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Effect of Increased BMI on Fetomaternal Outcome in Nulliparous Women Delivering Singleton Babies

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ABSTRACT
Aim: *To study the effects of obesity on fetomaternal outcomes in nulliparous pregnant women. Materials and methods: 200pregnant women were taken for study who were divided into four groups based on their BMI and effects of obesity on fetomaternal outcomes were studied.*
Results: *Incidence of abortion, pre eclampsia, eclampsia, GDM, caesarean section, PPH, wound sepsis, FGR, preterm labour, NICU admissions were more in obese women.*
Conclusions: *In our study, obesity plays an important role in affecting fetomaternal outcome and hence fetomaternal outcome can be improved by decreasing the epidemic of obesity.*
Keywords: *Pre eclampsia, eclampsia, gestational diabetes mellitus, fetal growth restriction, period of gestation, post partum haemorrhage, neonatal birth weight.*

INTRODUCTION

In 2009, World Health Organization (WHO) announced obesity in pregnancy as one of the important non-communicable diseases that threaten maternal and child health[1]. WHO describes obesity as ―One of the most blatantly visible, yet most neglected, public health problems that threaten to overwhelm both more and less developed countries. Lifestyle modifications over the years have led to a more sedentary lifestyle. This is of global concern, as excess bodyweight is now the sixth important risk factor contributing to disease worldwide and increased level of obesity may result in a decline in life expectancy in the future[2-4] Obesity is a modern-day epidemic with implications across the whole of the world. Obesity has been associated with greater risk of infertility, maternal morbidity, and complications of labor and delivery[5,6]. The body mass index (the Quetelet index) is the ratio of weight divided by the height squared (in metric units):

BMI = weight in kilograms/height in meters^2

The body mass index (BMI), or Quetelet index, was devised between 1830 and 1850 by the Belgian polymath Adolphe Quetelet during the course of developing "social physics"[7-8]

It is estimated that in the developed countries about 28% of pregnant women are overweight and 11% obese. In the U.S.A, 18.5% to 38% of women are obese depending on the definition used and in the U.K, 56% of all women are above the recommended BMI with 33% overweight and

23% obese. Obesity was noted to be an important risk factor for maternal death with 35% of the mortalities being obese women in the UK[9] .The National Family Health Surveys (NFHS) in India indicated an increase in the obesity from 10.6% in 1998–1999 to 14.8% in 2005–2006, while there was only a marginal decrease in the incidence of underweight from 36.2% (1998–1999) to 33.0% (2005–2006)[10].

The New BMI Criteria for the Asians by the Western Pacific Regional Office of WHO (WPRO)[11,12]

Normal range 18.5-22.9
Overweight 23- 24.9
Obese class 1 25-29.9
Obese class II ≥30

Although much has been written about the increased risk of the metabolic syndrome (obesity, hypertension, insulin resistance, and dyslipidemia) in infants born small for gestational age (SGA), recent evidence points toward an increase in adolescent and adult obesity in infants born either large for gestational age or macrosomic. There is abundant evidence linking higher birth weights to increased obesity in adolescents as well as adults for atleast 25 years[13,14]Many factors associated with perinatal morbidity and mortality are not amenable to intervention. Recent epidemiologic findings indicate that weight control may offer the potential for affecting gestational outcomes, in nulliparous pregnant women delivering singleton babies. With this in mind, we conducted a population-based cohort study of the effects of maternal increased BMI on pregnancy complications and adverse pregnancy outcomes[15].

AIMS AND OBJECTIVES

The present study was conducted with the following aims and objectives :-To evaluate the risk of antenatal and intranatal complications in women with increased body mass index, to find out the effect of increased body mass index (BMI) on perinatal outcomes in nulliparous women delivering singleton babies.

MATERIAL AND METHODS

The present observational and prospective study was conducted in the obstetrics and gynaecology department of government medical college and Rajindra Hospital, Patiala. A total of 200 nulliparous pregnant women in the first trimester fulfilling the inclusion criteria were taken for study.

Inclusion criteria was:- Willing to participate in the study, women bet
ween 19 – 35 yrs of age, women with delivery conducted in Labour Room Unit of Department of Gynaecology and Obstetrics, Rajindra Hospital, Patiala. **Exclusion criteria** was: Women with pre-existing medical complications like diabetes mellitus, hypertension, chronic renal diseases, endocrinal dysfunction, surgical conditions.

