

Short term effects of maternal obesity on mother and fetus: a prospective study

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ABSTRACT

Background: Obesity is such a common health care problem of female population that have major impact on pregnancy. The worldwide prevalence of obesity is more than doubled in between 1980 and 2015. The objectives of present study are to observe whether obese women have an increased risk of pregnancy related complications and adverse fetal outcome and also to compare pregnancy outcomes in different classes of BMI in obese group.

Methods: A prospective observational study conducted in OBG department JSS Hospital, Mysore from November 2014 to July 2016. All pregnant women attending OPD and inpatients of antenatal wards were screened for pre-pregnancy BMI. Total number of singleton births were 5727 in our institution. Out of which 314 obese pregnant women were included in the study group, remaining 5413 non-obese pregnant mothers were taken as control group respectively. They are closely monitored in every antenatal visit for development of complications such as pre-eclampsia, gestational diabetes mellitus, increased rate of caesarean section and presence of macrosomia (B.wt >3.5kg).

Results: In comparison to normal BMI pregnant women, obese mothers had an increased risk of gestational hypertension (16.9% versus 2.0%, OR-2.3) gestational diabetes mellitus (35.7% versus 3.1%, OR-2.84), preeclampsia (23.9% versus 5%, OR-1.64) cesarean sections (75.2% versus 65.4%), macrosomia (45.9% versus 22%, OR-1.64), it was also found that as BMI increases the incidence of these complications increase as seen in different classes of obese population.

Conclusions: Pregnancy associated with obesity is considered as a high-risk pregnancy and obesity being a modifiable risk factor, educating women in early pregnancy and preconceptional counseling regarding harmful effects of obesity and information regarding appropriate gestational weight gain is essential.

Keywords: Cesarean section, Gestational diabetes mellitus, Macrosomia, Pre-eclampsia

INTRODUCTION

Obesity is a considered as a pandemic in the 21st century. The prevalence rates of obesity in the general population have increased substantially in the past 20 years.

The latest projections from WHO show 2.3 billion were overweight and 700 million were obese in 2015.¹ While the rising figures include the population as a whole and

are of great concern, what is even more alarming is the number of women of childbearing age who are overweight or obese.

Prevalence of obesity is doubled among women from 16.5% to 33.2% in the last few years. The national health and nutritional examination survey indicated that more than one third of reproductive age is overweight and 8% are extremely obese.²

According to National Family Health Survey (NHFS-3) 2005-06 of India. The prevalence of obesity among Indian women between 15-49 yrs shown an increase by 24.52 per cent in a 7-year period.³

ICMR-INDIAB phase1 further stated that an increase of 24.1 per cent expecting a further increase by 91.3 per cent in a 5-year period and, on the whole, an increase by 127.4 per cent over a 12 years period.³ The obstetrical population has not been immune to this pandemic. According to Maternity Experiences Survey (MES) carried in 2006-2007, approximately one-third of women aged 15 and older began their pregnancy were either overweight or obese.⁴

This increase in the prevalence of maternal obesity is of great concern as it has been found to be associated with adverse health outcomes affecting the mother and her fetus, neonate and child such as hypertensive disorders of pregnancy, gestational diabetes mellitus, thromboembolic complications, excessive gestational weight gain and retainment after delivery, miscarriage (Yogev and Catalano, 2009), increased risk for a caesarean section, labour induction, prolonged delivery, shoulder dystocia, excessive blood loss, macrosomia/LGA, early neonatal deaths.⁵

Unfortunately, the association between obesity and adverse pregnancy outcomes is not universally acknowledged, which only serves to perpetuate the problem hence this study aimed to test the hypothesis that obesity, as determined by maternal body mass index (BMI), is associated with adverse outcomes for mother and baby, and to quantify this risk.

The objective of the study was to analyse whether obese pregnant women have an increased risk of complications compared to women with normal BMI such as complications in mother (Pre-eclampsia and gestational hypertension, gestational diabetes mellitus, caesarean delivery), Complications in fetus (macrosomia) and to compare pregnancy outcomes in different classes of BMI among obese women.

