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Original Research Article

The impact of maternal body mass index on maternal and perinatal outcome

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ABSTRACT

Background: The incidence of obesity has increased to pandemic proportions over the last 20 years. Obesity is a chronic illness which is associated with metabolic disease, nutritional deficiency, musculoskeletal complications and carcinomas. The aim of the study was to evaluate and compare the maternal and perinatal outcome in patients with BMI 20-24.9 kg/m^2 (normal), with BMI 25-29.9 kg/m^2 (overweight) and with BMI >30 kg/m^2 (obese).
Methods: This cross-sectional study was conducted on 300 singleton pregnant women with gestational age>37 weeks with cephalic presentation. The selected women were categorized into three groups of 100 each according to their BMI: Category I included normal women (BMI 20-24.9 kg/m^2), Category II included overweight women (BMI 25-29.9 kg/m^2) and Category III included obese women (BMI >30 kg/m^2).
Results: There was increased incidence of antepartum complications in obese women. The difference in the occurrence of pre-eclampsia among the three categories was statistically significant (p=0.001). Similarly, more obese women had eclampsia (5%) and gestational diabetes mellitus (6%) as compared to overweight and normal women and the difference was statistically significant in both these complications (p=0.02 for each). The risk of induction of labour was highest in obese women and so was the incidence of caesarean and instrumental deliveries and the difference was statistically significant. The difference in the onset of labour as well as mode of delivery among the three categories was statistically significant (p<0.05). In perinatal outcomes, the difference in mean birth weight of the babies among three categories was statistically significant (p<0.0001). The difference in incidence of low birth weight (<2.5 kg) as well as macrosomia (>4 kg) among babies of three BMI categories was statistically significant (p<0.05). The difference in the incidence of NICU admissions was statistically significant (p=0.02).
Conclusions: Obesity is an independent risk factor for adverse pregnancy outcomes and hence preventable steps should be taken for reducing the maternal and perinatal morbidity and mortality.

Keywords: Body mass index, Maternal outcome, Perinatal outcome

INTRODUCTION

The incidence of obesity has increased to pandemic proportions over the last 20 years. Obesity is a chronic illness which is associated with metabolic disease, nutritional deficiency, musculoskeletal complications and carcinomas. These obesity-related health issues extent to pregnancy where they are responsible for producing a variety of medical and obstetric complications resulting in an increased incidence of maternal and fetal adverse outcomes.[1] A number of systems have been used to classify obesity. The body mass index (BMI), also known as Quetelet's Index is currently in use.

The BMI is calculated as weight in kilograms divided by the height in meters squared Categories of BMI are as follows: BMI of 20-24.9 kg/m^2- normal, BMI of 25-29.9 kg/m^2- overweight, and BMI of >30 kg/m^2-obese.[2] The obese women when compared with women with a normal BMI have a greater risk of medical diseases during pregnancy.[3] The mechanism appears to be related to the endocrine milieu associated with obesity (increased levels of insulin, androgens and leptin).[4] Additionally, the non-specific marker of inflammation, C-reactive protein is raised.[5-7]

Chronic inflammatory process associated with obesity extends to the placenta during pregnancy, with recently described direct adverse fetal effects.[8] Gestational diabetes due to insulin resistance, eclamptic toxaemia, venous thromboembolism, preterm labor and respiratory distress syndrome are all associated with raised markers of inflammation both in maternal serum and placental tissue in obese women.[9]

Obese women are more likely to have induction of labor, prolonged labor, shoulder dystocia, operative and cesarean deliveries.[10] Anesthetic hazards are high.[11.12] There is increased chance of puerperal urinary tract infection, PPH, deep vein thrombosis, poor wound healing and lactation failure in obese women.[12,13]

Fetal macrosomia is common in pregnant women with high BMI which increase the risk of shoulder dystocia and fetal birth injury.[3,14,15]

Immediate neonatal complications such as hypoglycaemia, hyperbilirubinaemia and respiratory distress syndrome are also associated with raised maternal BMI.[3]

Congenital anomalies like neural tube defects, orofacial abnormalities, cardiac defects, limb reduction defects and intestinal tract anomalies such as anorectal atresia and omphalocele are also more common. There is also an increased risk of NICU admission.[16-19]

The present study has been designed to evaluate the maternal and perinatal outcome in patients belonging to different BMI categories admitted in our institution.

