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Effect of body mass index on maternal and neonatal outcome

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Abstract
Effect of maternal first-trimester Body Mass Index on maternal and neonatal outcome.
Background: Maternal obesity has been associated with adverse pregnancy outcomes, such as pre-eclampsia, eclampsia, pre- and post-term delivery, induction of labour, macrosomia, increased rate of caesarean section, and post-partum haemorrhage. The objective of this study was to determine the effect of maternal first-trimester Body Mass Index (BMI) on maternal and neonatal outcomes.
Methods: 500 pregnant women were enrolled in the study. In order to explore the relationship between maternal first-trimester Body Mass Index and pregnancy outcome, participants were categorized into four groups based on their Body Mass Index. BMI <18.5- underweight, BMI 18.5-24.9 normal weight, BMI 25-29.9 is overweight, BMI > 30 is obese. 125 participants were taken for each group and followed up till delivery.
Results: Women with an above-normal Body Mass Index had a higher incidence of pre-eclampsia, induction of labour, caesarean section, preterm labour, and macrosomia than women with a normal Body Mass Index. There was no significant difference in the incidence of post-term delivery between the control group and other groups.
Conclusion: Increased BMI increases the incidence of induction of labour, caesarean section, preterm labour and macrosomia. The BMI of women in the first trimester of pregnancy is associated with the risk of adverse pregnancy outcome.

Keywords: BMI, overweight, obesity, macrosomia, NICU admission

Introduction
Average body mass index (BMI) has increased over the past 30 years and obesity has become a global health issue. This tendency has a wide range of implications in the field of obstetrics as women with high BMI are at risk of various complications during pregnancy and childbirth. Increasing BMI is associated with an increased rate of caesarean delivery due in part to failure of labour progression.
Obesity is defined as excessive body fat to an extent that is highly likely to weaken health and increase illness. BMI, also known as the Quetelet index is the most frequently applied indicator of obesity and is calculated as weight in kilograms divided by the height in square meters (kg/m2).
Various medical complications that occur in pregnancy have been ascribed to the growing frequency of obesity among women of reproductive age group. With the advent 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.
Previous studies have concluded that maternal obesity increases the risk of gestational diabetes, pregnancy-induced hypertension, preeclampsia, labour induction, cesarean delivery, macrosomia, shoulder dystocia and admission to neonatal intensive care unit (NICU). Hence, we have studied the outcome of pregnancy in the 4 categories of body mass index- underweight, normal, overweight and obese.
Obesity and overweight are defined as body mass index > 30 kg/m2 or a waist hip ratio of > 0.85 and BMI >25 respectively in women. (1) Body mass index is calculated as weight in kg/ square of height in meters. The body mass index (BMI), or Quetelet index, is a word coined by Adolphe Quetelet. This reflects the nutritional status of a person.

Who Classification

Table 1: WHO classification of BMI

BMI	Classification
≤18.5	Underweight
18.5-24.9	Normal weight
25.0-29.9	Overweight
30.0-34.9	Class I obesity
35.0-39.9	class II obesity
≥40	class III obesity

Recommended Weight Gain in Pregnancy

In 1990, Institute of medicine (IOM) has given recommendations for ranges of weight gain with the important goal to improve birth weight of the infant. The risk of low birth weight rises with inadequate weight.

Table 2: Recommended weight gain in pregnancy

BMI	Weight GAIN
Under weight	12.5- 18
Normal	11.5- 16
Over weight	7-11.5
Obese	At least 6.8 (higher limit not specified)

AIM

Effect of obesity as classified by Body Mass Index during first trimester on maternal and fetal outcomes

Objectives

To estimate maternal and neonatal complications when pregnancy is associated with obesity

Materials and Methods

Place of study: The present study is conducted at Government maternity hospital, Tirupati.

Study design: The present study is a prospective comparative study conducted among the patients attending Government maternity hospital.

Patient population: A total of 500 pregnant patients, 125 from each group were taken.

Inclusion criteria

1. Pregnant women delivered at Government maternity hospital, Tirupati.
2. Singleton pregnancy with >37 weeks gestational age
3. Gives informed consent

Exclusion criteria

1. Women unable to give written and informed consent
2. Women with pre pregnancy weight and height not recorded
3. Previous cesarean section
4. Malpresentations during delivery
5. Previous history of diabetes mellitus or hypertension.

