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Research Article

MATERNAL OBESITY AS A PREDICTIVE MARKER FOR ADVERSE PREGNANCY OUTCOME: A CASE–CONTROL STUDY

JYOTI SAINI[1]*, SAWAI SINGH LORA[2], MONICA CHETANI GUPTA[3]

[1]Department of Obstetrics and Gynaecology, Zanana Hospital, SMS Medical College, Jaipur, Rajasthan, India. [2]Department of Pediatrics, J. K. Lon Hospital, SMS Medical College, Jaipur, Rajasthan, India. [3]Department of Obstetrics and Gynaecology, FNB, Reproductive Medicine, FMAS, Delhi, India
***Corresponding author: Jyoti Saini; Email: drjyotiindoria@gmail.com**

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ABSTRACT

Objective: Obesity in pregnancy is an important risk factor for adverse maternal and neonatal outcomes. In the past, various studies have compared adverse pregnancy-related outcomes between obese and normal body mass index (BMI) mothers. In the present study, we aimed to examine the impact of obesity class on maternal and perinatal outcomes.

The aim of the study was to evaluate the association between maternal adiposity and pregnancy outcomes.

Methods: A prospective and cross-sectional study conducted at Zanana Hospital SMS Medical College Jaipur on 68 antenatal obese/overweight woman (BMI>25 kg/m^2) and 68 control antenatal woman (BMI<25 kg/m^2) with singleton pregnancies.

Results: The incidence of gestational diabetes was 8.82% and 2.94%, respectively, in obese and control group. The incidence of pre-eclampsia was 14.70% and 5.88% in obese and control group. The incidence of gestational hypertension was 8.82% and 5.88% in obese and control group. The cesarean delivery rates were higher in obese group (55.88%) than control group (32.35%). About 20.58% of babies born to obese women and 8.82% of babies born to control were admitted in NICU ($p<0.05$). The incidence of pre-term delivery, fetal abnormality, and macrosomia was higher in obese group as compared to control group.

Conclusions: Obesity increases the risk of many adverse maternal and neonatal outcomes. Therefore, appropriate measures must be taken to reduce obesity incidence in women of reproductive age to circumvent the adverse maternal and neonatal outcomes associated with obesity.

Keywords: Adverse pregnancy-related outcomes, Obesity class, Maternal adiposity, Pregnancy outcomes

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INTRODUCTION

Obesity is a state of excessive fat accumulation, occurring commonly due to an excessive intake of fat rich food, and/or due to decreased physical activity, though other factors such as metabolic and endocrine derangement and genetics also have an important role to play. Nowadays, obesity is a global problem especially in a modern world and it carries the risk of developing potentially dangerous states such as high blood pressure, Type 2 diabetes, coronary heart disease, stroke, and various cancers [1].

In the past two decades, obesity has risen to high magnitude both in developing and developed countries. Obesity is considered as the sixth important public health problem which causes several diseases such as polycystic ovarian syndrome, chronic hypertension, diabetes, cardiovascular diseases, strokes, and cancer. Obesity is likely to reduce the overall life expectancy [2,3]. Seeing the increasing magnitude the WHO had declared obesity as a pandemic issue in females especially in the child bearing age [4]. Maternal obesity has increased considerably among women of reproductive age in the last decades in both high and middle-income countries [5]. In 2014, the estimated percentage of overweight and obesity among pregnant women was 21.7 % in India [6].

Maternal obesity leads to negative outcomes for both mother and fetus and also has health implications later in life for both mother and child. Increasing obesity is associated with rise in various adverse obstetric and fetal outcomes, especially higher incidence of pre-eclampsia, gestational diabetes, abnormal labor, cesarean section, deep vein thrombosis, wound infection, fetal macrosomia, unexplained fetal death, respiratory distress, and neonatal death. The excessive accumulation of adipose tissue during pregnancy leads to chronic inflammatory responses and results in derangement of metabolic homeostasis culminating in obesity related disorders in pregnancy such as gestational diabetes mellitus (GDM), hypertensive disorder in pregnancy (Gestational hypertension, pre-eclampsia, and eclampsia), and fetal growth disorders [1]. Maternal obesity and GDM are independently linked to unfavorable pregnancy outcomes with some variations in the influence of each condition. GDM increases the risk of hypertensive disorders of pregnancy, polyhydramnios, and premature delivery. GDM leads to excessive fetal growth, which increases the risk of cesarean deliveries, shoulder dystocia, and neonatal hypoglycemia. The fetus is at risk for macrosomia, cesarean deliveries, stillbirth, and congenital anomalies Long-term complications of GDM include diabetes and cardiovascular disease in mothers, obesity, and diabetes in the offspring [7-9].

