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Original Research Article

Maternal and fetal outcomes in overweight and obese pregnant women

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ABSTRACT

Background: The prevalence of obesity among child bearing age women is rising in India and it has adverse implications on mother and fetus. The aim of this study is to assess impact of overweight and obese mothers on antenatal, intrapartum, postpartum and neonatal outcomes.
Methods: It is an observational hospital-based study. Pregnant women were categorized into three groups depending on their body mass index (BMI)–normal (BMI–18.5–24.9 kg/m^2), overweight (BMI–25.0–29.9 kg/m^2) or obese (BMI>40 kg/m^2). Antepartum, intrapartum, postpartum and neonatal complications were noted.
Results: Out of 104 women, 36 each were in normal and overweight group and 32 were in obese group. Obese and overweight women had higher rate of caesarean section (68.8% and 44.4%) compared to normal group (30.6%, P-value – 0.006). Failed induction rate was more in obese and overweight women (12.5% and 11.1%) compared to normal group (2.8%) but not statistically significant. Postpartum hemorrhage (PPH) was high in normal group (36.1%, P-value–0.040). Neonatal hyperbilirubinemia requiring NICU admission was significantly high in overweight and normal group (P-value–0.000). Gestational diabetes and hypertension were comparatively more in obese and overweight group but not statistically significant.
Conclusions: Women who are obese and overweight pregnant women have increased risk for caesarean section and have higher rate of failed induction. They have higher tendency to develop gestational diabetes and hypertension in pregnancy. Postpartum hemorrhage was high in normal BMI women. Neonatal intensive care admissions for neonatal hyperbilirubinemia were high in overweight and normal BMI women.

Keywords: Body mass index, Obesity, Overweight

INTRODUCTION

Obesity is a public health concern worldwide. The prevalence of obesity has increased substantially even in India and it is rising at an alarming rate. Overweight and obesity in India in women aged 18-69 years is 21% and 8.3% respectively.[1] Women in reproductive age group between 18-49 years had a 6.4% obesity prevalence. The causes for this are change in dietary habits, sedentary lifestyle and lack of physical activity. Obesity in pregnancy is recognized as a major risk factor for potential adverse impact on mother and fetus. Obese pregnant women are more prone to have higher rates of miscarriages, preterm delivery, caesarean sections, gestational diabetes, hypertensive disorders of pregnancy, altered fetal growth and neonatal morbidity and mortality. To safeguard the unborn child and the mother, the Institute of Medicine (IOM) in the US has suggested the optimal GWG (gestational weight gain) at the time of pregnancy.[2] Our study is to find the adverse effects of maternal overweight and obesity on mother and fetus compared to normal body mass index (BMI) mothers. The most widely used measurement for defining obesity is body mass index. It is easy and readily calculated, so BMI is an extremely

popular approach. BMI is an individual's weight in kilograms divided by the square of her height in meters. Individuals are deemed as obese when BMI is greater than or equal to 30 kg/m^2, overweight when BMI is between 25 to 29.9 kg/m^2 and normal when BMI is between 18.5 to 24.9 kg/m^2. Obesity is further classified into moderate obesity (30-34.5 kg/m^2), severe obesity (35-39.9 kg/m^2) and very severe obesity (>40 kg/m^2). BMI may be deceiving in some instances like professional athletes and weightlifters where in the muscle mass increases the BMI rather than fat.

METHODS

Study type

It is a hospital based observational study.

Study place

The study was conducted department of OBG in KS Hegde hospital, Mangaluru.

Study duration

The study duration was from October 2022 to April 2024.

Ethical approval

The approval from the Institutional Ethics Committee (INST.EC/EC/120/2022;REG.NO.EC/NEW/INST/2020/834) was obtained.

Inclusion criteria

Pregnant women with different BMIs were recruited in this study. Pregnant women attending antenatal clinic before 20 weeks with singleton pregnancy and with a BMI from 18.5 to 40 kg/m2 were included.

Exclusion criteria

Pregnant women with pre-existing diabetes, chronic hypertension, renal disorder, previous history of thrombo-embolic event and low BMI (<18.5 kg/m^2) were excluded.