Methodology

It is a prospective study carried out from July 1st 2021 to 30 June 2022 in Government Maternity Hospital, Sri Venkateswara medical college, Tirupati. Women were categorised into four different BMI classes and mode of delivery was categorized into spontaneous delivery, instrumental vaginal delivery, planned cesarean section and emergency cesarean section. Exclusion criteria were: deliveries before 37 weeks of gestation, multiple births, breech deliveries and deliveries where maternal height or pre-pregnancy weight were not recorded. Women with a history of more than one previous cesarean delivery were also excluded because the hospital policy is to deliver these women with a planned cesarean with no attempt at vaginal delivery. The final cohort consisted of 500 deliveries.

In this study, BMI was used to categorize the participants. The weight and height were routinely measured for each woman in the first trimester, then BMI was calculated according to the formula "weight in kg/height in m2". Women were distributed into four groups based on their BMI according to the WHO classification of obesity; each group included 125 participants.

Group 1, women with low BMI (>18.5kg/m2)

Group 2, women with normal BMI (18.5-24.9 Kg/m2),

Group 3 consisted of women who are overweight (BMI 25-29.9 Kg/m2) and the last group included women with class I obesity (BMI 30-34.9 Kg/m2).

All the pregnant women were followed up till delivery and postpartum period, maternal and perinatal outcome were studied.

Results

The study was carried out on 500 women who fulfilled the inclusion criteria. There was no significant difference between the four groups concerning age. Regarding the mode of delivery, there was a significant difference between the four groups. Class I obesity group showed markedly increased C.S. rate due to failure to progress compared to the overweight and the normal BMI groups (29.2%, 22.4% and 12.7%, respectively). 10.3% of women delivered by cesarean section in the underweight group.

Table 3: Maternal Complications according to BMI

BMI	<18.5	18.5-24.9	25-29.9	>30	Total out of 500
Gestational hypertension	5(4%)	9(7.2%)	11(8.8%)	17(13.6%)	42(8.4%)
Preeclampsia	12(9.6%)	3(2.4%)	4(3.2%)	4(3.2%)	23(4.6%)
Gestational diabetes	2(1.6%)	5(4%)	12(9.6%)	21(16.8%)	40(8%)
postpartum infections	9(7.2%)	4(3.2%)	5(4%)	11(8.8%)	29(5.8%)

Table 4: Delivery methods by different BMI groups

BMI	Normal delivery	Instrumental delivery	Planned cesarean	Emergency cesarean
<18.5 (125)	85.6% (107)	4% (5)	2.4% (3)	8.0%(10)
18.5-24.9 (125)	80.8%(101)	6.4%(8)	2.4% (3)	10.4% (13)
25- 29.9 (125)	72.8% (91)	4.8% (6)	4.8%(6)	17.6% (22)
>30 (125)	62.4%(78)	8% (10)	5.6%(7)	24.0% (30)

Table 5: Causes for Cesarean Section

Indications for cesarean section	<18.5 (13 out of 125)	18.5-24.9 (16 out of 125)	25- 29.9 (28 out of 125)	>30 (37 out of 125)
CPD	23.0% (3)	25.0% (4)	21.4%(6)	27.0% (10)
Contracted pelvis	7.6% (1)	6.2% (1)	10.7%(3)	10.8% (4)
Failed induction	7.6% (1)	6.2% (1)	7.2% (1)	8.1%(3)
Failed progression	7.6% (1)	12.5% (1)	10.7% (3)	18.9% (7)
Fetal distress	30.7%(4)	18.7% (1)	14.2% (4)	10.8% (4)
Severe oligohydramnios	7.6% (1)	12.5% (2)	7.1%(2)	5.4%(2)
Abnormal presentation	7.6%(1)	12.5% (2)	10.7% (3)	8.1%(3)
Placenta previa	7.6% (1)	6.2% (1)	7.1% (3)	5.4%(2)
Others			10.7% (3)	5.4%(2)