METHODS

It is a prospective observational study conducted in OBG Department, JSS Medical college and Hospital, Mysore from November 2014 to July 2016. All obese pregnant women (i.e pre-pregnancy BMI/BMI at the first antenatal

visit >30 kg/m²) attending OPD and those admitted in wards were taken as subjects.

Inclusion criteria

- All pregnant women with singleton pregnancies, booked with the hospital
- Regular with follow up till delivery.

Exclusion criteria

- Unbooked cases with no data on pregnancy, delivery or birth outcome
- Twin pregnancies, abortions, fetal deaths
- Lost to follow up
- Known case of hypertensives, diabetes mellitus and thrombophilias.

All mothers were followed up with regular antenatal check-ups with measurement of blood pressure and investigations such as urine protein, OGCT with 75 gm glucose were done. They are closely monitored in every antenatal visit for any development of pre-eclampsia, gestational diabetes mellitus. They were admitted in due time in our antenatal ward for timely management and intervention.

Relevant complications if any, were treated as per protocol. Mode of delivery was decided according to obstetric indication. They are monitored in their hospital stay and till the end of delivery to know the rate caesarean sections and prevalence of macrosomic babies.

Statistical analysis

Statistics used were descriptives, cross tabs, odd's ratio, All the statistical calculations were done through SPSS for windows (v 16.0).

RESULTS

For the given time period, a total of 5727 singleton pregnant women were followed up to delivery. Out of which 314 obese pregnant women were taken as a study group for the present study.

The remaining sample was considered as control group consists of 5413 non-obese women. The incidence accounts to 5.48% of the total sample of singleton deliveries.

Table 1: Age and parity analysis.

| Age | Obese (n=314) | Non-obese (n=5413) | parity | Obese (n=314) | Non-obese (n=5413) |
|-------|---------------|--------------------|--------------|---------------|--------------------|
| 18-24 | 103 (32.8%) | 2636 (48.7%) | primigravida | 175 (55.7%) | 3085 (57%) |
| 25-29 | 127 (40.4%) | 2165 (40%) | multigravida | 139 (44.3%) | 2327 (43%) |
| >30 | 84 (26.8%) | 612 (11.3%) | | | |

The maximum was in the age group of 18-24 years. Parity analysis of both the groups were similar with no statistical significance.

Majority of the sample (76.10%) of the study group come under class -1 (30-34.9) kg/m² BMI. Mean BMI for the group is 34.1kg/m² (Table 1). The complications studied

have significant increase in obese compared to non-obese group.

In obese group the rate of emergency LSCS is greater than that of elective LSCS (43.3%vs30.7%). The rate of emergency LSCS in obese group is higher than that of non-obese group (43.3%vs40.6%) but not found to be statistically significant (Table 2).

Table 2: Comparison of complications in obese and non-obese.

| Complications | Obese (n=314) | Non-obese (n=5413) | P value | Odd's ratio (95% CI) |
|-------------------------------|---------------|--------------------|---------|----------------------|
| Gestational hypertension | 53 (16.9%) | 107 (2.0%) | 0.0005 | 2.31(2.66-1.95) |
| Pre-eclampsia | 75 (23.9%) | 309 (5.7%) | 0.0002 | 1.64 (1.92-1.36) |
| Mild | 52 (16.6%) | 190 (3.5%) | | |
| Severe | 23 (17%) | 119 (2.1%) | | |
| Gestational diabetes mellitus | 112 (35.7%) | 166 (3.1%) | 0.0001 | 2.86 (3.14-2.20) |
| Diet | 75 (23.9%) | 107 (1.97%) | | |
| Insulin | 37(11.8%) | 59 (1.08%) | | |
| Macrosomia (>3.5 kg) | 144 (45.9%) | 1203 (22.2%) | 0.0002 | 1.10 (0.85-1.36) |
| Mode of delivery | | | | |
| Cesarean section | 236 (75.2%) | 3540 (65.4%) | 0.001 | |
| Emergency LSCS | 136 (43.3%) | 2200 (40.6%) | | |
| Elective LSCS | 97 (30.7%) | 1343 (24.8%) | | |
| NVD | 78 (24.8%) | 1873 (34.6%) | | |
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Table 3: Distribution of BMI classes among obese group.

| BMI class | BMI (kg/m ²) | No. of pregnant women | Percent |
|-----------|--------------------------|-----------------------|---------|
| Class-I | 30-34.9 | 239 | 76.1 |
| Class-II | 35-39.9 | 59 | 18.8 |
| Class-III | 40+ | 16 | 5.1 |

The complications such as gestational hypertension, pre-eclampsia and GDM increased significantly as BMI increased which was comparable with other studies.

