

## Maternal obesity - Risks and outcome

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### Abstract

**Background:** The increasing rate of maternal obesity in reproductive age group is a major challenge to obstetricians, as it can result in adverse outcomes for both women and foetuses making the pregnancy a high risk one.

**Aim and objectives of the study:** Aim of the study is to evaluate the effect of obesity on maternal and perinatal outcome, in obesity complicating pregnancies. Objective is to assess the risk of obesity related complications in pregnancy by comparing with pregnancies with normal BMI.

**Methodology:** Prospective cohort study done between January 2017 – January 2018 in the Department of Obstetrics and Gynecology at Gitam Institute of Medical Sciences and Research - hospital, deemed to be University, Visakhapatnam.

**Results:** One hundred and five pregnant (105) women with BMI > 30kg/m<sup>2</sup> and two hundred and ten (210) pregnant women with BMI 18.5kg/m<sup>2</sup> to 25kg/m<sup>2</sup> were selected and were followed prospectively. Obese group had 9.35 fold increased risk of gestational diabetes, 7.0 fold increased risk of preeclampsia and increased caesarean delivery rate (56.57%). There were increased admissions to NICU among newborns of obese women (25.26%) when compared to control group (8.37%).

**Conclusion:** Pregnancies in obese women should be regarded as high risk pregnancies and appropriate antenatal, intranatal and post-natal care should be provided with heightened surveillance, with anticipation, early diagnosis and prompt intervention.

**Keywords:** BMI; maternal outcome; foetal outcome; obesity; GDM

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### Introduction

Worldwide obesity almost doubled between 1980 and 2014 as a silent epidemic and currently becoming an endemic condition. At present India is in 3rd position next to US and China and is racing ahead to the top. According to NHANES III (The Third National Health and Nutrition Examination Survey), 20% people are in reproductive age group [1].

Obesity may be defined as an abnormal growth of the adipose tissue due to enlargement of fat cell or increase in fat cell number or both [2]. Body Mass

Index (BMI) is commonly used for the assessment of obesity. BMI: "Weight in kg's divided by the square of the height in meters (kg/ m<sup>2</sup>) [3].

**Categories of BMI:** According to WHO and National Heart Lung and Blood Institute (1998), Underweight <18.5 (kg/m<sup>2</sup>); Normal weight 18.5 – 24.99 (kg/m<sup>2</sup>); Over weight 25-29.99(kg/m<sup>2</sup>); Obese >30 (kg/m<sup>2</sup>). Freedman et al. [4] classified obesity based on BMI as: Class I (Moderate obesity) 30-34.9 (kg/m<sup>2</sup>); Class II (Severe obesity) 35-39.9 (kg/m<sup>2</sup>); Class III (Very severe/morbid obesity) >40 (kg/m<sup>2</sup>). Obesity is a pre-existing maternal morbidity that makes pregnancy a high risk one.

Pregnancy specific complications of obesity are gestational diabetes, hypertensive disorders, preterm birth, prolonged pregnancy, multifoetal gestation, other complications, intrapartum complications, intra operative complications, increased birth weight, increased perinatal morbidity & mortality and postpartum complications. Other complications include urinary tract infections, anaesthetic & postpartum complications.

**Materials and methods:**

*Study design:* Prospective cohort study. Period of study from January 2017 to June 2018.

*Caseselection:* Among all antenatal mothers attending antenatal outpatient department, mothers were chosen according to their first trimester BMI > 30kg/m<sup>2</sup> as study group and mothers with a normal BMI between 18.5kg/m<sup>2</sup> and 25kg/m<sup>2</sup> as control group, irrespective of age, parity, socio-economic status, those who have given valid informed consent.

*Exclusion criteria:* Mothers who are not booked at first trimester, first or second trimester abortions, antenatal women who are diagnosed to have anomalous babies, women with known medical disorders, over weight (25.1kg/m<sup>2</sup> to 29.9kg/m<sup>2</sup>) and underweight (BMI <18.5kg/m<sup>2</sup>) gravidas and women who could not be followed till delivery are excluded from study.

**Methodology**

1. All Pregnant mothers were selected, according to the criteria. 2. In all pregnant women detailed history followed by complete examination was done. 3. Hematological, biochemical investigations,

USG were done relevantly. 4. They were followed till delivery and postpartum until discharge and outcome studied. 5. Incidence of complications like gestational hypertension, preeclampsia, gestational diabetes, postdated pregnancies, caesarean rates, duration of hospital stay were studied, infants birth weight, gestational age, NICU admissions were noted and its relation with obesity is analyzed.