Based on pre-pregnancy weight (self-reported by the mother) or first booking visit weight which is taken before 20 weeks of gestation, BMI was calculated. Women were classified into 3 groups according to BMI as normal weight (BMI–18.5–24.9 kg/m^2), overweight (BMI–25.0–29.9 kg/m^2) or obese (BMI>30 kg/m^2). The patients who consented for the study were registered and were followed up until delivery to look for antepartum, intrapartum, postpartum complications and neonatal complications. Total samples collected are 104 out of which 36 women belong to normal and overweight groups each and 32 were in obese group. Detailed socio-demographic variables of the participants were obtained. The variables that were taken into consideration were antepartum variables which included gestational diabetes mellitus (GDM), gestational hypertension, preeclampsia/eclampsia, abruption, preterm, postdated pregnancy.

Intrapartum variables included were induction of labour, failed induction, mode of delivery, instrumental delivery and shoulder dystocia. Postpartum variables which were included are postpartum haemorrhage, puerperal sepsis, surgical site infection, deep venous thrombosis, prolonged hospital stay. Neonatal variables which were taken into consideration was low birth weight (<2 kg), macrosomia (>4 kg), prematurity, admission to neonatal intensive care unit (NICU), APGAR score, hyperbilirubinemia, respiratory distress syndrome (RDS), early neonatal death/congenital anomalies.

Statistical analysis

Statistical analysis of the data was performed using SPSS 23.0. The categorical variables were presented as frequency and percentage. Continuous variables presented as mean±standard deviation. Comparison between the group was done by ANOVA. Categorical variables were analysed using chi-square test. P value<0.05 was considered statistically significant.

RESULTS

A total of 104 pregnant mothers were included in this study. Mean age of women in all 3 groups was 27 to 29 years. The mean BMI in obese group was 32.173 and the maximum BMI in our study was 36. Mean BMI in overweight and normal group was 27.032 and 22.014 respectively (Table 1). Though we found the percentage of GDM was more in obese (37.5%) and overweight (30.6%) groups, but was not statistically significant. Similarly, hypertensive disorders in pregnancy also showed increased trend in obese (9.4%) and overweight (8.3%) groups and no women developed hypertension in normal group (Table 2).

Though more women (around 30%) in obese and normal BMI group needed induction of labour compared to overweight group but it was noted women of obese and overweight group had high rate of failed induction (12.5% and 11.1%) compared to normal group (2.8%) but it was not statistically significant. The p value of 0.006 was statistically significant indicating caesarean section was significantly more in higher BMI groups with almost 70% of women in obese group had to undergo caesarean section (Table 3). There was statistically significant association (p value-0.040) postpartum haemorrhage (PPH) which is seen more in normal BMI group. No patient had SSI in higher BMI groups and only 1 patient developed DVT in obese category (Table 4). The mean neonatal birth weight was 3.3 kg±0489 kg (2.16-4.42 kg) in obese group, 3.143±0.407 kg (2.4-4 kg) in overweight group and 3.188±0.436 kg (2.28-3.9 kg) in normal group. There were no cases of any congenital anomalies, still birth or early neonatal deaths in any of these 3 groups. There were more

numbers of neonates from overweight and normal BMI group who had hyperbilirubinemia and required NICU admission mainly for phototherapy which was statistically significant (P value–<0.000) (Table 5).

Table 1: Demographic parameters of the participants.

BMI groups			
Categories	**Obese (32) Mean±SD**	**Overweight (36) Mean±SD**	**Normal (36) Mean±SD**
Age (in years)	28±4.408 (22-37)	29±5.690 (20-43)	27±5.232 (19-36)
Weight (kg)	79.417±5.830 (65-88)	65.896±5.566 (57-78)	54.020±5.583 (44-68)
Height (cm)	155.438±5.346 (140-167)	155.500±5.196 (143-165)	155±4.611 (146-165)
BMI	32.173 (30-36)	27.014 (25-29)	22.032 (19-24)

BMI – body mass index

Table 2: Antepartum variables of the participants in different BMI groups.

