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Research Article

"EFFECT OF BODY MASS INDEX ON PREGNANCY OUTCOME" - A PROSPECTIVE STUDY

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ABSTRACT

Objectives: The objective of the study was to evaluate the impact of high pre pregnancy body mass index (BMI) (<12 weeks of gestation) on the occurrence of maternal pregnancy outcome.

Methods: A longitudinal observational study was carried out in a tertiary care hospital. In Group I, 50 antenatal women with gestational age <12 weeks BMI 18.5–35 kg/m2 and having singleton pregnancies were included in the study, while 50 women with normal BMI formed the Group II. Both groups were followed up throughout pregnancy and post-natal to assess complication during pregnancy, labour, and puerperium.

Results: The mean BMI in Group I and Group II was 27.516 kg/m^2 and 21.433 kg/m^2. The prevalence of anemia was 40% and 26% among two groups. Antenatal and post-natal complications were gestational diabetes mellitus (Group I - 28% and Group II - 6%), preeclampsia (Group I - 16% and Group II - 2%), required induction of labor (Group I - 26% and Group II - 6%), preterm labor (Group I - 4% and Group II - 16%), and meconium staining of liquor (Group I - 20% and Group II - 12%), and the difference was statistically significant among two groups. Newborn complications were weight ≥2.5 kg (Group I - 74% and Group II - 48%), neonatal intensive care unit admission requirement (Group I - 26% and Group II - 17%), and the difference was statistically significant among two groups. Other complications which were not statistically significant among two groups were oligohydramnios (Group I - 2% and Group II - 4%), polyhydramnios (Group I - 6% and Group II - 4%), and appearance, pulse, grimace, activity, and respiration score at 1 min <7 (Group I - 14% and Group II - 6%).

Conclusion: Pregnancy complications related to maternal BMI is a growing problem. Both lean and obese mothers carry an increased risk of adverse perinatal outcome. Given the major economic and medical consequence of pregnancy in these women, all attempts should be made to maintain a normal BMI in women of childbearing age. Pre-pregnancy counseling, health programs and appropriate multidisciplinary management should be done.

Keywords: Body mass index, Obesity, Pregnancy, Outcome.

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INTRODUCTION

As per the World Health Organization, obesity is one among today's most blatantly visible yet most neglected public health problems. In general, although men may have higher rates of overweight, women have higher rates of obesity. Maternal obesity may end in negative outcomes for both women and fetuses. The maternal risks during pregnancy include gestational diabetes and preeclampsia. The fetus is at risk for stillbirth and congenital anomalies such as fetal macrosomia [1]. Although pre-pregnancy body mass index (BMI) has a genetic as well as nutritional component, a low pre-pregnancy BMI is considered a marker for minimal tissue reserve. Women with low pre-pregnancy BMI are at increased risk for several adverse pregnancy outcome including preterm deliveries and intrauterine growth retardation. Similarly maternal obesity adversely affects pregnancy outcome primarily through increased risks of hypertensive diseases, (chronic hypertension and pre-eclampsia) diabetes (pre-gestational and gestational), cesarean sections and infections and also for macrosomic neonates, large for gestational age and as an independent risk factor for neural tube defect, fetal mortality, and preterm deliveries.

Maternal obesity is linked with higher rates of cesarean delivery. Pregnancy outcomes are negatively affected by maternal obesity (increased risk of neonatal mortality and malformations) [2]. In earlier research, the connection between maternal height and weight with pregnancy complications was extensively explored, but in recent times, BMI is widely accepted as a much better measure of over or underweight [3]. Preconception BMI may be a key indicator for service providers as pre-pregnancy BMI defines the recommended individual gestational weight gain.

In earlier research, the connection between maternal height and weight with pregnancy complications was extensively explored, but in recent times, BMI is widely accepted as a much better measure of over or underweight [4]. Mothers who are overweight or obese during pregnancy and childbirth, as measured by increasing maternal BMI, are known to be in danger of serious antenatal, intrapartum, postpartum and neonatal complications. Diabetes, hypertensive disorders including preeclampsia, fetal, deaths, big sized babies, postdate pregnancies, and cesarean sections have all been associated with maternal obesity [5-8]. In view of above background, we conducted this study with an objective

to evaluate the impact of high pre pregnancy BMI (<12 weeks of gestation) on the occurrence of maternal pregnancy outcome.