The incidence of emergency LSCS in all the groups increased as BMI increases such as (41%, 49.2% and 56.2 %) in class I, class II and class III respectively,

which is found to be statistically significant with p value =0.0001. But the incidence of elective LSCS, it is higher in class III (37.5%) followed by class I (31.8%) and then by class II (25.4%) which is not statistically significant (p value=0.145).

The incidence of macrosomia increases as BMI increases seen as 41% in class I with a drastic increase to 62.10% in class II and 62.5% in class III.

However, the p value for this increase in incidence =0.006, which is not statistically significant (Table 4).

Out of n=314 obese pregnant women only 133 (42.3%) were without any antenatal complications such as hypertensive disorders and gestational diabetes, out of

which 9.02% obese pregnant women not even had other complications like macrosomia and operative delivery.

90.98% of the obese group had at least any one of the 4 complications discussed above.

Table 4: Distribution of complications in different classes of BMI.

| | N=314 | Class 1 (n=239) | Class 2 (n=59) | Class 3 (n=16) | P value |
|--------------------------------------|-------------|-----------------|----------------|----------------|---------|
| Gestational hypertension | 53 (16.9%) | 30 (12.6%) | 17 (28.8%) | 6 (37.5%) | 0.001 |
| Pre-eclampsia | | | | | 0.001 |
| Mild | 52 (16.6%) | 30 (12.6%) | 16 (27.1%) | 6 (37.5%) | |
| Severe | 23 (7.3%) | 14 (5.9%) | 6 (10.2%) | 3 (18.8%) | |
| Gestational diabetes mellitus | | | | | 0.0003 |
| Diet | 75 (23.9%) | 50 (20.9%) | 16 (27.1%) | 9 (56.2%) | |
| Insulin | 37 (11.8%) | 24 (10%) | 8 (13.6%) | 5 (31.2%) | |
| Macrosomia | 144 (46%) | 98 (41%) | 36 (62.1%) | 10 (62.5%) | 0.006 |
| Mode of delivery | | | | | |
| NVD | 78 (24.8%) | 64 (26.8%) | 13 (22%) | 1 (6.2%) | |
| Elective LSCS | 97 (30.9%) | 76 (31.8%) | 15 (25.4%) | 6 (37.5%) | 0.145 |
| Emergency LSCS | 136 (40.3%) | 98 (41%) | 29 (49.2%) | 9 (56.2%) | 0.0001 |
| Instrumental | 3 (1%) | 1 (0.5%) | 2 (3.5%) | 0(0) | |

Only pre-eclampsia is seen 14.1% of obese women which significantly increases as BMI increases in different classes of obese group as 12.9%, 16.9% and 18.5% in class I, class II and class III respectively. Only GDM is

seen in 22.3% of obese women but there is no statically significant increase in the incidence between class I and class II, but a marked increase is seen in Class III (21.75%, 20.3% and 37.5% respectively (Figure 1).

