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Original Research Article

The impact of high maternal body mass index on obstetric and perinatal outcomes

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ABSTRACT

Background: The incidence of obesity has increased to pandemic proportions over the last 20 years. Maternal obesity is associated with a wide array of adverse maternal pregnancy outcomes and increased risks in the offspring. The aim of the study was to find the effect of obesity on maternal and perinatal outcome in obese women in comparison to those of normal weight women.

Methods: The study was designed as a case-control study. Antenatal women with first trimester body mass index (BMI) of more than 30 kg/m² constituted the cases and those with BMI between 18 and 24.9 kg/m² formed the controls.

Results: There was increased incidence of antepartum complications in obese women. Obese women had a significant history of prior treatment for infertility ($p < 0.00001$). The incidence of gestational diabetes (OR 4.76, 95% CI 1.267-17.72 $p = 0.014$), gestational hypertension (OR 3.05, 95% CI 1.01-9.20 $p = 0.04$), induction of labor (OR 2.5, 95% CI 1.0-6.28 $p = 0.04$), preeclampsia (OR 2.38, 95% CI 1.0-5.64 $p = 0.04$), Caesarean section (OR 1.98, 95% CI 1.24-3.14 $p = 0.003$), postpartum haemorrhage (OR 8.57, 95% CI 1.07-76.15 $p = 0.04$) and wound infection (OR 8.57, 95% CI 1.07-76.15 $p = 0.04$) and adverse neonatal outcomes such as higher mean birth weight ($p < 0.0001$) and requirement of NICU (OR 2.79, 95% CI 1.33 -5.84 $p = 0.006$) was higher in obese women.

Conclusions: Obesity is an independent risk factor for adverse pregnancy outcomes and hence, interventions directed towards weight loss and prevention of excessive weight gain must begin in the preconception period.

Keywords: Body mass index, Maternal outcome, Obesity, Perinatal outcome

INTRODUCTION

The incidence of obesity has increased to pandemic proportions over the last 20 years. The incidence is higher in females than males according to the World Health Organization (WHO). In 2016, more than 1.9 billion adults, 18 years and older, were overweight. Of these over 650 million were obese. In 2016, 39% of adults aged 18 years and above were overweight and 13% were obese.^{1,2} A lifestyle changing towards sedentary has been attributed to increased incidence of obesity in women. According to National Family Health Survey (NFHS)-4 (2015-16), the percentage of women aged 15-49 years

who were overweight or obese in India was 20.7% and in Odisha was 16.5%.³

Body mass index (BMI) is an important predictor of nutritional status of pregnant women which has been considered as an important prognostic indicator of pregnancy outcomes. The BMI is calculated as weight in kilograms divided by the height in meters squared. Categories of BMI are as follows: BMI of 20-24.9 kg/m² are considered normal, BMI of 25-29.9 kg/m² are overweight, and BMI of >30 kg/m² are obese.⁴ The WHO has defined the criteria of overweight as body mass index (BMI) >25 kg/m² and that for obesity as BMI >30 kg/m².

High maternal body mass index is related to adverse pregnancy outcomes such as preeclampsia, gestational hypertension, pre- and post-term delivery, induction of labor, macrosomia, caesarean section and post-partum haemorrhage.^{5,6}

The objective of the study was to find the effect of obesity on maternal and perinatal outcome in obese women compared to those of normal weight women and will highlight the importance of including weight reduction in preconception counseling of obese women.

METHODS

A prospective case-control study was conducted in the Dept. of Obstetrics and Gynecology, Kalinga Institute of Medical Sciences (KIMS), Bhubaneswar from September 2018 to March 2020. The study population included pregnant women fulfilling our inclusion criteria and willing to participate in our study.

Inclusion criteria

Women with singleton pregnancy having BMI ≥ 30 kg/m² at first visit, in the first trimester who have not been exposed to other factors already known for causing pregnancy complications other than BMI were considered as cases and those with BMI between 18 and 24.9 kg/m² were taken as controls.

Exclusion criteria

Obese women with medical complications like diabetes, hypertension, hypothyroidism etc. family history, exposure to other factors already known for causing pregnancy complications and those with recurrent abortions where the cause was already known.

All the patients coming for their first antenatal check-up (ANC) in the first trimester were examined after obtaining an informed consent. Their detailed clinical history, physical examination and routine investigations were done. This included complete blood count (CBC),

blood grouping, viral marker screening for HIV, HbSag and HCV, serum thyroid stimulating hormone (TSH), urine for routine and microscopic examination and ultrasound scan {nuchal translucency (NT) scan, nasal bone (NB) scan at 11-13 weeks period of gestation (POG)}. Subsequent ultrasound scans included Anomaly scan between 18-20 weeks of gestation and fetal growth scan in third trimester. A record of the same was maintained. Weight and height were measured and noted at each ANC. For measuring weight, a standardized bathroom scale was used. For measuring height, stadiometer was used. If they developed any obstetric complications during the course of pregnancy, the necessary investigations were carried out as a part of routine ANC. Glucose challenge test with 75g glucose for assessment of GDM was done at first ANC and repeated between 24-28 weeks of pregnancy as mandatory for these patients. Any medical complication developing throughout pregnancy, mode of delivery, any operative interventions, maternal complications and perinatal outcome were noted.