METHODS

A longitudinal observational study was carried out in the department of obstetrics and gynecology department of a tertiary care hospital. In Group I, 50 antenatal women with gestational age <12 weeks BMI 18.5–35 kg/m^2 (considering negligible weight gain till 12 weeks of gestation) and having singleton pregnancies were included in the study, while 50 women with normal BMI formed the Group II. Both groups were followed up throughout pregnancy and post-natal to assess complication during pregnancy, labor, and puerperium. Anthropometric measurements and relevant investigations were carried out as per standard protocol. Data were collected by means of pretested questionnaire by interview herself and followed up till puerperium. Institutional ethical clearance was taken, and informed consent was taken from all. Data were entered into Excel sheet and analyzed using SPSS software.

RESULTS

The mean BMI in Group I and Group II was 27.516 kg/m^2 with standard deviation of 2.2241 and 21.433 kg/m^2 with standard deviation of 1.7806, respectively (Table 1). Table 2 shows the socio-demographic parameters of both groups. The association between the two groups with respect to socio-demographic parameters was not significant.

The prevalence of anemia in Group II was 40%, and in the Group II was 26%. The difference was statistically insignificant. Gestational diabetes mellitus (GDM) was present in 28% of Group I and 6% in Group II and the difference was statistically significant. About 16% patients were having preeclampsia in Group I and 2% in Group II and the difference was statistically significant. About 26% patients required induction of labor in Group I and 6% patients required induction in Group II and the difference was statistically significant. About 2% patients developed oligohydramnios in Group I and 6% patients in Group II. About 6% of the patient developed polyhydramnios in Group I while 4% patients developed polyhydramnios in Group II. The difference was statistically insignificant with respect to Amniotic fluid index (Table 3). Mode of delivery was normal vaginal delivery in 58% of Group I and 92% in Group II. Cesarean sections were required in 42% patients of Group I and 8% in Group II. The difference was statistically significant with respect to mode of delivery (Table 4). 4% patients underwent in preterm labor in Group I, while 16% patients underwent in preterm labor in Group II and the difference was statistically significant. Meconium staining of liquor was present in 20% of Group I and 12% of Group II and the difference was statistically significant with a p = 0.031. Wound infection was found in 16% of Group I and 2% of Group II and the difference was statistically significant.

Table 1: BMI distribution among two groups

BMI	n	Mean	Std. Deviation	Minimum	Maximum
Group I	50	27.516	2.2241	25.1	33.3
Group II	50	21.433	1.7806	18.0	24.6
Total	100	24.475	3.6554	18.0	33.3

BMI: Body mass index

Table 2: Socio-demographic distribution among two groups

Socio-demographic Factors	Group I		Group II		p-value
	No	%	No	%	
Age group					
≤20 years	1	2	3	6	0.97
21–30 years	17	34	28	56	
>30 years	32	64	19	38	
Religion					
Hindu	40	80	36	72	0.34
Muslim	7	14	11	22	
Sikh	3	6	1	2	
Christian	0	0	2	4	
Education					
Illiterate	17	34	13	26	0.513
Literate	33	66	37	74	
Place of residence					
Rural	14	28	12	24	0.820
Urban	36	72	38	76	
Socio-economic status					
Lower Middle class	18	36	18	36	1.000
Lower class	18	36	15	30	
Middle class	12	24	13	26	
Upper middle class	2	4	4	8	
Total	50	100	50	100	

About 74% newborn in Group I and 48% new born in Group II were in ≥2.5 kg group while 26% new born in Group I and 39% new born in Group II were in <2.5 kg group. The difference was statistically significant. Appearance, pulse, grimace, activity, and respiration (APGAR) score at 1 min was <7 in 14% of Group I and 6% of Group II while APGAR score at 1 min was ≥7 in 86% of group I and 94% of Group II. The difference was statistically significant with a p-value. Neonatal intensive care unit (NICU) admission required in 26% of cases in Group I and 17% of Group II. The difference was statistically significant (Table 5).

DISCUSSION

Age

About 38% of patients of Group II belonged to >30 years age group this was 64% in Group II. While only 2% of patients of overweight were ≤20 years of age this was 6% in normal weight group. This could be due to the age-related weight gain in these patients. Our results are comparable with Meher-Un-Nisa *et al*. who reported that obesity was more often found in women of higher age 29 [9].

GDM

In our study, association between maternal obesity and GDM was found to be statistically significant (p=0.008), that is, the incidence of GDM in pregnancy in women who are overweight/obese is higher than that of normal BMI women. This result is supported by Uebel *et al*. and Abenhaim *et al*. who found similar increased risk of GDM who are overweight or obese [10,11].