Aim

The aim of the study was to evaluate the association between maternal adiposity and pregnancy outcomes.

METHODS

Study design

A prospective and cross-sectional study conducted at Zanana Hospital, SMS Medical College, Jaipur, on 68 antenatal obese/overweight woman (Body mass index [BMI]>25 kg/m^2) and 68 control antenatal woman (BMI<25 kg/m^2) with singleton pregnancies between May 2022 and December 2022.

Inclusion criteria

The following criteria were included in the study:

1. Age 18–45 years
2. Singleton intrauterine pregnancy.

Exclusion criteria

The following criteria were excluded from the study:

a. Multiple pregnancy
b. Congenital malformations in fetus
c. Pre-existing diseases
   - Hypertension
   - Diabetes Mellitus
   - Renal disease
   - Connective tissue diseases
d. Use of anti-obesity/Anti-lipidemic drugs
e. Prior cesarean section or prior abdominal surgery

Methodology

Gravid subjects attending the antenatal OPD at Mahila Chikitsalya SMS Medical College, Jaipur, with a singleton intrauterine pregnancy during the study period were recruited for the study after taking an informed written consent and clearance from the Ethics Committee of Hospital. A detailed history regarding age, parity, socioeconomic status, past and personal history, family history, menstrual, and obstetric history was taken and BMI was calculated. They are followed up to delivery and postpartum until discharge and the following outcomes are studied.

Table 1: Comparison of maternal outcomes in obese and control group

Complications	Control		Obese	
	No	Percentage	No	Percentage
Gestational diabetes mellitus	2	2.94	6	8.82
Pre-eclampsia	4	5.88	10	14.70
Gestational hypertension	4	5.88	6	8.82
APH	4	5.88	10	14.70

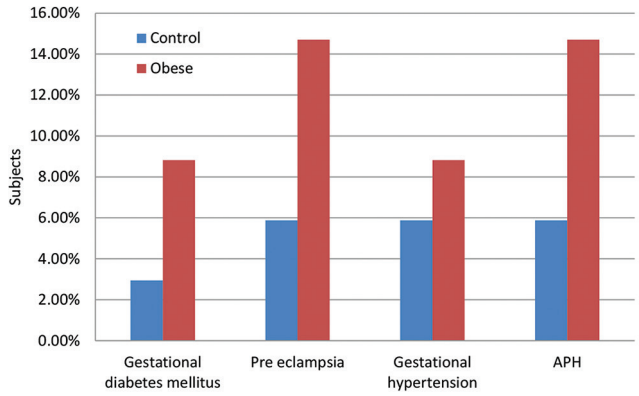


Table 2: Comparison of obstetrics complications in obese and control group

Complications	Control		Obese	
	No	Percentage	No	Percentage
Multiple pregnancy	2	2.94	2	2.94
Abruptio placenta	2	2.94	2	2.94
Placenta previa	2	2.94	2	2.94
Malpresentation	10	14.70	6	8.82

p>0.05(not significant)

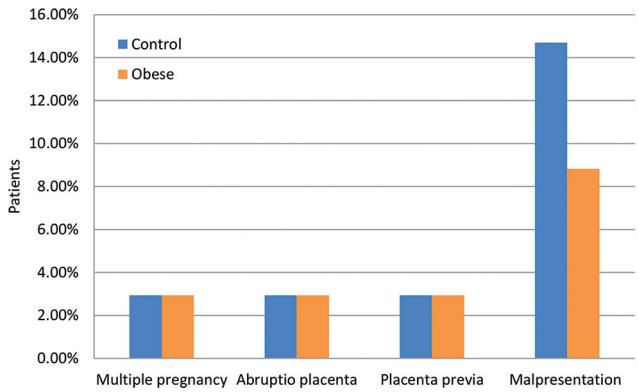


Table 3: Comparison of vaginal and cesarean delivery in obese and control group

Mode of delivery	Control	Obese
Vaginal	46 (67.64%)	30 (44.11%)
Cesarean	22 (32.35%)	38 (55.88%)

p=0.001(significant)