METHODS

This cross-sectional study was conducted in the Department of Obstetrics and Gynaecology, SMGS Hospital, Government Medical College, Jammu over a period of one year. The study included 300 singleton pregnant women with gestational age >37 weeks with cephalic presentation. Women with chronic hypertension, pre-gestational diabetes, multifetal gestation, malpresentations and prior cesarean section were excluded from the study. The selected women were categorized into three groups of 100 each according to their BMI: Category I included normal women (BMI 20-24.9 kg/m^2), Category II included overweight women (BMI 25-29.9 kg/m^2) and detailed history and clinical examination including general physical, obstetrical and systemic examinations. Category III included obese women (BMI >30 kg/m^2). All the patients included in the study were subjected to All the investigations including Hb, BT, CT, urine routine examination, PT, PTI, platelet count, renal function tests, liver function tests, blood sugar (fasting and postprandial) and urine for albumin were done.

Under maternal outcome, the variables studied included antepartum complications (gestational diabetes mellitus, pre-eclampsia, eclampsia), onset of labour (spontaneous, induced), mode of delivery (vaginal, cesarean, instrumental) and postpartum complications (postpartum hemorrhage).

Perinatal outcome variables included still births, low birth weight <2500 grams, macrosomia weight >4000 grams, congenital abnormalities and NICU admissions.

Statistical analysis

Results were expressed in numbers, percentage and mean±standard deviation. All results were analyzed statistically with the help of chi-square test, Fisher's exact test, one-way ANOVA, wherever applicable. The difference was considered significant at $p<0.05$.

RESULTS

In the present study, 300 singleton pregnant women were equally distributed into three categories according to their BMI. In Category I (BMI 20-24.9 kg/m^2), mean age of normal women was 24.51 years; in Category II (BMI 25-29.9 kg/m^2), mean age of overweight women was 25.45 years; and in Category III (BMI >30 kg/m^2), mean age of obese women was 26.72 years. The difference in the mean age was statistically significant ($p<0.0001$). Similarly, the difference in the mean weight of Category I (55.92 kg), Category II (63.88 kg) and Category III (77.71 kg) women was statistically significant ($p<0.0001$). Even the difference in mean height of women in Category I (154.81 cm), Category II (153 cm) and Category III (152.68) was statistically significant ($p=0.015$). The difference in mean BMI of women in Category I (23.33 kg/m^2), Category II (27.55 kg/m^2) and Category III (33.31 kg/m^2) was also statistically significant ($p<0.0001$) in the present study.

There was increased incidence of antepartum complications in Category III women as compared to Category II and Category I women. The difference in the occurrence of pre-eclampsia among the three categories was statistically significant ($p=0.001$). Similarly, the differences in the incidence of eclampsia as well as that of gestational diabetes mellitus among the three categories was statistically significant ($p=0.02$ for each) (Table 1).

Table 1: Antepartum complications in three categories.

Variables	Category I (n=100)	Category II (n=100)	Category III (n=100)	Statistical inference
Pre-eclampsia	3	12	19	χ^2=12.8, p=0.0001
Eclampsia	0	1	5	χ^2=7.14, p=0.02
GDM	0	2	6	χ^2=7.19, p=0.02

Table 2: Onset of labour and mode of delivery in three categories.

Variables		Category I (n=100)	Category II (n=100)	Category III (n=100)	Statistical inference
Labour onset	Spontaneous	77	72	60	χ^2=8.19, p=0.01
	Induced	20	26	38	
	Elective LSCS	3	2	2	
Mode of delivery	Vaginal	81	64	55	χ^2=16.79, p=0.002
	Cesarean	17	32	37	
	Instrumental	2	4	8	

The difference in the onset of labour as well as mode of delivery among the three categories was statistically significant (p<0.05) as shown in Table 2.

Under postpartum complications, only postpartum haemorrhage was seen in 3% of women in Category III as compared to 2% in Category II and 1% of women in Category I. The difference in the incidence of PPH among the three groups was statistically not significant (p=0.60).

In perinatal outcomes, the difference in mean birth weight of the babies among three categories was statistically significant (p<0.0001).

In the category I, mean birth weight was 2.73 kg; in Category II, it was 2.79 kg and in Category III, mean birth weight of babies was 3.08 kg. As shown in Table 3, the difference in incidence of low birth weight (<2.5 kg) as well as macrosomia (>4 kg) among babies of three BMI categories was statistically significant (p<0.05).

Table 3: Birth weight of babies in three categories.

Variables	Category I (n=100) (%)	Category II (n=100) (%)	Category III (n=100) (%)	Statistical inference
Low birth weight (<2.5 kg)	11	3	2	χ^2=9.64, p=0.008
Macrosomia (≥4 kg)	1	2	7	χ^2=6.41, p=0.04

Under perinatal complications, 14% babies born to women in Category III needed NICU admission as compared to 5% each in Category II and Category I. The difference in the incidence of NICU admissions was statistically significant (p=0.02).