Preeclampsia

In our study, the frequency of preeclampsia remained significantly high in overweight category as compared to normal groups and difference was statistically significant with a p = 0.036. Eclampsia was not found in any category. Results were comparable with Voigt *et al*. who found that 37.9% patients in the BMI >30 category had preeclampsia and 1.2% in the BMI <25 category had preeclampsia [12]. Ehrenthal *et al*. also concluded that preeclampsia was more common in the obese with a p < 0.0001. Furthermore, Baeten *et al*. found that incidence of eclampsia increased with increasing BMI [13].

Anemia

The prevalence of anemia in Group I was 40%, and in the Group II was 26% and the difference was statistically insignificant with a p = 0.202. These results could be due to possible nutritional etiology of anemia in the population. The results were inconsistent with Sahu *et al*. who concluded that anemia (p=0.02) was significantly present among lean women [14]. Our results could be compared with Galtier-Dereure *et al*. who reported that anemia appears to occur less often in severely obese pregnant women than in normal-weight pregnant women [15].

Mode of delivery

Mode of delivery was normal vaginal delivery in 58% of Group I and 92% in Group II. Cesarean sections were required in 42% patients

Table 3: Distribution of ante-natal and post-natal complications among two groups

Complications	Group I		Group II		Odds ratio (95% confidence interval)	p-value
	No	%	No	%		
Anemia						
Yes	20	40	13	26	1.897 (0.812 to 4.431)	0.202
No	30	60	37	74		
GDM						
Yes	14	28	3	6	6.093 (1.627 to 22.816)	0.008
No	36	72	47	94		
Pre-eclampsia						
Yes	8	16	1	2	9.333 (1.121 to 77.707)	0.036
No	42	84	49	98		
Induction of labor						
Yes	13	26	3	6	5.505 (1.460 to 20.756)	0.014
No	37	74	47	94		
Amniotic fluid index						
Normal	46	92	45	90	REF	
Oligohydramnios	1	2	3	6	0.489 (0.043 to 5.586)	1.0
Polyhydramnios	3	6	2	4	1.467 (0.234 to 9.201)	0.96
Pre-labor						
Yes	1	4	8	16	0.375 (0.069 to 2.031)	0.036
No	49	96	42	84		
Meconium staining						
Yes	10	20	2	4	6.000 (1.242 to 28.988)	0.031
No	40	80	48	96		
Wound infection						
Yes	8	16	1	2	9.333 (1.121 to 77.707)	0.036
No	42	84	49	98		
Total	50	100	50	100		

GDM: Gestational diabetes mellitus

Table 4: Distribution of Mode of delivery among two groups

Mode of delivery	Group I		Group II		Total	Odds ratio (95% confidence interval)	p-value
	No	%	No	%			
Caesarean section	21	42	4	8	25	8.328 (2.595 to 26.722)	<0.001
Vaginal	29	58	46	92	75		
Total	50	100	50	100	100		

Table 5: Distribution of Fetal complications among two groups

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	Group I		Group II		Total	Odds ratio (95% confidence interval)	p-value
	No	%	No	%	No		
Birth weight							
≥2.5 kg	37	74	24	48	61	3.083 (1.330 to7.149)	0.014
<2.5 kg	13	26	26	52	39		
APGAR Score at 1 Min							
<7	7	14	3	6	10	2.550 (0.620 to 10.492)	0.317
≥7	43	86	47	94	90		
NICU Admission							
Yes	13	26	4	8	17	4.041 (1.215 to 13.433)	0.033
No	37	74	46	92	83		
Total	50	100	50	100	100		

NICU: Neonatal intensive care unit, APGAR: Appearance, pulse, grimace, activity, and respiration

of Group I and 8% in Group II. The difference was statistically significant with a $p < 0.001$. There was a higher proportion of cases landed up in caesarean section when compared to the controls. Our study is supported by John and Mahendran reported that increased incidence of caesarean section among obese mothers [16]. The indications for caesarean section were failed induction, macrosomia, and prolonged labor. The cesarean section rate increased, along with maternal BMI, in most studies including the present one (p=0.01). The fact that obesity is now more frequent in the obstetric population has resulted in a renewed interest in the effects of weight on the risk of cesarean delivery. The higher cesarean section rate in obese women carries an extra risk of higher perioperative morbidity, including anesthetic problems, infections, blood loss and prolonged hospitalization. Reasons reported for surgery generally include macrosomia-associated cephalo-pelvic disproportion, fetal distress and stagnation of induced labor.