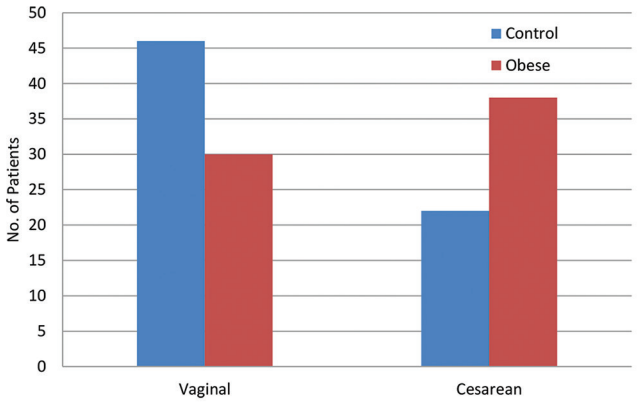
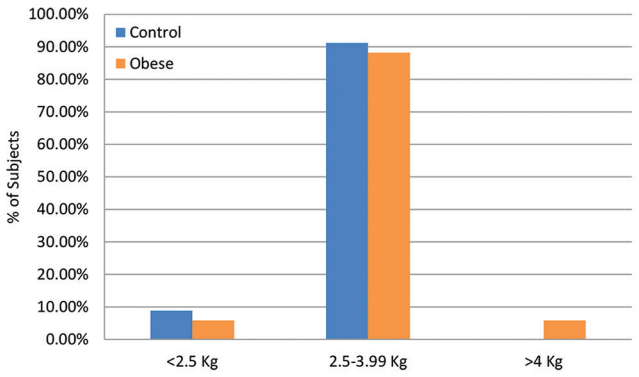


Table 4: Comparison of birth weight in obese and control group

Birth weight (kg)	Control		Obese	
	No	Percentage	No	Percentage
<2.5	6	8.82	4	5.88
2.5–3.99	62	91.18	60	88.24
>4	0	0	4	5.88
Total	68	100	68	100



- Gestational diabetes
- Pre-eclampsia
- Gestational hypertension
- Malpresentation
- Abruptio placenta
- Placenta previa
- Labor induction and their indication
- Mode of delivery (vaginal/Cesarean delivery)
- Duration of hospital stay.

For neonates, the following outcomes are studied

- Gestational age at birth,
- Birth weight,
- APGAR at 5 min,
- Admission in NICU and indications for admission is analyzed.

Table 5: Comparison of mean birth weight in obese and control group

Case	Numbers	Mean (kg)	Standard deviation	Student t-test
Control	68	2.91	0.323	t=4.80
Obese	68	3.15	0.442	p=0.001

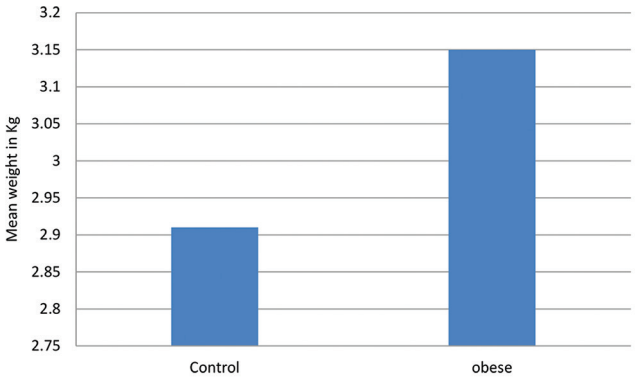
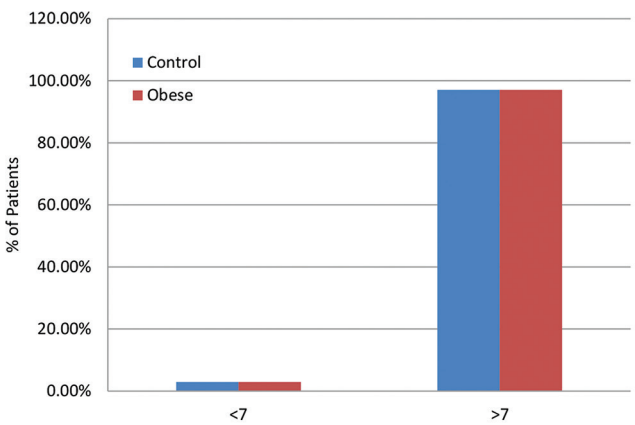


Table 6: Comparison of APGAR at 5 min in neonates in obese and control group

Apgar at 5 minutes	Control		Obese	
	No	Percentage	No	Percentage
<7	2	2.94	2	2.94
>7	66	97.06	66	97.06



RESULTS

The incidence of gestational diabetes was 8.82% and 2.94%, respectively, in obese and control group. The incidence of pre-eclampsia was 14.70% and 5.88% in obese and control group. The incidence of gestational hypertension was 8.82% and 5.88% in obese and control group. The results were statistically significant.

Obstetric complications such as multiple pregnancy, placenta previa, abruptio placenta, and malpresentation existed in both groups, but the difference was not statistically significant.

The cesarean delivery rates were higher in obese group (55.88%) than control group (32.35%).