A detailed history and general physical and local examination was done. This was done with a non-judgemental attitude and maintaining complete audio-visual privacy. BMI was calculated at 1st antenatal visit in the first trimester. BMI was calculated as weight (kg) divided by height (m^2). Pregnant women were divided into four groups according to BMI as per WHO criteria. Group-I : Normal (BMI 18.50 - 22.9 kg/m^2)Group-II : Overweight (BMI 23-24.9 kg/m^2)Group-III :Obese class I (BMI 25.00-29.9 kg/m^2)Group-IV : Obese class II (≥ 30.00 kg/m^2)

Maternal outcome variables included were: Abortion, gestational Diabetes, pre-eclampsia, eclampsia, FGR, post term, placenta Praevia, abruptio Placenta, presence of meconium , mode of termination - spontaneousor induced, mode of delivery, pre-term delivery, rate of lower segment caesarean section, PPH, wound sepsis . Neonatal outcome variables included were - Neonatal birth weight, NICU admissions.

The data was collected, compiled and analysed statistically.

RESULTS

TABLE I(A) Relation of BMI with the Incidence of Abortion

Groups	Total Number Of Patients(N)	Number Of Patients With Abortion (N)	%Age
Group I	50	1	2%
Group Ii	50	Nil	Nil
Group Iii	50	4	8%
Group Iv	50	3	6%

Statistical Analysis TABLE I (B)

Groups	X^2	p value
Group I& Group II	0.99	0.319
Group I& Group III	7.50	0.032
Group I& Group IV	5.18	0.036

As shown in table I(A), the incidence of abortion was 6% in obese class II , 8 % in obese class I , 2% in normal weight and none of the patients had abortion in overweight women. Hence, 8 patients who had abortion in first trimester were excluded from further study .

As shown in table I (B) , A Stastically significant difference in the incidence of abortion with increased BMI was noted in group III and IV (p value <0.05)

TABLE II(A) Relation of BMI with Pre – Eclampsia (Pes) In Four Bmi Groups

Groups	Total Number Of Patients (N)	Number Of Patients(N)	%Age
Group I	49	6	12.24
Group Ii	50	10	20
Group Iii	46	12	26.08
Group Iv	47	20	42.55

Statistical Analysis TABLE II(B)

Groups	X^2	p value
Group I& Group II	24.47	0.001
Group I& Group III	21.25	0.001
Group I& Group IV	11.36	0.011

As shown in table II (A), the highest number of women in group IV had PES (42.55%) followed by 26.08% in group III, 20% in group II and 12.24% in group I . Incidence of pre eclampsia increased as BMI increased.

TABLE III (A) Relation of BMI with The Incidence of GDM

GROUPS	TOTAL NUMBER OF PATIENTS(N)	NUMBER OF PATIENTS WITH GDM(n)	%AGE
GROUP I	49	1	2.04
GROUP II	50	2	4
GROUP III	46	4	8.69
GROUP IV	47	6	12.76

Statistical Analysis TABLE III(B)

Groups	X^2	p value
Group I& Group II	5.18	0.01
Group I& Group III	6.53	0.005
Group I& Group IV	6.59	0.004

As evident from table III (A), the incidence of GDM was lowest(2.04%) in normal weight group and highest (12.76%) in obese class II group . Incidence was 4% in overweight group and 8.69 % in obese class I group.

Hence, there was significant relation of increased BMI with the incidence of eclampsia. Results were statistically significant (p value = <0.05)

TABLE IV(A) Period of Gestation at Delivery and its Relation with BMI

PERIOD OF GESTATION		GROUP I(N=49)		GROUP II(N=50)		GROUP III(N=46)		GROUP IV (N=47)	
		No	%age	No	%age	No	%age	No	%age
PRETERM	(< 34 weeks)	2	4.08	2	4	N	N	3	6.38
	(35 -37 weeks)	2	4.08	3	6	3	6.52	3	6.38
TERM		45	91.83	41	82	40	86.95	40	85.10
POST-TERM		nil	Nil	4	8	3	6.52	1	2.12

Statistical Analysis (Preterm) TABLE IV(B)

Groups	X^2	p value
Group I& Group II	4.24	0.050
Group I& Group III	8.94	0.001
Group I& Group IV	4.59	0.050

Statistical Analysis (Term)

Groups	X^2	p value
Group I& Group II	4.18	0.031
Group I& Group III	5.18	0.010
Group I& Group IV	4.59	0.048

Statistical Analysis (Post Term)

Groups	X^2	p value
Group I& Group II	0.54	0.461
Group I& Group III	0.72	0.396
Group I& Group IV	0.72	0.396

Table IV(A) showed that about 2 patients (4.08%) each; 2 patients (4%) and 3 patients (6%); no patient and 3 patients (6.52%); 3 patients (6.38%) each delivered at <34 weeks and 35-37 weeks gestation respectively in normal weight, overweight , obese class I and obese class II respectively .Above table depicted that number of post term pregnancies were 4 (8%) in overweight group , 3 (6.52%) in obese class I , 1 (2.12%) in obese class II. No post term pregnancy was there in normal weight subjects. As shown in above table, 91.83%, 82%, 86.95 %, 85.10 % patients in normal, overweight , obese class I and obese class II groups respectively had delivery at term gestation .