**Results**

One hundred and five pregnant (105) women with BMI > 30kg/m<sup>2</sup> and two hundred and ten (210) pregnant women with BMI 18.5kg/m<sup>2</sup> to 25kg/m<sup>2</sup> were selected and were followed prospectively. Six obese women were excluded from the study, as four women had miscarriage, one lost for follow-up and one had anomalous baby. Nine women with normal BMI were excluded from the study, as five women had miscarriages, three lost for follow-up and one had anomalous baby. The remaining 94 obese women and 201 women with normal BMI were followed and studied.

The difference in age group distribution was statistically significant. The majority of obese women (40.42%) were between 25-29yrs, majority of control women (56.72%) were between 20-24yrs. Proportion of women in the age group >30yrs were 27.65% in obese group and only 8.96% in control group (Table 1).

**Table 1:** Maternal age distribution.

Age (years)	Control		Obese	
	No.	Percentage	No.	Percentage
<20	13	6.47	1	1.06
20-24	114	56.72	29	30.85
25-29	56	27.86	38	40.42
≥30	18	8.96	26	27.65

P < 0.05 (significant)

The mean weight at booking in obese women was 76.73kg & in control women, it was 51.25kg. The mean BMI at booking in obese women was 32.7313kg/m<sup>2</sup>. In control women it was 21.7035 kg/m<sup>2</sup>. The mean weight at term in obese women was 83.94kg and in control women it was 61.33kg (Table 2).

**Table 2:** Maternal weight and bmi at booking and delivery.

	Group	Total	Mean (kg)	Standard deviation	Student -t test
Wt at booking	Control	201	51.25	4.682	T=32.1 P=0.001
	obese	94	76.73	9.065	
BMI at booking	Control	201	21.7035	1.70879	T=43.3 P=0.001
	obese	94	32.7313	2.66237	
Wt at delivery	Control	201	61.33	5.602	T=26.6 P=0.001
	obese	94	83.94	9.056	

In the study group 84.04% were moderately obese, 11.71% were severely obese and only 4.25% were morbidly obese (Table 3).

**Table 3 :** Categorisation of obese women.

BMI kg/m <sup>2</sup>	Category	Numbers	Percentage
30-34.9	Moderate obesity	79	84.04
35-39.9	Severe obesity	11	11.71
≥ 40	Morbidly obesity	4	4.25

### Parity

Among obese women 38.29% were nulliparous and 61.69% were parouswomen, where as in control group 45.77% were nulliparous and 54.23% were parous women.  $X^2=11.02$ ,  $P=0.02$  (significant).

The incidence of gestational diabetes was 15.95% and 1.99% respectively in obese and control group. The results were statistically significant. Incidence of gestational hypertension was 12.76% and 2.99% in obese and control group respectively & are statistically significant. The incidence of pre eclampsia was 30.05% & 5.97% in obese and control group respectively, which is statistically significant (Table 4).

**Table 4:** Pregnancy related medical disorders.

Complications	Control		Obese		Test of significance	Odds ratio
	No	per-cent-age	No	Per-cent-age		
GDM	4	1.99	15	15.95	P < 0.05	9.35
PET	12	5.97	29	30.85		7.02
GHTN	6	2.99	12	12.76		4.75

Obstetric complications like multiple pregnancy, placenta previa, abruption placenta and malpresentation existed in both groups, but the difference was not statistically significant (Table 5).

**Table 5:** Other obstetric complications.

Complications	Control		Obese	
	No.	Percentage	No.	Percentage
Multiple pregnancy	2	1	1	1.06
Abruptio placenta	1	0.50	1	1.06
Placenta previa	2	1	1	1.06
Breech	8	3.98	5	5.31
Face	0	0	1	1.06

$P > 0.05$  (not significant)

Their labour induction rates were 26.60% and 4.9% in obese and control group respectively. The rates were higher in obese group and the difference was statistically significant. Obese women had 6.92 times increased risk of being induced than control women (Table 6).

**Table 6:** Induction of labour.

Induction	Control		Obese	
	No.	Percentage	No.	Percentage
Yes	10	4.98	25	26.60
No	191	95.02	69	73.40

$X^2 = 1.5$ ,  $P < 0.05$ , Odd's ratio: 6.92

In obese group the majority of induction of labour was done for hypertensive disorders of pregnancy (64.66%). Postdatism was the major reason for induction in control (40%) (Table 7).