Induction of labor

Comparison of induction of labor in Group I and Group II showed that normal BMI was associated with lower induction of labor with p=0.014 which was statistically significant. This is similar to results of Usha Kiran *et al.* [17]. Our study also supported by Elíasdóttir *et al.* who reported that obese women have a significantly increased risk of requiring

induction of labor compared with normal weight women [18]. The most common indication for induction in the Group I was preeclampsia whereas in Group II was postdatism.

Postpartum hemorrhage (PPH)

PPH occurred in 4% of the patients in Group II and in 8% of the patients in the Group I. The difference was statistically insignificant with a p = 0.67. Our results were consistent with those of Usha Kiran *et al*. [17].

Amniotic fluid index

Oligohydramnios in the Group II was 6% and in the Group I was 2%. The difference in ultrasound findings remained statistically insignificant with a p = 0.69.

Preterm labor

Preterm labor pains occurred in 16% of the pregnancies with Group II, and 4% in Group I. The difference was statistically significant with a p = 0.036. Our study was similar to a study by Hendler et al. who stated that obese women had fewer spontaneous preterm births at <37 weeks of gestation (6.2% vs. 11.2%; p<0.001) and at <34 weeks of gestation (1.5% vs. 3.5%; p=0.012) [19].

Meconium stain

About 4% of babies born to women with normal BMI had meconium stained liquor while the number rose to 20% in babies born to overweight and obese mothers. The data was statistically significant with p = 0.031. Results matched with study by Marie I. Cedergren stating that meconium aspiration occurred more often in infants of morbidly obese women than in women with normal BMI values: Adjusted OR 2.85 (95%CI 1.60, 5.07).

Wound infection

Wound infection was present in 2% of Group II and 16% of Group I. The difference was statistically significant with a p = 0.036. Which can be related to local changes, such as an increase in adipose tissue, an increase in local tissue trauma related to retraction, the immune dysfunction, increased association of diabetes with obesity and a lengthened operative caused by obesity. Our results can be compared with those of Satpathy *et al*. who reported that following cesarean section delivery, obese women have a higher incidence of wound infection and disruption [20].

Birth weight

Birth weight was found to be higher in cases when compared to controls. In our study 74% newborns were ≥2.5 kg, 26% newborns <2.5 kg in Group I while in Group II 48% newborns were ≥2.5 kg, 52% newborns <2.5 kg. This is statistically significant as p-value is 0.014. The study was consistent with Sebire *et al*. who found that in comparison to women with normal BMI, the birth weight was found to be above 90th centile (1.57 (1.50–1.64), 2.36 (2.23–2.50) in obese pregnant women (odds ratio (99% confidence interval) for BMI 25–30 and BMI ≥30, respectively) [21].

APGAR score

APGAR score was compared amongst babies born to women in different BMI group at one minute. The APGAR score at one minute was found <7 in 14% in Group I, 6% in Group II, respectively, while the APGAR score at one minute was found >7 in 86% in Group I and 94% of Group II, respectively. This came out to be statistically insignificant with p = 0.317. The result was in contrast to Nohr *et al*. who mentioned that greater weight gains and high maternal BMI decreased the risk of growth restriction and increased the risk of the infant's being born large-for-gestational-age or with a low Apgar score. In general, low GWG was advantageous for the mother, but it increased the risk of having a small baby, particularly for underweight women [22].

NICU admission

In our study, 26% newborn of Group I and 8% of Group II got admitted in NICU. Majority of this admission was due to fetal distress. It was clearly evident that maternal obesity had led to fetal distress and subsequent admission to NICU. Other studies have also reported similar findings of increased NICU admissions for babies born to obese mothers [23].

CONCLUSION

Pregnancy complications related to maternal BMI is a growing problem. Both lean and obese mothers carry an increased risk of adverse perinatal outcome. Given the main economic and medical consequence of pregnancy in these women, all attempts should be made to take care of a traditional BMI in women of childbearing age. Pre-pregnancy counseling, health programs, and appropriate multidisciplinary management should be done. This research demonstrates that maternal BMI is a crucial risk factor of pre-eclampsia. An increased BMI increases the incidence of induction of labor, caesarean section, preterm labor, and macrosomia. The health implications of obesity are considerable for both the mother and baby – during pregnancy and beyond – and must be recognized and acted upon by service providers. Initiatives are being designed to stop obesity within the prenatal and early year's populations, recognizing that obesity and related conditions track very closely from childhood through adolescence into adulthood.

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AUTHORS CONTRIBUTION

All authors have contributed to preparation of manuscript.

CONFLICT OF INTEREST

Nil.

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