BMI groups						
Variables		**Obese (32) N (%)**	**Overweight (36) N (%)**	**Normal (36) N (%)**	**Total (104)**	**P value**
GDM	Yes	12 (37.5)	11 (30.6)	08 (22.2)	31 (29.8)	0.386
	No	20 (62.5)	25 (69.4)	28 (77.8)	73 (70.2)	
Hypertensive disorders	Yes	03 (9.4)	03 (8.3)	00 (0)	06 (5.8)	0.182
	No	29 (90.6)	33 (91.7)	36 (0)	98 (94.2)	
Abruptio	Yes	01 (3.1)	00 (0)	00 (0)	01 (1)	0.321
	No	31 (96.9)	36 (0)	36 (0)	103 (99)	
Preterm	Yes	02 (6.3)	03 (8.3)	01 (2.8)	06 (5.89)	0.594
	No	31 (96.9)	35 (97.2)	35 (97.2)	98 (94.2)	
Postdated	Yes	09 (28.1)	04 (11.1)	08 (22.2)	21 (20.2)	0.204
	No	23 (71.9)	32 (88.9)	28 (77.8)	83 (79.8)	

GDM – gestational diabetes mellitus

Table 3: Intrapartum variables of the participants in different BMI groups.

BMI groups						
Variables		**Obese (32) N (%)**	**Overweight (36) N (%)**	**Normal (36) N (%)**	**Total (104)**	**P value**
Induction of labour	Yes	10 (31.3)	07 (19.4)	11 (30.6)	28 (26.9)	0.456
	No	22 (68.8)	29 (80.6)	25 (69.4)	76 (73.1)	
Failed induction	Yes	04 (12.5)	04 (11.1)	01 (2.8)	09 (8.7)	0.294
	No	28 (87.5)	32 (88.9)	35 (97.2)	95 (91.3)	
Mode of delivery	caesarean	22 (68.8)	16 (44.4)	11 (30.6)	49 (47.1)	0.006
	Vaginal	10 (31.3)	20 (55.6)	25 (69.4)	55 (52.9)	
Instrumental delivery	Yes	32 (0)	36 (0)	34 (94.4)	102 (98.1)	0.148
	No	00 (0)	00 (0)	02 (5.6)	02 (1.9)	

Table 4: Postpartum variables of the participants in different BMI groups.

BMI groups						
Variables		**Obese (32) N (%)**	**Overweight (36) N (%)**	**Normal (36) N (%)**	**Total (104) N (%)**	**P value**
PPH	Yes	04 (12.5)	06 (16.7)	13 (36.1)	23 (22.1)	0.040
	No	28 (87.5)	30 (83.3)	23 (63.9)	81 (77.9)	
SSI	Yes	00 (0)	00 (0)	01 (2.8)	01 (1)	0.385
	No	32 (0)	36 (0)	35 (97.2)	103 (99)	
DVT	Yes	01 (3.1)	00 (0)	00 (0)	01 (1)	0.321
	No	31 (96.9)	36 (0)	36 (0)	103 (99)	
Prolonged stay	Yes	01 (3.1)	04 (11.1)	01 (2.8)	06 (5.8)	0.235
	No	31 (96.9)	32 (88.9)	35 (97.2)	98 (94.2)	

PPH – postpartum haemorrhage, SSI - surgical site infection, DVT – deep vein thrombosis

Table 5: Neonatal outcomes of the participants in different BMI groups.

BMI groups						
Variables		**Obese (32) N (%)**	**Overweight (36) N (%)**	**Normal (36) N (%)**	**Total (104) N (%)**	**P value**
LBW	Yes	02 (6.3)	02 (5.6)	02 (5.6)	06 (5.8)	0.990
	No	30 (93.8)	34 (94.4)	34 (94.4)	98 (94.2)	
Macrosomia	Yes	06 (18.8)	04 (11.1)	09 (25)	19 (18.3)	0.312
	No	26 (81.3)	32 (88.9)	27 (75)	85 (81.7)	
Hyperbilirubinemia	Yes	08 (25)	29 (80.6)	23 (63.9)	60 (57.7)	0.000
	No	24 (75)	07 (19.4)	13 (36.1)	44 (42.3)	
Admission to NICU	Yes	07 (21.9)	24 (66.7)	25 (69.4)	56 (53.8)	0.000
	No	25 (78.1)	12(33.3)	11 (30.6)	48 (46.2)	
RDS	Yes	05 (15.6)	12 (33.3)	10 (27.8)	27 (26)	0.240
	No	27 (84.4)	24 (66.7)	26 (72.2)	77 (74)	