**Table 7:** Indications for labour induction.

Indication	Control		Obese	
	No.	Percentage	No.	Percentage
Gestational hypertension	-	-	4	16
Pre-eclampsia	3	30	12	48
Pre-eclampsia with IUGR	-	-	1	4
Postdatism	4	40	4	16
PROM	1	10	-	-
PPROM	1	10	1	4
Oligohydramnios	1	10	3	12

The vaginal delivery was lower in obese group (41.48%) when compared to control group (66.17%). The primary cesarean delivery rates were higher in obese group (26.59%), when compared to control group (13.93%). The instrumental delivery rates were higher in obese group (6.38%) (Table 8).

**Table 8:** Mode of delivery.

Mode of delivery	Control		Obese	
	No	Percentage	No	Percentage
Vaginal	133	66.17%	39	41.48%
Primary LSCS	28	13.93%	25	26.59%
RPT LSCS	33	16.42%	24	25.53%
Forceps	4	1.99%	6	6.38%
Assisted breech	1	0.49 %	-	-
VBAC	2	1%	-	-

$\chi^2=19.51$ ,  $P=0.001$  (significant)

The cesarean delivery rates were higher in obese group (56.57%) than in control group (30.35%). Obese women had 2.49 fold increased risk of cesarean delivery than non-obese women. The rates increased with severity of obesity (Table 9).

**Table 9:** Cesarean delivery rates.

Mode of delivery	Control	Obese			Total
		Moderate	Severe	Very severe	
Vaginal delivery	140 (69.65%)	41 (51.89%)	3 (27.28%)	1 (25%)	45 (43.43%)
Cesarean delivery	61 (30.35%)	38 (48.10%)	8 (72.72%)	3 (75%)	49 (56.57%)

$\chi^2=19.51$ ,  $P=0.001$  (significant);  $\chi^2=19.16$ ,  $P=0.001$ , Odd's ratio:2.49.

### Intrapartum complications

No shoulder dystocia or complete perineal tear was seen in either group. There was one case of atonic hemorrhage in each group.

Wound infection and dehiscence rates were higher in obese group (30.42% and 14.29%) than control group (9.84% and 1.67%) respectively. Obese group had 4.04 fold and 10 fold increased risk for wound infection and dehiscence respectively than control group. Postpartum deep vein thrombosis was not seen in either group (Table 10).

**Table 10:** Postpartum complications.

Complications	Control		Obese		Odds ratio
	No	Percentage	No	Percentage	
Wound infection	6	9.84	15	30.42	4.04
Wound dehiscence	1	1.67	7	14.29	10
Deep vein thrombosis	-	-	-	-	-

$P<0.05$  significant

89.36% of obese women & 97.5% of control women delivered at term. 10.46% of obese women & 2.49% of control group delivered preterm, significant number of preterm births are due to increased incidence of preeclampsia (Table 11).

**Table 11:** Gestational age of neonate at delivery.

Gestational age (weeks)	Control		Obese	
	No.	Percentage	No.	Percentage
>37	196	97.5	84	89.36
35-37.6	3	1.49	5	5.31
32-34.6	2	1	3	3.19
<32	0	0	2	2.01

$\chi^2=5$ ;  $P=0.05$  (significant)

### APGAR

The difference of Apgar at 5 minutes between obese and control group was statistically significant ( $P=0.05$ ).

Majority of the neonates of obese women (44%) were between 3kg & 3.49kg and of control women (48.28%) were between 2.5kg – 2.99kg. 21% babies of obese women were between 3.5kg-3.99kg when compared to 8.87% babies of control women. 3 babies were >4kg in obese women but none in control group (Table 12).

25.26% of babies born to obese women and 8.37% babies of control women were admitted in NICU ( $P<0.05$ ). The major reason for admission of babies of obese women was for the care of infants of diabetic mother and in control group the reason was meconium aspiration and preterm births in obese groups (Table 13).