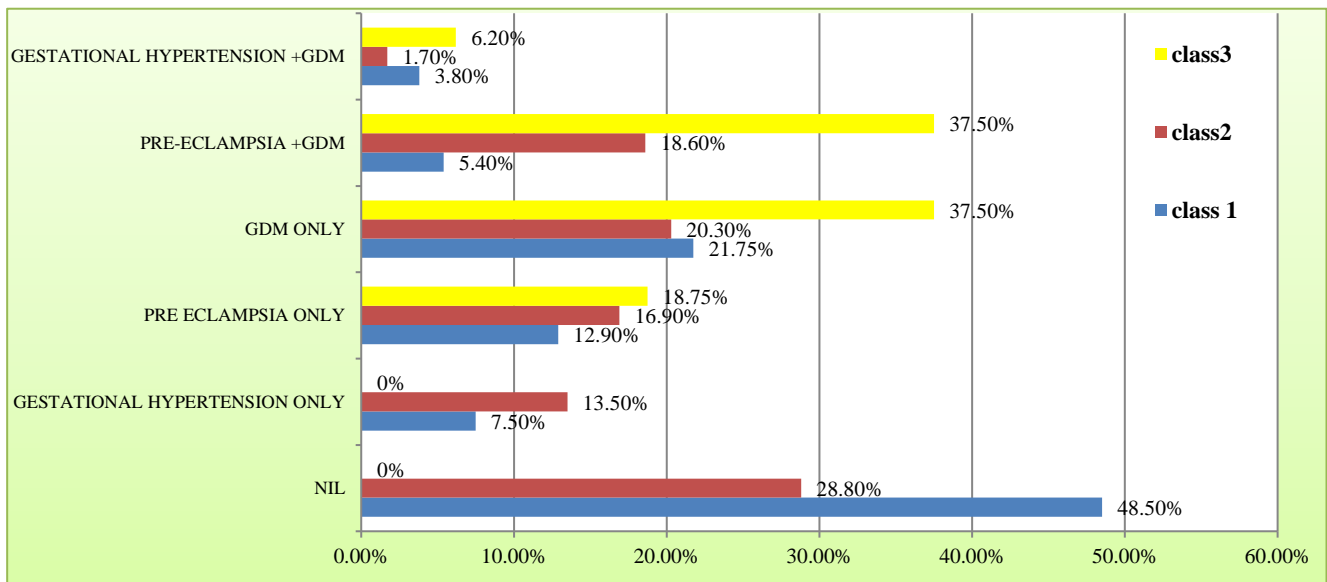


Figure 1: Combination of complications in different classes of BMI.

Presence of all four complications such as GDM, pre-eclampsia, macrosomia and caesarean section are present in 8.6% of obese pregnant women (n=314). The presence of all four complications in obese group (n=314) increases with increase in BMI which is seen as

7.1%, 8.5% and 31.2% in class I, class II and class III respectively. P value for increase in the incidence of presence of all 4 complications = 0.004 which is statistically significant (Figure 2).

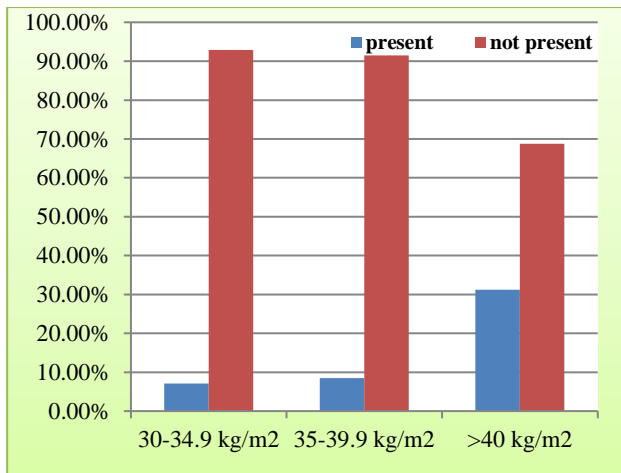


Figure 2: combination of all four complications among obese women.

DISCUSSION

Obesity has become epidemic proportions in India in the 21st century, affecting 5% of the country’s population. The percentage of childbearing obese women is increasing, and it is estimated that at least 22% of women ages 20-39 years are either overweight or obese.⁶ The present study identified the incidence of obesity in our hospital with 5.48% (n=314) of singleton pregnancies delivered at term.

Pre-pregnancy weight may have some impact on woman’s weight during her pregnancy; specifically, if a woman is obese prior to becoming pregnant, is likely to remain obese during pregnancy and likely to result with poor pregnancy outcomes.