LBW – low birth weight, NICU – neonatal intensive care unit, RDS – respiratory distress syndrome

DISCUSSION

In our study, there is a higher trend of developing GDM and hypertensive disorders with increasing BMI, though it was not statistically significant in our sample size. Gross et al found that 5% of obese pregnant women developed GDM3, while Ehrenberg et al reported an even higher rate of 8% in a similar population.[4] The rate of GDM in obese women (30–34.9 kg/m2) is 5.5% and in extremely obese women (35-39.9kg/m2) is up to 11.5%. These studies highlight the critical impact of pre-pregnancy BMI on the likelihood of developing GDM during pregnancy.

C´wiek et al, reported a clear association, indicating potential variability in population-specific factors affecting GDM. Obesity is associated with insulin resistance, a condition where the body's cells do not respond effectively to insulin. During pregnancy, insulin resistance can lead to higher levels of circulating glucose. The consistent findings across multiple studies suggest that as maternal weight increases, so does the risk of GDM, highlighting the importance of maintaining a healthy weight before conception.[5]

The incidence of hypertensive disorders, that is gestational hypertension, was higher in obese individuals (9.4%) and in overweight (8.3%) than normal weight individuals (0%). This association was not statistically significant (P 0.182), suggesting that while obese and overweight women showed a higher trend, the difference was not statistically conclusive. Sibai et al, found increased frequency of pre-eclampsia 12.6% with BMI>34kg/m2 than women with BMI<20 kg/m2 (P<0.0001).[6]

The research on the link between being overweight as a mother and giving birth early has mixed variations. We did not observe many cases of preterm in our study in all the 3 groups probably due to small sample size and couldn't conclude anything regarding this aspect. Research has shown that there is increased risk of preterm birth associated with maternal obesity particularly very early preterm births before 28 weeks of gestation, suggesting that the level of maternal obesity could be critical in determining preterm risk.[7] Naeye et al, found a higher incidence of preterm birth with higher maternal weight, suggesting that maternal obesity might be a risk factor for preterm birth.[8] Cnattingius et al, showed that nulliparas with BMI>30kg/m2 had higher overall risk for preterm <32 weeks but this was not statistical significance when women with hypertension were excluded. Sebire et al, showed that there was no link between BMI and preterm birth in a major English population cohort study.[9]

In our study, post-dated pregnancies were more common in obese individuals (28.1%) and normal weight (22.2%) groups compared to overweight (11.1%). Overall, post-dated pregnancy has become more common in the present days due to sedentary lifestyle. Ehrenberg et al and Sebire et al, demonstrated that high BMI had an Odd's ratio of 1.5 and 1.72-times higher risk for prolonged pregnancy and they also have prolonged labor and failed induction.[10,11]

There is also increased incidence of induction of labor among obese women ranging 1.7 to 3.3 times. In our study, we found obese and normal group women needed induction of labor (around 30%) compared to overweight group. The difference we found was that normal BMI group women responded well to induction of labor and had a vaginal delivery with a rate of failed induction being very low of only 2.8% compared to obese group of 12.5% and overweight group of 11.1%. Post-dated pregnancy is common these days because of sedentary lifestyle hence seen even in normal BMI group but these women respond well to induction. Whereas women in higher BMI group experience high rate of failed induction which in turn increases caesarean section rate.