**Table 12:** Birth weight of the neonate.

Birth weight (kg)	Control		Obese	
	No.	Percentage	No.	Percentage
1.5-1.99	1	0.49	4	4.21
2.0-2.49	8	3.94	6	6.31
2.5-2.99	98	48.28	20	21.05
3.0-3.49	78	38.42	42	44.21
3.5-3.99	18	8.87	20	21.05
≥4	-	-	3	3.10
Total	203		95	

P<0.05 (significant)

**Table 13:** NICU admissions and their indications.

Indication	Control		Obese	
	No.	Percentage	No.	Percentage
Meconium aspiration	5	29.4	3	12.5
Asphyxia	1	5.8	3	-
Transient tachypnea of new born	2	11.76	-	-
Infant of diabetic mother with RDS	-	-	2	8.33
Preterm	4	23.53	7	29.16
Infant of diabetic mother	4	23.53	6	25
IUGR	1	5.8	1	4.16
Low birth weight	-	-	2	8.33
Total	17	8.37	24	25.26

Among vaginal delivery group 24.45% of obese women and 10.71% of control women required prolonged hospital stay (>2days) and in cesarean delivery group 32.65% of obese women and 11.48% of control women required prolonged hospital stay (>7days) (Table 14).

**Table 14:** Hospital stay.

	Hospital stay	Control		Obese		P value
		No.	Percentage	No.	Percentage	
Vaginal delivery	2 days	125	89.29	34	75.55	<0.05
	> 2 days	15	10.71	11	24.45	
Cesarean delivery	7 days	54	88.52	33	67.35	<0.05
	> 7 days	7	11.48	16	32.65	

## Discussion

### AGE

In the study, women in the obese group were slightly older when compared to women with normal BMI (Table-1). The mean maternal age in obese antenatal group was 27.01yrs. This is in accordance with that, increasing age and parity are risk factors for obesity. It was observed in the study that, among obese individuals more antenatal women belong to moderate obesity (82%). Those with morbidly obese were only 5.56%.

### Hypertensive disorders complicating pregnancy

Few persons like Dasgupta et al. [5] studied the overall incidence of hypertensive disorders which found to be 38% which was significantly high and is in accordance with our study where the overall incidence of hypertensive disorders is higher.

Obese women were observed to have an increased incidence of gestational hypertension (12.76%) when compared with control group (2.99%) (4.26 fold increase). Incidence of hypertensive disorders is considerably higher in our study (Table 4) and all the other studies. Weiss et al. 2004 [6] reported an incidence of 10.2%. Dasgupta et al. [5] showed an incidence of hypertensive disorders as 17%. Dave et al. [7] reported an incidence of hypertension is 22%.

*Incidence of pre-eclampsia (Table 4):* The incidence of preeclampsia was higher in obese group, when compared to control group (30.85% Vs 5.97%). This frequency was almost 5.16 times higher. Our study correlated with many studies by Deve A et al. [7], Heather E. Robinson et al. [8] and Ramos et al. [1]

who reported an incidence of 18.9 -22.6% and 16% respectively.

*GDM (Table 4):* In our population, obese group exhibited a higher risk of developing gestational diabetes (15.95 %), when compared to normal BMI group (1.99%), i.e. 8 folds risk increase for gestational diabetes among obese women., which is in accordance with other studies like Gross et al. [9] (6.5%), Ehrenberg et al [10] (8%), Ramos et al. [1] (14%), whereas studies like Dave et al. [7] reported incidence of GDM is low (2%), in contrast with other studies.

*Antepartum hemorrhage (Table 5):* In our study, antepartum complications like placental abnormalities such as placenta previa and placental abruption occurred equally among obese women and normal weight women. Bainco et al. [11] showed an increased incidence of abruption among obese women when compared to women with normal BMI. But results of Wolf et al. [12] including ours did not show association of increase BMI and APH.

*Multiple pregnancies (Table 5):* In our study, there was no significant association with multiple pregnancy and BMI, which occurred equally in obese group (1.06%) and control group (1%). This is in accordance with study done by Cedergren [13]. But other studies have reported, that there is increased incidence of multiple pregnancies [5, 9].

*Malpresentations:* In our study, there was no significant association with abnormal presentations and increased BMI. This is consistent with study done by Cedergren [13]. But other studies reported, that there is increased incidence of abnormal presentations [5, 9, 14].

*Induction of labour:* We observed that, labour induction was more in obese group (26.6%). When compared to control group (4.98%), which is in accordance with other studies [5, 7]. The risk of induction among the obese women was increased almost 5.3 fold. Cedergren [13] in his study had an incidence ranging from 13.1% -18.3% according to the severity of obesity.

In our study induction of labour is required in 22.34% of antenatal, among them, in obese group main reason for induction was hypertensive disorder

(76%). In control group major reason for induction was past dates (40%). This is in consistent with Dave A et al. [7] and Weiss et al. [6].