2 babies were >4 kg in obese women but none in control group.

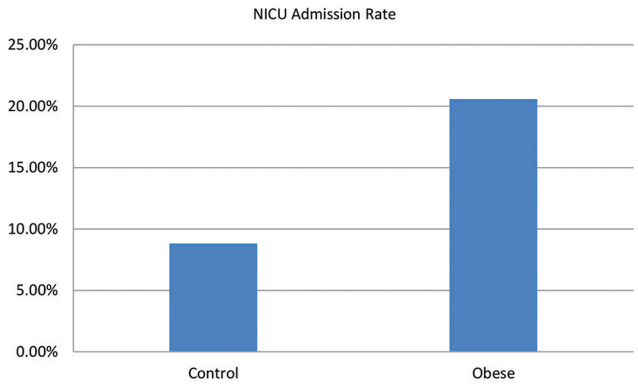
The mean birth weight of neonate was 3.15 kg in obese group and 2.91 kg in control group.

The difference of APGAR at 5 min between obese and control group was not statistically significant (p>0.05).

About 20.58% of babies born to obese women and 8.82% of babies born to control were admitted in NICU (p<0.05).

Table 7: Comparison of NICU admission rates and their indications in obese and control group

Indications	Control		Obese	
	No	Percentage	No	Percentage
Meconium aspiration	2	33.33	2	14.28
Infant of diabetic mother	2	33.33	6	42.85
Preterm	2	33.33	2	14.28
Abnormality	0	0	2	14.28
Macrosomia	0	0	2	14.28
Total	6	8.82	14	20.58



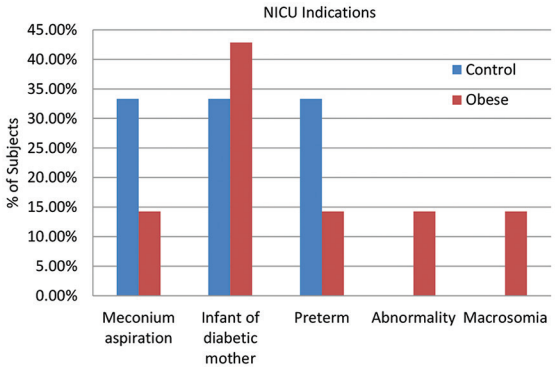
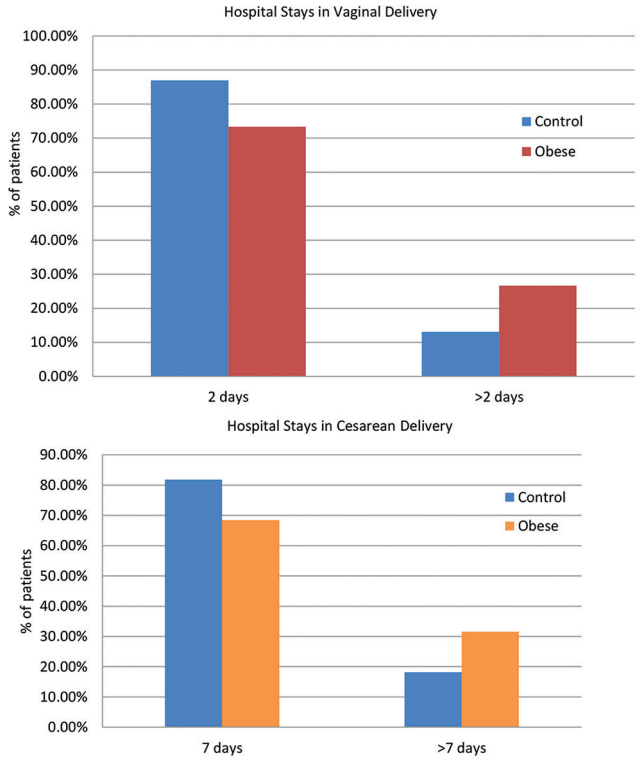


Table 8: Comparison of hospital stay duration in obese and control group

Hospital stay	Control		Obese	
	No	Percentage	No	Percentage
Vaginal delivery				
2 days	40	86.95	22	73.33
>2 days	6	13.05	8	26.66
Cesarean delivery				
7 days	18	81.81	26	68.42
>7 days	4	18.18	12	31.57

p<0.05 significant



Among vaginal delivery group, 26.66% of obese women and 13.05% of control women required prolonged hospital stay (>2 days).

DISCUSSION

In the present study, it is demonstrated that obesity in early pregnancy is associated with significantly increased risks of developing GDM, GHTN, APH, and pre-eclampsia. Overweight and obese pregnant women have higher incidence of cesarean section and have prolonged hospitalization.