There was a significant difference in the incidence of preterm and term delivery between group I, II III and IV. (p value <0.05)

No stastically significant difference in the incidence of postterm in all the groups

TABLE V(A) Relation of BMI with the Mode of Delivery (NVD , LSCS)

GROUPS	NVD		LSCS	
	No of patients	%age	No of patients	%age
GROUP I N=49	40	81.63	9	18.36
GROUP II N=50	38	76	12	24
GROUP III N=46	30	65.21	16	34.78
GROUP IV N=47	25	53.19	22	46.80

Statistical Analysis TABLE V(B)

Groups	X^2	p value
Group I& Group II	14.02	0.002
Group I& Group III	9.45	0.021
Group I& Group IV	6.62	0.010

Above table showed that incidence of NVD was 81.63% in normal weight group followed by 76% in overweight group, 65.21% in obese class I and 53.19% in obese class II group. Incidence of vaginal delivery was lower in obese women .Above table depicted that 9 out of 49 (18.36%) patients in normal weight group underwent LSCS. 12 out of 50 (24%) patients in overweight group underwent LSCS. 16 out of 46 (34.78%) and 22 out of 47 (46.80%) patients in obese class I and obese class II respectively underwent LSCS.

There was statistically significant difference in the incidence of LSCS with increased BMI in group II, III and IV.

TABLE VI(A) Relation of BMI With Post Partum Haemorrhage (PPH)

GROUPS	TOTAL NUMBER OF PATIENTS(N)	NUMBER OF PATIENTS (n)	%AGE
GROUP I	49	N	NIL
GROUP II	50	N	NIL
GROUP III	46	1	2.17%
GROUP IV	47	2	4.25%

Statistical Analysis TABLE VI(B)

Groups	X^2	p value
Group I& Group II	0.00	1.00
Group I& Group III	4.02	0.051
Group I& Group IV	5.02	0.049

As shown in table VI (A), none of the patients had PPH in group I and group II while 2.17% and 4.25 % patients had PPH in group III and group IV respectively. There was a statistically significant association of the incidence of PPH with increased BMI in group III and IV (p value <0.05).Results were statistically significant in groupII ,III and IV(p value <0.05).

TABLE VII (A) Neonatal Birth Weight and Its Relation with BMI

NEO-NATAL BW	GROUP I (N=49)		GROUP- II (N=5)		GROUP – III (N=46)		GROUP – IV (N=47)	
	No	%age	No	%age	No	%age	No	%age
<2500gm	10	20.4	9	18	9	19.56	9	19.14
2501-3499gm	35	71.42	35	70	31	67.39	31	65.95
≥3500gm	4	8.16	6	12	6	13.04	7	14.89

Statistical Analysis TABLE VII(B)

Groups	X^2	p value
Group I& Group II	8.16	0.007
Group I& Group III	5.69	0.017
Group I& Group IV	6.35	0.017

As shown in above table , number of neonates with BW ≤2500gm in group I was highest (20.4%) followed by group III (19.56%), group IV (19.14%) and group II (18%). Maximum number of neonates with BW = 2501-3499gm in group I was 71.42%, followed by group II (70%) and then group III (67.39%) and group IV (65.95%). Neonates weighing >3500gm were maximum in group IV (14.89%), followed by group III (13.04%), group II (12%) , group I (8.16%).
Results were statistically significant with p value <0.05 showing significant association of increased neonatal birth weight with increased maternal BMI in groups II,III and IV.

DISCUSSION

Today, obesity is a worldwide individual and public health issue because it contributes to the development of several chronic diseases. It is already commonly known that maternal overweight and obesity are associated with adverse pregnancy outcome, such as maternal hypertension, preeclampsia, gestational diabetes, more frequent cesarean delivery, delivery of large-for-gestational-age (LGA) infants and stillbirths. The primary objective of the present study was to assess the effects of maternal obesity on maternal and fetal outcomes. The salient observations made in this study and their comparison with other studies is discussed as under:

TABLE 8 Relation of BMI with the Incidence of Abortion In Various Studies

Author name and year	Normal	Overweight	Obese
Lashen et al (2004)[37]	10.5		12.5
Boots C et al (2011)[72]	10.7		13.6
Present study (2016)	2	Nil	7

The present study showed higher rate of abortion in obese group (7%) as compared to normal weight women (2%). Our study is comparable to both the above studies.