Table 6: Perinatal outcome

BMI	<18.5	18.5- 24.9	25-29.9	>30
Mean birth weight (g)	2186	2960	2985	3200
Macrosomia	0	4 (3.2%)	6 (4.8%)	2 (1.6%)
Low birth weight	13 (10.4%)	09 (7.2%)	11(8.8%)	17(13.6%)
NICU admission	2(1.6%)	0	3(2.4%)	6(4.8%)

Discussion

As obesity is a major concern worldwide, it is important to stand on its impacts on labour. In our study, it was clearly shown that obesity rather than overweight affects labour as well as the mode of delivery. This was represented by increased incidence of gestational hypertension, gestational diabetes, highly significant cesarean rate and postpartum infections in the class obesity group versus overweight and normal BMI groups.

Maternal and Fetal Outcomes

Gestational diabetes

8% in the study group had gestational diabetes. Incidence was more in overweight and obese category. The study shows that there is increased incidence of gestational diabetes as the BMI increases to more than normal. As compared to overweight patients, obese were more prone to develop gestational diabetes. This suggests that as the maternal BMI increases the risk of gestational diabetes increases.

Gestational Hypertension

8.4% in the study group had gestational hypertension. Incidence was 13.6% in obese category. The incidence in the normal BMI group was 7.4% whereas in the underweight group was 4% and in the overweight group the incidence was 8.8% this study shows there is significant relationship between body mass index and incidence of gestational hypertension. This shows that the incidence of gestational hypertension increases as the body mass index increases.

Preeclampsia

The incidence in normal BMI group was 2.4%, whereas in underweight group was 9.6% and in overweight group 3.2%, in obese group the incidence was 3.2%. According to our study, there was a significant association between body mass index and pre-eclampsia, an increased incidence in underweight women. But most of the previous studies showed an increased risk of gestational hypertension in overweight and obese women.

Mode of delivery

Significant rate of cesarean was observed in overweight and obese women which is 17.6% and 24.8% respectively where as in underweight and normal weight women it is 8% and 10.4%.

Mean Birth Weight

Mean birthweight and its association between body mass index was assessed. The values show an increasing trend towards birth weight with an increase in body mass index. Mean birth weight in underweight was 2856 gm, in normal weight, it was 2961gm. The mean birth weight in obese women was 3200gm, whereas in overweight it was 2985gm.

Postpartum infections

The incidence of postpartum infections were 7.2%, 3.2%,4% and 8.8% respectively in underweight, normal, overweight and obese pregnant women. The most common infections associated were urinary tract infections, surgical site, and also perineal tear associated infections. The incidence was higher in underweight women as per our study even though it was not statistically significant. This is probably related to malnutrition and impaired wound healing.

Macrosomia

Our study showed an incidence of macrosomia of 4.8% in the overweight and 1.6% in the obese group with no association with BMI.

Nicu admission

Neonatal ICU admissions in various BMI groups were compared which showed significant relation with body mass index. The incidence was 1.6% in underweight women whereas it was 4.8% in overweight women.

The present study adds to the evidence that increased body mass index increases maternal and neonatal complications in pregnancy and outcomes of labour are significantly affected by increased BMI. The points of strength are being a multicentric study with large sample size and being limited to a specific population, single full-term primigravida, without any medical or surgical factor that may affect the labour route. The main limitation of this study is the absence of class II and III obesity groups, which may be explained by the rarity of morbid obesity among this age group as well as in primigravida women.

Conclusion

Awareness of these detrimental effects of obesity is to be made to all healthcare workers. Knowledge to be given to obese women about lifestyle interventions and physical activity are a part of management of obesity in pregnancy to reduce the associated risks and complications. To stop this growing health problem globally, effective anti-obesity strategies should be implemented at national level and worldwide. Obesity in pregnancy is preventable as it is a modifiable risk factor in child bearing age groups; the health and economic impact of rising obesity rates is of greater public health importance. Preconceptional counselling is the best time to create awareness regarding the complications of obesity in pregnancy and therefore dietary interventional measures to be started at this period. Awareness among reproductive age group women about the importance of normal weight before pregnancy to be done.

Conflict of Interest

Not available

Financial Support

Not available

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