The increased caesarean rates in obese women can be attributed to factors such as dystocia, increased soft tissue deposition in the pelvis and higher rates of foetal macrosomia. These factors complicate vaginal delivery, necessitating surgical intervention. In our study, we found a high rate of 68.8% of caesarean rate in obese group. Surgical site infections (SSI) are more common in obesity

as the development of seroma and hematomas is more and also due to poor vascularity to subcutaneous adipose tissue. No cases of puerperal sepsis were reported across all three BMI categories in our study, suggesting a uniform absence of this complication regardless of maternal BMI. Literature shows that puerperal sepsis can occur more frequently in obese women due to immunological and inflammatory changes associated with obesity.[12]

In our study, PPH was more in normal BMI group. In other studies, increase in PPH with increase in BMI has been attributed to higher rates of caesarean section and higher risk for haemorrhage. But some studies have not shown such co-relation.[13]

Pregnancy itself is a risk factor for venous thrombo-embolism (VTE). The possible reasons include venous stasis from decreased mobility in obese individuals, higher levels of inflammatory markers promoting a hypercoagulable state. In a population-specific case-control study, a danish group examined how obesity (BMI>30 kg/m2) and cigarette smoking affect pregnancy-associated VTE.[14] Obesity was linked to an approximately 5-fold increased risk of VTE overall and a roughly 15-fold increased risk of PE compared to a 4-fold increased risk of DVT.[14] Due to relatively small sample size and a few of the patients had received prophylactic thromboprophylaxis in our study which limited the detection of DVT. Only one obese woman developed DVT.

Maternal early pregnancy BMI have a meaningful impact on pregnancy outcome. Women who are obese before pregnancy are prone to non-communicable diseases like diabetes, hypertension and cardiovascular disease. According to institute of medicine, gestational weight gain in pregnancy should be 5-9 kg if they are obese and 6.8-11.3 kg if they are overweight.[2] Increased maternal weight pre-pregnancy or the increased weight gain in pregnancy is a risk factor for fetal macrosomia in non-diabetic mothers. It also increases the risk of shoulder dystocia, cesarean section, instrumental delivery and childhood obesity.

Watkins et al, demonstrated that fetus of obese women had a two-fold high risk for neural tube defects.[15] There is a correlation between maternal obesity and increased likelihood of structural defects like cleft lip, palate, renal and urinary system.[16,17] As a result of the fact that many of these problems manifest themselves during the time of organogenesis that takes place in the first eight weeks of pregnancy, it is recommended that the mother's weight be optimized prior to the occurrence of conception. There is proof to imply that a notable rise in the hazard of late foetal death is connected with maternal obesity that occurs prior to pregnancy. Pregnant women who are nulliparous and have a high body mass index are most vulnerable to infant mortality, with the danger being more than twice as high for them as it is for other mothers.[18] During pregnancy, insulin resistance can lead to higher levels of circulating glucose, which crosses the placenta and stimulates foetal insulin production. Insulin acts as a growth hormone for the foetus, promoting increased growth and higher birth weights. We did not find significant neonatal weight difference between the 3 groups.

In our study, neonatal intensive care unit (NICU) admissions were significantly higher in overweight (66.7%) and normal weight (69.4%) groups compared to obese (21.9%) group, with a significant association (P-0.000). Neonates from the overweight and normal weight mothers required intensive care admission mainly for phototherapy to treat neonatal hyperbilirubinemia. A study discussing the impact of BMI, gestational diabetes (GDM) and preeclampsia on neonatal outcomes, including hyperbilirubinemia, notes that these maternal conditions are indeed associated with an increased risk of neonatal jaundice. The study points out that the physiological stresses changes in foetal blood chemistry and increased bilirubin production, can lead to higher rates of hyperbilirubinemia.[19]

The limitation of the study is very limited sample size. Hence, we could not get significant findings in our study though variables like GDM, hypertensive disorders, post-dated pregnancy, IOL, failed induction, neonatal weight were high in higher BMI groups. We hardly had few cases of preterm labour, DVT and SSIs in our study, so couldn't interpret these findings too.

CONCLUSION

The significant variables were mode of delivery, PPH, admission to NICU and hyperbilirubinemia. Caesarean section was more in obese women. PPH was more among normal and overweight women. Admission to NICU was more among normal and overweight group because of neonatal hyperbilirubinemia for the need for phototherapy. There is obvious increase in trend of GDM, gestation hypertension in obese and overweight women. Failed induction requiring more caesarean section was high in higher BMI women. Addressing the challenges associated with maternal obesity through targeted interventions and comprehensive prenatal care can enhance the health and well-being of both mothers and their neonates, improving pregnancy outcomes and promoting the health of future generations.

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