Statistical analysis

Statistical analysis was performed using Statistics Package for Social Sciences (SPSS) for Windows, version 21.0. The results were assessed at a confidence interval of 95% and at a significance level of $p < 0.05$. A binary logistic regression analysis was carried out to calculate the Odds ratio of different maternal complications. The differences in the variables were evaluated by Chi-square-test for categorical data or by Student t-test for continuous data. The analysis was done separately for each complication so as to independently verify which complication changed due to BMI and which did not.

RESULTS

A total of 105 pregnant women with BMI ≥ 30 kg/m² (cases) and 150 pregnant women with BMI between 18-24.9 kg/m² (controls) were included in the study. Maternal characteristics are presented in Table 1.

Table 1: Maternal characteristics.

Characteristics	Obese women (N=105)	Normal weight women (N=150)	P value
Mean age (years)	26.37 \pm 4.13	26.22 \pm 3.83	0.76
Mean weight at booking (kg)	81.40 \pm 6.48	53.63 \pm 3.71	<0.0001
BMI (Mean \pm SD, kg/m ²)	31.48 \pm 1.26	20.40 \pm 0.97	<0.0001
Parity status N (%)			
Nulliparous	38 (36.19)	67 (44.67)	0.22
Multiparous	67 (63.81)	83 (55.33)	$\chi^2=1.499$
Infertility N (%)	21 (20)	4(2.67)	<0.00001

Prior treatment for infertility was higher in obese mothers (20%) than in normal weight mothers (2.67%) ($p < 0.00001$). There was no difference observed for

gestational age at delivery in both groups ($p=0.34$) (Figure 1).

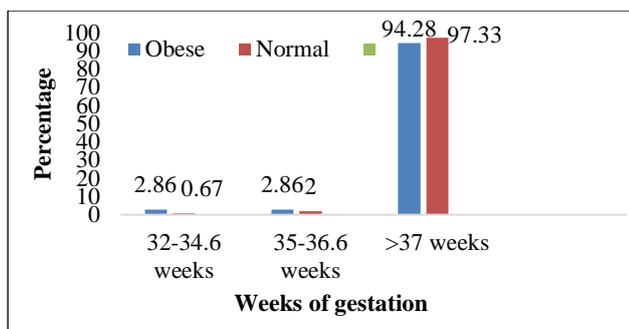


Figure 1: Gestational age at termination.

Obese mothers had 4.76 times more likelihood of developing gestational diabetes mellitus than normal weight mothers. Requirement for induction of labor was also more in obese mothers (Table 2). Gestational hypertension was higher in obese mothers than normal weight mothers (OR=3.05) and so was preeclampsia (OR=2.38) (Table 2).

Peripartum complications are summarized in Table 3. Postpartum haemorrhage and wound infection were higher in the obese group (OR=8.57; p=0.04).

Table 2: Maternal outcomes.

Outcome	Cases N (%) obese N (%) 105	Control N (%) normal N=150	Odds ratio (95% CI)	P value
GDM	10 (9.52)	3 (2)	4.76 (1.27-17.72)	0.014
Induced labour	13 (12.38)	8 (5.33)	2.50 (1.0-6.28)	0.04
Pre-eclampsia	15 (14.29)	9 (6)	2.38 (1.0-5.64)	0.04
Gestational hypertension	10 (9.52)	5 (3.33)	3.05 (1.01-9.20)	0.047
Hypothyroidism	1 (0.95)	1 (0.67)	1.43 (0.08-23.16)	0.80
PROM	2 (1.90)	1 (0.67)	2.89 (0.25-32.32)	0.388
Malpresentation	6 (5.72)	6 (4)	1.45 (0.45-4.64)	0.526
IUGR	6 (5.72)	5 (3.33)	1.75 (0.52-5.91)	0.362
Mode of delivery				
Caesarean section	61 (58.1)	46 (30.67)	1.98 (1.24-3.14)	0.003
Normal vaginal	44 (41.9)	104 (69.33)		

Table 3: Peripartum outcomes.

Outcome	Obese N(%) 105	Normal N (%) 150	Odds ratio (95% CI)	P value
PPH	6 (5.71)	1 (0.67)	8.57 (1.07-76.15)	0.04
Wound infection/gaping	6 (5.71)	1 (0.67)	8.57 (1.07-76.15)	0.04

Table 4: Neonatal outcomes.

Outcome	Obese N=105	Normal N=150	Odds ratio (95% CI)	P value
Mean weight (kg)	3.250±0.534	2.977±0.421		<0.0001
Live born (N, %)	100 (95.25)	148 (98.66)	0.27 (0.05-1.42)	0.12
Still born (N, %)	3 (2.85)	1 (0.67)	4.38 (0.44-42.72)	0.20
IUD (N, %)	2 (1.90)	1 (0.67)	2.89 (0.25-32.32)	0.38
APGAR score <7 AT 5 min (N, %)	3 (2.85)	3 (2)	1.44 (0.28-7.28)	0.65
NICU admission (N, %)	22 (20.95)	13 (8.67)	2.79 (1.33-5.84)	0.006

Neonatal outcomes are summarized in Table 4. Neonates born to obese mothers had higher birth weight in comparison to neonates of normal weight women (p<0.0001). Intrauterine death, still born and low APGAR score (<7 at 5 minutes) were slightly higher in obese group but results were not statistically significant (p=0.38, 0.2 and 0.65 respectively). Requirement of neonatal intensive care due to macrosomia and

respiratory distress was significantly higher for neonates of obese mothers (OR=2.79; p=0.006).