The mean age of the present study is 26.9 which was comparable to other studies such as Mandal et al (26.8) and Teresa et al (26.32).⁸ The present study revealed that the parity analysis is similar to the studies by Dasgupta et al and Mandal et al, that the BMI gradient did not differ by parity.^{8,9}

There is a significant increase in gestational hypertension in obese population compared to non-obese group (16.9% vs 2.1%), which is found to be significant with an odd’s ratio of 2.3 comparable to that of study done by Dasgupta

et al (Table 5). The incidence of gestational hypertension increases as BMI increases significant p value of 0.001.⁹

Pre-eclampsia in antenatal period is higher in obese women (mild PIH of 16.6% and severe PIH of 17%), when compared to non-obese women (mild PIH of 3.5% and severe PIH of 2.1%) with the p value <0.0002. Similarly, Sebire et al (2001) reported in their study, a 2-4-fold increase in preeclampsia in obese women.¹¹

Brien et al, reported that the risk of preeclampsia typically doubled with each 5-7 kg/m² increase in maternal BMI.¹² There was a linear trend of increase in incidence of pre-eclampsia which is seen similar to that observed by Yogev and Catalano.⁵

In general, 1-3% of all pregnancies are diagnosed to have gestational diabetes, while in obese women it is found to be approximately 17% according to Gabee et al.¹³ In the present study GDM was significantly seen in 35.7% of obese pregnant women contrary to 3.1% in non-obese pregnant women.

The odd’s ratio for this association being 2.86 comparable with study by Sebire et al who had shown an odd’s ratio of 3.5 and Dasgupta et al shown an odd’s ratio of 5 in their studies.^{9,11} The magnitude of this risk positively correlating with increase in maternal weight is also seen in the meta-analysis of 20 studies examined by Chu et al and his associates and our study also shows increase in incidence is significant with p value=0.0003.¹⁴

The present study is in accordance with the study of Ehrenberg who reported a higher chance of caesarean delivery in obese women (13.8% versus 7.7%, P <0.0001).¹⁵

Out of 314 obese women 44.6% underwent emergency LSCS with most common indication being fetal distress and failed induction, and 30.7% underwent elective LSCS with most common indication being cephalo pelvic disproportion.

Most of the studies carried by Mandal et al, Teresa et al (Table 5) showed that, Emergency LSCS was particularly increased with increasing BMI but the present study showed that there is no significant increase in the rate of emergency LSCS when compared to that of non-obese.

Table 5: Comparison with other studies.

| | Gestational hypertension | Pre-eclampsia | GDM | Macrosomia | Cesarean delivery |
|----------------|--------------------------|---------------|--------|------------|-------------------|
| Kumari et al | 28.8% | - | 24.5% | 32.6% | 15.2% |
| Mandal et al | 12.32% | 8.76% | 19.43% | 22.28% | 58% |
| Dasgupta et al | 36.9% | 18% | 26.9% | 2.47% | 33.8% |
| Vijay et al | - | 36% | 8% | 16% | 44% |
| Present study | 16.9% | 23.9% | 35.7% | 46% | 75.2% |

Sheiner et al stated that after having adjusted for diabetes mellitus, no significant association was found between macrosomia and obesity alone.¹⁶ Besides, Catalano had already demonstrated that GDM can be a confounding factor in between macrosomia and obesity. In an analysis of a multi-country, facility based, cross-sectional survey of macrosomia in 23 developing countries, the cut off for macrosomia for Indian population is taken as ≥ 3.5 kg.¹⁷

In the present study, the results showed a significant association between macrosomia (b.wt >3.5 kg) and obesity with odds ratio of 1.10, however there was no linear trend of increase in macrosomia in different classes of obese group.

Combination of pre-eclampsia and GDM is seen in 9.6% of obese pregnant women and this association increases as BMI increases seen as 5.4%,18.6% and 37.5% in class I, class II and class III obese groups respectively. This is in concurrence with the study of Weiss and associates (FASTER Trial, 2004) which showed a marked increase in pre-eclampsia and diabetes of class I (10.2% and 12.3%) and class II (6.3% and 9.5%).¹⁸

CONCLUSION

The higher incidence of pregnancy complications in obesity is well established by many studies and this study also correlates with most of them. Hence obesity being a modifiable risk factor, interventions such as pre-conceptional counselling, pre-conceptional weight loss and recommended pregnancy weight gain can be helpful in achieving the goal, a healthy mother and a healthy baby.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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