TABLE 9 Various Studies Showing The Relation Of Bmi With The Incidence Of Pre Eclampsia

Author name and year	Normal (%age)	Overweight(%age)	Obese(%age)
Bhattacharya et al (2007)[53]	5	8.1	14.7
Athukoralaetal (2010)[55]	3.8	5.6	11.4
Anjanavermaet al (2012)[62]	8.86	9.6	11.9
Rajinaroraet al (2013)[1]	2.5	6	9.3
Feresuet al (2015)[68]	3.2	5.4	9.3
Present study et al (2016)	12.24	20	34.40

The present study showed increased incidence of pre eclampsia with obesity with highest percentage in obese group (34.40%) followed by overweight (20%) and normal weight women (12.24%). Our study is comparable to all the above mentioned studies.

TABLE 10 Various Studies Showing Relation of BMI With GDM

Author name and year	Normal (%)	Over weight (%)	Obese (%)
Anjanavermaetal (2012)[62]	0.24	1.2	7.1
Rajinaroraetal (2013)[1]	3.4	9.6	16.2
Feresuetal (2015)[68]	2.5	4.9	9.5
Present study (2016)	2.04	4	10.75

The present study concluded that the incidence of GDM was highest in obese (10.75%) followed by overweight (4%) and normal weight women (2.04%). Thus, our study showed similar results as the above studies.

TABLE 11 Various Studies Depicting Relation of BMI with the Incidence of Pre Term Labour

Author name and year	Normal (%)	Overweight(%)	Obese(%)
Anjanaverma et al (2012)[62]	3.6	4.2	5.9
Yazdanietal (2012)[60]	2.12	4.7	6.1
Rajinaroraetal (2013)[1]	8.8	8.2	7.8
Present study (2016)	8.16	10	9.67

The results of the present study are in accordance with Anjanaarora et al (2012)[62] and Yazdani et al (2012)[60] showing highest incidence of preterm labour in obese women (9.67%) followed by overweight (10%) and normal weight women (8.16%). However , our study is dissimilar to the results of Rajinarora et al (2012)[1] .

Table 12 Various Studies Showing the Relation of BMI with the Incidence of PPH

Author name and year	Normal	Overweight	obese
Bhattacharya et al (2007)[53]	9.5	13.3	19.9
Anjanavermaet al (2012)[62]	1.47	1.2	1.19
Feresuet al(2015)[68]	3.1	3.4	3.7
Present study (2016)	Nil	Nil	3.22

Results of the present study demonstrated statistically significant increase in the rate of PPH in obese women (3.22%) as compared to normal weight and overweight women. This could be due to better management of third stage of labour. However , we could not prevent PPH in obese women inspite of best efforts. Our study is comparable to Bhattacharya et al (2007) and Feresu et al (2015) but in contrast to Anjanaverma et al (2012) but the difference is very small.

TABLE 13 Various Studies Showing Relation of BMI with the Neonatal Birth Weight (<2500gm)

Author name and year	Normal	Overweight	Obese
Baeten JM et al (2001)[50]	4.1	4.0	4.8
Bhattacharya et al (2007)[53]	7.0	6.2	7.6
Aroraet al (2013)[1]	10.3	6.5	6.4
Present study(2016)	20.24	18	19.35

Our study demonstrated similar results as that of Arora et al (2013)[1] with maximum number of normal weight women delivering <2500 gm babies (20.24%) followed by obese women(19.35%) and overweight women (18%). However , our study results differ from Beaten et al (2001)[50] and Bhattacharya et al (2007)[53] . It could be due to variations in geographical region.

TABLE 14 Various Studies Showing Relation of BMI with the Neonatal Birth Weight (>3500 gm)

Author name and year	Normal	Overweight	Obese
Aroraetal (2013)[1]	14.4	23	33
Present study (2016)	8.16	12	13.97

The present study demonstrated that babies born to obese women had high birth weight as compared to babies born to normal weight women Thus, it is comparable to the above study.

SUMMARY AND CONCLUSIONS

The mean age group in group I (normal weight) women was 23.80±2.42, 22.82±2.49 in group II (overweight women) , 24.16±3.05 in group III (obese class I) and 24.38±2.98 in group IV (obese class II), Majority of the obese women had pre eclampsia (34.40%) as compared to normal weight women (12.24%), There was a statistically significant association of GDM with obesity as 10.75% patients had GDM in obese group whereas only 2.04% patients were diabetic in normal weight pregnant women. Statistically significant association of obesity was found with pre term labour as the incidence was 6.38% in obese class II and 4.08% in normal weight women, Incidence of PPH was nil in normal weight women and 2.17% and 4.25% in obese class I and obese class II respectively, babies with birth weight >3500gm were found more in obese class II (14.89%). Hence, neonate birth weight increases with maternal obesity significantly.

Prevention rather than treatment has gained newfound interest, particularly with the increasing incidence of obesity and risk of attendant complications in developing countries. Based on this review, there appears to be an opportunity to potentially break the cycle of obesity during pregnancy. Having obese women loose weight and achieve a normal BMI prior to conception would be the ideal goal. We still have to go a long way to achieve this goal.

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