DISCUSSION

The mean weight and BMI at booking for obese women in our study was 81.40(±6.48) kg and 31.48(±1.26) kg/m² which was statistically significant in comparison with

normal BMI women ($p < 0.0001$). The study by Alves et al done in Portugal in 2019 also reported a significant difference in the BMI at booking ($p < 0.001$) of obese and normal weight women.⁷

In our study, 20% of obese women required in-vitro fertilization for conception in comparison to only 2.67% of normal BMI women ($RR = 7.5$, 95%CI 2.65-21.21) which was statistically significant ($p = 0.0001$). Similar results have been reported by previous studies by Vellanki et al, Green et al, Rich-Edwards et al and Grodstein et al.⁸⁻¹¹ This is attributed to increased insulin resistance, amenorrhea and ovulatory dysfunction in obese women.

Obese pregnant women have been shown to have very high likelihood, two to eleven-fold, of developing gestational diabetes mellitus (GDM) as shown in previous literature by Ovesen et al, Chu et al and Yogev et al.¹²⁻¹⁴ In our study population, obese group developed gestational diabetes mellitus (9.52%) in comparison to normal BMI group (2%). Thus, there was 4.76 fold risk increase for GDM among obese women.

Obese women were observed to have an increased risk of gestational hypertension among by 3.05 folds and preeclampsia by 2.38 folds. This is similar to previous studies. Leddy et al and Dave et al reported an Odds ratio of 2.5 (95%CI 2.1-3.0) and 2.0 (95%CI 1.15-3.45) respectively for gestational hypertension in obese women and 3.2 (95%CI 1.8-5.8) and 2.0 (95%CI 0.99-4.0) respectively for risk of preeclampsia in obese.^{15,16} Obesity in pregnancy leads to increased need for induced labor as well as increased occurrence of failed induction. Labor induction was more common in obese group (12.38%) when compared to control group (5.33%). The risk of induction among the obese women in our study was increased almost 2.5 fold (95%CI 0.92-5.79). This is in accordance with other studies that estimated increase to be between 1.7-fold and 2.2-fold. Kumari et al and Sujatha et al have reported higher rates of labor induction in obese women ($OR = 1.71$; 95%CI 0.78-3.73 and $OR = 3.14$; 95%CI 1.60-5.80 respectively).^{17,8} The higher early induction rates may be due to the co-morbid conditions that are associated with obesity such as gestational hypertension and preeclampsia.

Obese women had 1.98 fold increased risk (95%CI 1.24-3.14) of cesarean delivery when compared to control group. It is likely multifactorial with increased dystocia, macrosomia and other maternal complication such as eclampsia or gestational hypertension and diabetes mellitus. Similarly, higher occurrence of need for caesarian section had been reported in previous reports by Scott-Pillai et al, Ramonienè et al, Wahabi et al and Sebire et al.¹⁸⁻²¹ ranging from 1.2 to 2.8 times more in obesity than normal weight mothers.

Higher incidence of PPH was reported in obese group ($OR = 8.57$; 95%CI 1.01-72.24; $p = 0.04$) which was more

in comparison with previous studies by Vellanki et al and Kumari et al.^{8,17}

Obese women were found to be at a greater risk of post-operative wound infection and gaping ($OR = 8.57$; 95%CI = 1.01-72.24).

In our study, the mean birth weight of the neonates of obese group was $3.25 (\pm 0.534)$ kg which was significantly higher ($p = 0.001$) than the neonates of control group where it was $2.97 (\pm 0.421)$ kg. Neonates of obese mothers had increased NICU admission, the major reasons for admission being infants of diabetic mothers and macrosomia. The results are concurrent with previous studies by Usha et al and Vasudevan et al.^{22,23}

CONCLUSION

Obesity during pregnancy carries high maternal and fetal risks. Antenatal complications like GDM, gestational hypertension, preeclampsia, increase in the need for induction of labor and increased incidence of operative interference was associated with pregnancies complicated with obesity. Increased birth weight, stillbirth and higher NICU admissions was also found. Postpartum pregnancy complications like wound infection with increased requirement for secondary suturing was also reported in obese pregnant women. Like all modifiable risk factors of disease, the best approach to obesity in pregnancy is its prevention. Approaches to prevent complications of obesity in pregnancy can be offered in pre-pregnancy period. During pregnancy excessive weight gain is also to be avoided. Education and awareness is essential for all women of child bearing age regarding the risk of adverse outcome associated with obesity in pregnancy. Pregnancy in obese mothers should be considered as a high risk condition and warrants a high level specialized antenatal, natal and post-natal care.

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