Congenital anomalies were seen in 2% of babies born to women in Category III as compared to 1% each in Category II and Category I. The difference in the incidence of congenital anomalies was statistically not significant (p=0.70).

Similarly, still births were seen in 2% of babies born to women in Category III, whereas none was seen in Category II and Category I. The difference in the incidence of still births was statistically not significant (p=0.33).

DISCUSSION

The present study evaluated the impact of maternal BMI on maternal and perinatal outcomes among 300 women divided in three categories according to their BMI. Category I included normal women (BMI 20-24.9 kg/m^2), Category II included overweight women (BMI 25-29.9 kg/m^2) and Category III included obese women (BMI >30 kg/m^2).

Under anthropometric parameters, the differences in mean age, mean weight, mean height and mean BMI among the three categories women were statistically significant (p<0.05). In this study, it was observed that

overweight and obese women were slightly older and short in stature when compared with women with normal BMI.

In the present study, among the antepartum complications, the risk of GDM increased significantly with the increase in BMI (p=0.02). Sahu et al. and Hincz et al. also found that obese women had a significant risk for GDM (p=0.0004 and p<0.001 respectively).[20,21] Also, in the present study the risk of pre-eclampsia increased significantly with the increase in BMI (p=0.001). Sahu et al, Hincz et al and Sahu et al also found that obese women had a significant risk for pre-eclampsia (p=0.004, p<0.05, p<0.001 respectively).[20-22]

Risk of eclampsia increased significantly with the increase in BMI (p=0.02) in the present study with a respective incidence of 5%, 1% and 0% in obese, overweight and normal BMI categories. Jared et al found the incidence of eclampsia to be 1.2%, 0.8% and 0.5% in obese, overweight and normal BMI women respectively.[23] In the present study, the risk of induction of labor increased significantly with the increase in BMI (p=0.01). Kiran et al also found an increased risk of induction of labor in obese women (OR 1.6; CI 1.3-1.9).[24] Sahu et al also found a significantly higher incidence of induction of labor in obese women (p<0.05).[22]

In the present study, the risk of cesarean sections and instrumental deliveries increased significantly with increase in BMI (p=0.002). Sahu et al and Hincz et al also reported a significantly higher risk for cesarean delivery in these women (p=0.01).[20,21] Similarly, Sahu et al. found a significant risk of cesarean and instrumental deliveries in obese women.[22]

The risk of PPH in the present study did not increase significantly with the increase in BMI (p=0.60). Sahu et al also did not find a statistically significant difference in the occurrence of PPH in obese, overweight and normal BMI women (p>0.05). However, Bhattacharya et al in their study found that obese women were more likely to have PPH (OR 1.5; CI 1.3-1.7).[22,25] This difference might be attributed to higher number of women in their study.

The mean birth weight of babies in this study increased significantly with increase in BMI (p<0.0001). Hincz et al and Mazumder et al also found that the mean birth weight of babies increased with the increase in BMI (p<0.05).[21,26] Moreover, in the present study the incidence of low birth babies decreased significantly with increase in BMI (p<0.008). Sahu et al found the incidence of LBW babies (<2 kgs) to be 19.11% in obese, 14.10% in overweight and 6.82% in the normal BMI group (p<0.05).[22] The risk of macrosomia increased significantly with the increase in BMI (p=0.04) in the present study. Sahu et al, Hincz et al also found that the risk of macrosomia increased with increase in BMI (p<0.05, p<0.001 respectively).[20,21]

In the present study, number of NICU admissions increased significantly with increase in BMI (p=0.02). Sahu et al, Perlow et al and Sarkar et al also found that the incidence of NICU admissions increased significantly with increase in BMI (p<0.01, p=0.01, p=0.01 respectively).[22,27,28]

The incidence of congenital anomalies did not increase significantly with increase in BMI (p=0.70) in the present study. Sahu et al also did not find a significant association between maternal obesity and congenital anomalies.[20] However, Werler et al found that the incidence of congenital anomalies was 4 times higher in women weighing 110 kg or more, 1.9 times higher in women weighing 80-89 kg as compared to women with 50-59 kg weight.[29]

Present study did not find a significant difference in the rate of still births among the three categories (p=0.33). Similarly, Sahu et al did not found a significant difference in the rate of still births in obese, overweight and normal BMI groups (p>0.05).[20] Contrary to this, Sahu et al. (22) found a significantly higher rate of still births (p<0.05) in obese women.

CONCLUSION

Obesity is an independent risk factor for adverse pregnancy outcomes and hence preventable steps should be taken for reducing the maternal and perinatal morbidity and mortality. A general awareness regarding weight control, food habits and lifestyle modification is required as there are increasing trends of being overweight and obese both in developing as well as developed nations.

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