For the neonates, maternal overweight and obesity were associated with significantly increased risks of LGA and NICU admission. The high prevalence of overweight and obesity among pregnant women is increasing and the strong association between excess maternal weight and adverse pregnancy outcomes had resulted in increasing the burden of obstetric care [10].

Maternal obesity is associated with an increased risk of GDM [11,12] A meta-analysis of 20 studies demonstrated that the odds ratio of developing GDM was 2.14, among overweight (BMI 25–30 kg/m^2), and 3.5 in obese mothers (BMI>30 kg/m^2) [12].

Hedderson *et al*. in their study found that pre-pregnancy weight gain in the 5 years before becoming pregnant, increases the risk of developing GDM, and that this was especially true for women who were not initially overweight [11]. Hedderson *et al*. [11] found that GDM was more likely in women with age older than 35 years and who were of Asian ethnicity.

The reason obese women are at higher risk of developing GDM has not been fully understood but probable reason seems to be related to an increase in insulin resistance. The continued production of counter-regulatory (anti-insulin) hormones by the growing placenta leads to insulin resistance throughout pregnancy [11].

The development of GDM leads to many adverse maternal and fetal implications. For mother, these include an increased risk of hyperglycemia, cesarean delivery, and diabetes in later life [13]. The implications for the newborn may be even more severe. Pregnancies complicated by GDM have an increased risk of perinatal mortality and a increased risk of macrosomia. In addition to being larger, infants born of pregnancies complicated by GDM also have significantly larger skin folds and therefore are at increased risk of shoulder dystocia and resultant birth injury [14]. Moreover, infants born of GDM pregnancies are more likely to develop childhood and adult obesity as well as Type 2 diabetes mellitus [15].

Maternal obesity is associated with an increased risk of hypertensive disorders of pregnancy, including preeclampsia having odds ratio between 2 and 3 [16]. The risk increases as BMI increases [17].

Moreover obese and overweight women are at increased risk of complications during labor and delivery. The rate of successful vaginal delivery decreases as maternal BMI increases. A meta-analysis showed that the odds ratio of cesarean delivery were 1.46, 2.05, and 2.89 among overweight, obese, and severely obese women, respectively, in comparison to normal weight pregnant women [18].

Maternal obesity have also influence on the success rate of attempted vaginal birth after cesarean [19].

The reason behind increased cesarean rate in obese pregnant women is not known, but a probable explaination is that obese women are more likely to experience dysfunctional labor. Vahratian *et al*. [20] found that the rate of cervical dilation in nulliparous women in spontaneous labor decreased as maternal BMI increased.

Maternal obesity is associated with abnormal fetal growth. Mother who are heavier are lesser incidence of small-for-gestational age infant or intrauterine growth restriction, but the protective effect appears to dissipate once the maternal BMI reaches the level of obesity (>30 kg/m^2). The major concern with maternal obesity is fetal macrosomia which appears to be increased 2- to 3-times in obese mothers [21]. In a meta-analysis, the prevalence rates of fetal macrosomia were 13.3% for obese women as compared with 8.3% for the normal weight control group [22].

Although a number of factors are responsible for increase in the prevalence of fetal macrosomia, the existing data suggest that maternal obesity is the main factor, followed by maternal diabetes status [21].

Fetal macrosomia in obese women is associated not only with an increase in the absolute size of the fetus, but also in a change in body composition [23,24] Sewell *et al*. [23] found that the average fat mass of infants born to mothers with a BMI (>25 kg/m^2) was more as compared the offspring of women with a BMI<25 kg/m^2.

Maternal obesity is also associated with an increased risk of congenital malformation including neural tube defect (NTD) in the offspring, even after matching for ethnicity, maternal age, education, and socioeconomic status [25-27]. Watkins *et al*. [26] found that a 1 kg/m^2 increase in BMI is associated with a 7% increased risk of having an infant with NTD. The underlying mechanism responsible for increased risk of NTD in obese pregnancies is unknown. Various researches have suggested that

a reduction in the amount of folic acid reaching the developing embryo due to insufficient absorption and chronic hypoxia, greater maternal metabolic demands, and increased circulating levels of triglycerides, estrogen, and insulin (due to increased insulin resistance) may be responsible for increased frequency of NTD in off springs of obese mothers [25,26].

CONCLUSION

Pregnancy complications related to maternal obesity is a growing problem. Maternal obesity is a risk factor for GDM, pre-eclampsia, and gestational hypertension, fetal macrosomia, and increased newborn hospitalization. Therefore, pre-pregnancy counseling and appropriate multidisciplinary management should be done to bring awareness among pregnant women.

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