancies of women with abnormal BMI it is imperative to educate women regarding importance of maintaining a healthy pre conceptional weight. The effect of maternal BMI and gestational weight gain has been studied by Cedergren and colleagues in over 2 lakh women in Sweden and they found that a gestational weight gain of less than 8 kilograms in obese women is associated with reduced risk of large for gestational age babies, pre-eclampsia, cesarean section and operative vaginal delivery.<sup>3</sup>

Weiss et al reported similar outcomes in a prospective multicenter study of more than 16,000 women from FASTER trial (First And Second Trimester Evaluation of Risk).<sup>4</sup> Hendler et al reported that, the rate of suboptimal visualization of fetal anatomy was significantly higher in obese women which is probably one of the reasons contributing to the higher rates of congenital anomalies in babies of obese mothers apart from other factors that have been associated with fetal anomalies like hyperinsulinemia, raised levels of triglycerides and chronic hypoxia.<sup>5</sup>

Our study has found a significant association between higher maternal body mass index and family history, gestational diabetes, gestational hypertension, induced labor, caesarean rates, macrosomia, prolonged hospital stay for both mother and baby, low Apgar scores, increased rates of NICU admission. Also low maternal BMI was linked to antenatal anaemia and low birth weight.

There was no statistically significant difference between each BMI class and infertility treatment, APH, rates of PROM, shoulder dystocia, perineal tear, postpartum hemorrhage, wound infection, DVT, gestational age at delivery, still birth and NTD.

In a 10 year population based cohort study of 5788 pregnant women conducted by Crane JM et al, they found higher rates of adverse outcomes such as increased birth weight, preterm birth, Apgar score, neonatal metabolic abnormality, NICU admission, stillbirth, and neonatal death in the obese individuals. They also found increased rates of metabolic disorders in the newborn and composite adverse outcomes.<sup>6</sup>

# CONCLUSION:

It should be stressed that weight loss should be attempted pre conceptionally because the degree of weight loss required to yield improvements in hypertension, diabetes and hyperlipidemia may be harmful during pregnancy. Of late, bariatric surgery which has demonstrated better glycemic control has been in vogue for the management of morbid obesity, specially being appropriate for women with a BMI > 35 with comorbidities.<sup>7</sup>

In the first trimester, particular attention should be given to provide an early screening for diabetes and determine baseline blood pressure and early ultrasound to accurately determine gestational age and rule out twinning as many patients are ovulation induced.

Weight gain recommendations should be explained and appropriate diet and exercise as suggested by nutritionist.

In the second trimester, obese women should be counselled regarding requirement of additional ultrasounds and the increased chance of fetal anomalies due to difficulty in identification of anomalies owing to their body habitus should be explained.

In the third trimester, imaging for interval growth may be suggested if fundal height is difficult to assess. As there is an increased risk of still birth few clinicians recommend admission testing but no evidence exists to support this practice.

During labor and delivery, early epidural is recommended and progress of labor is monitored closely as there are increased chances of failed induction and operative deliveries. Thromboprophylaxis should be ensured. Above all, focus on diet

and exercise should be a lifelong behavioral change rather than restricting it to pregnancy.

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