*Mode of delivery:* In our study, the cesarean delivery rates were 56.57% in obese group and 30.35% in control group. Obese women had 2.49 fold increased risk of cesarean delivery when compared to control group. Weiss et al. [6], Dave A et al. [7] and Cedergren [13] reported same increased incidence of caesarean deliveries among obese women. This risk of caesarean section is increasing with the severity of obesity. Both the primary and repeat caesarean delivery rates increased in obese group. Obese women had 2.29 folds increased risk for cesarean delivery than control group. Obese women had higher risk of emergency cesarean delivery (31.34% Odd's ratio: 2.13) than control group (17.64%). Similarly obese women had increased risk of elective cesarean delivery (5.97%, Odd's ratio: 2.06) than control group (2.94%).

*Intrapartum complications:* Other intrapartum complications like complete perineal tear and shoulder dystocia were not seen in either groups, which may be due to the timely cesarean delivery rates and timed instrumental delivery rates. Atonic post-partum hemorrhage occurred in one woman in each group, and the association was not statistically significant [11]. This may be due to the active management of third stage of labour and reduced instrumental deliveries. Whereas study by Dasgupta et al. [5] showed that incidence of PPH is increased 3 times in obese and 22 times in case of morbidly obese individuals.

### **Postpartum complications:**

*Wound sepsis:* we found obese women to be at a greater risk of postoperative wound infection and wound dehiscence. Among obese (29.41%) women incidence of wound infection is higher when compared to control group (9.84%). The obese women had 4 fold increased risk for wound infection.

Incidence of wound dehiscence is higher among obese (13.72%) women, when compared to control group (1.67%). It was shown that obese women had 8.21 fold increased risk for wound dehiscence among obese women. Dave A et al. [7] reported increased wound dehiscence rate in obese gravida. In our study

wound disruption is more in case of morbidly obese patients; almost all 3 of the morbidly obese required secondary suturing. These results are consistent with (60) Dasgupta et al. [5], and Usha Kiran et al. [15].

*Venous thromboembolism:* No evidence of thromboembolism in either of the group. This could be because of judicious use of prophylactic injection Heparin among those individuals, with risk factor and increased BMI. A retrospective case control study in Denmark showed a significant association between obesity and venous thromboembolism with an odd's ratio of 5.3.

### **Fetal outcome**

*Gestational age at birth:* There is conflicting data in the literature regarding maternal obesity and preterm birth, with some studies [16] showing increased risk and some studies showing no change [17]. In our study, significant difference was found between obese and control groups for preterm birth <37 weeks. 89.36% of obese women and 97.5% of control women delivered at term and 10.36% of obese women and 2.49% of control group delivered preterm, significant preterm births are due to increased incidence of preeclampsia.

*Birth weight of the neonates:* Majority of the neonates of obese women (44%) were between 3kg-3.49kg and among control women (48.28%) were between 2.5kg - 2.99kg. 3 babies were >4kg in obese women but none in control group. As previously reported [10, 17], obese women had increased risk of delivering high birth weight babies. HAPO study [18] showed that higher maternal BMI results in increased frequency of birth weight >90th percentile. This was proved in study done by Dave A et al. [7].

*NICU admissions:* There were increased admissions to NICU among neonates of obese women (25.26%) in contrast to control group (8.37%). The major reasons for admission of babies of obese women, were for the care of infants of diabetic mother, care of preterm and in control group the reason was meconium aspiration and preterm births.

*APGAR at 5 min:* The difference of Apgar at 5 minutes between obese and control group was statistically significant. This is conflicting with study done by Myles et al. [19] and Wolf et al. [12].

*Duration of hospital stay:* Among vaginal delivery group 24.45% of obese women and 10.71% of control women required prolonged hospital stay (>2days) and in cesarean delivery group 2.65% of control women and 11.48% of obese women required prolonged hospital stay + (>7days). As documented in previous studies [20], the obese women had prolonged hospital stay, which may be due to associated medical complications, wound infection and NICU admission.

### **Conclusion**

Obesity in pregnancy is associated with numerous maternal and perinatal risks & poses a considerable challenge to the obstetrician. Hence pregnancies in obese women should be regarded as high risk pregnancies and appropriate antenatal, intranatal and post-natal care should be provided with heightened surveillance, with anticipation, early diagnosis and prompt intervention. In addition, massive obesity among women of child bearing age is associated with a number of health risks later in life. This stresses the importance of focusing on effort to reduce the increasing incidence of obesity in fertile women. The best time of intervention may be before a woman considers a pregnancy.

### **Conflicts of interest**

Authors declare no conflicts of interest.

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