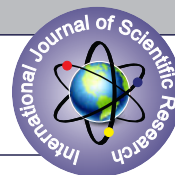


A STUDY OF OBESITY COMPLICATING PREGNANCY AND ITS MATERNAL AND FETAL OUTCOME



Obstetrics and Gynaecology

Dr. Kumari Nisha	M.B.B.S, DNB-1, M.D. (Obs. & Gynae.), Senior Resident, Department of Obstetrics and Gynaecology, Darbhanga Medical College and Hospital, Laheriasarai, Bihar.
Dr. Renu Jha*	MBBS, M.D. (Obs. & Gynae.), Ph.D. (Obs. & Gynae.), Associate Professor, Department of Obstetrics and Gynaecology, Darbhanga Medical College & Hospital, Laheriasarai, Darbhanga, Bihar.*Corresponding Author
Dr. [Prof.] Kumudini Jha	MBBS, M.D. (Obs. & Gynae.), Ph.D. (Obs. & Gynae.), D.N.B., Professor and Head of Department, Department of Obstetrics and Gynaecology, Darbhanga Medical College & Hospital, Laheriasarai, Darbhanga, Bihar.

ABSTRACT

BACKGROUND: Obesity among fertile women is reaching epidemic proportions. Mothers who are overweight or obese during pregnancy and childbirth are known to be at risk of significant antenatal, intrapartum, postpartum and neonatal complications. So the aim of the current study was to evaluate the effect of obesity on the maternal and perinatal outcomes in pregnancies complicated by obesity.

MATERIAL AND METHODS: A Prospective case-control study was conducted in Department of Obstetrics and Gynaecology, Darbhanga Medical College and Hospital, Laheriasarai, Bihar from June 2020 to May 2021 for a period of 1 year. The sample size of 150 subjects of which, 77 pregnant women with BMI $>30\text{kg/m}^2$ were considered as cases and 73 pregnant women with BMI $<30\text{kg/m}^2$ were controls and followed prospectively. Antepartum, intrapartum and postpartum complications were recorded. IBM SPSS version 22 was used for statistical analysis.

RESULTS: The mean age was 23 ± 3.53 among controls and it was 25 ± 4.44 among cases. A statistically significant association was observed with socioeconomic status (0.033), induced labour (0.035) and prolonged hospital stay (0.004) indicating that maternal obesity is a major risk factor for antepartum, intrapartum and postpartum complications. An increased risk of hypertensive disorders of pregnancy, gestational diabetes mellitus (GDM), pre-eclampsia, induction of labour, caesarean section, postpartum complications like wound infection, atonic PPH (post-partum haemorrhage), the longer length of maternal stay in hospital and preterm birth were observed among obese subjects.

CONCLUSION: Pregnancy complications related to maternal BMI is a growing problem. Maternal obesity is a risk factor for gestational diabetes, preeclampsia, labor induction, cesarean for fetal distress and wound infection.

KEYWORDS

BMI, Caesarean, Maternal Obesity

INTRODUCTION

Pregnancy is unique, yet the normal physiological chapter in women's life. However, pre-existing morbidity of the mother as well as those arising during pregnancy and intrapartum may make it a high-risk one. Obesity is one such morbidity affecting a large number of antenatal women in recent years. In recent times, obesity is a worldwide individual and public health issue because it contributes to the development of several chronic diseases. Obesity among pregnant women is reaching epidemic proportions. According to WHO global estimates, about 18% of the world's adult population (13% of men and 17% of women) were obese in 2019. In India The National Family Health Survey-III, which includes the health of women of child-bearing age, reports that 33% of women have a body mass index (BMI) below normal, 14.8% of women are overweight or obese and 57.9% of pregnant women are anemic.

Maternal obesity was defined according to the World Health Organization (WHO) and National Institute of Health guidelines as follows: overweight, body mass index (BMI) $25-29.9\text{kg/m}^2$; or obese, BMI $>30\text{kg/m}^2$. Underweight was defined as BMI $<19.8\text{kg/m}^2$. Factors such as dietary knowledge, attitude and practices, physical activity level and perhaps also sociodemographic and health behaviour factors are likely reasons for these increases in the prevalence of overweight. Mothers who are overweight or obese during pregnancy and childbirth, as measured by increasing maternal body mass index (BMI), are known to be at risk of significant antenatal, intrapartum, postpartum and neonatal complications. Antenatal complications include recurrent miscarriage, congenital malformations, pregnancy-induced hypertension (PIH), pre-eclampsia, gestational diabetes mellitus (GDM) and venous thromboembolism. Overweight and obese women are more likely to be induced and require caesarean. Infants of overweight and obese mothers are often macrosomic and require prolonged hospital admissions. The mechanisms of these associations remain unclear, as gestational weight gain reflects both maternal nutritional status, as well as tissue expansion during pregnancy. The impact of increased BMI in the general population has been the focus of many studies, but studies pertaining to pregnant women are few in India. So the aim of the current study was to evaluate the effect of obesity on the maternal and perinatal outcomes in pregnancies complicated by obesity.

MATERIAL AND METHODS

A Prospective case-control study was conducted in Department of Obstetrics and Gynaecology, Darbhanga Medical College and Hospital, Laheriasarai, Bihar from June 2020 to May 2021 for a period of 1 year. The sample size of 150 subjects of which, 77 pregnant women with BMI $>30\text{kg/m}^2$ were considered as cases and 73 pregnant women with BMI $<30\text{kg/m}^2$ were considered as controls and followed prospectively. BMI was calculated as weight (kg) divided by height (m^2). Irrespective of age, parity, socioeconomic status, antenatal women willing to follow up and delivery in study settings were included. Women with BMI between 25.1kg/m^2 and 29.9kg/m^2 and BMI $<18.5\text{kg/m}^2$ were excluded. Pregnant women with chronic diseases like Hypertension, Diabetes, Heart Disease, Epilepsy, TB, Bronchial Asthma, Multiple Gestation, Intrauterine Fetal Demise, Miscarriage, Anomalous baby were also excluded.

The study protocol and written informed consent was taken from the subjects. Relevant hematological, biochemical investigations, USG were done. They were followed up to delivery and postpartum until discharge and outcome studied. Detailed physical examination with regards to weight, height, pulse, BP was recorded. They were examined for anemia, pedal edema and systemic examination of Cardiovascular System, Respiratory System and Central Nervous System was done.

With the above information, the antenatal mothers were followed up during the antenatal period, delivery and postpartum until discharge. They were looked forth on the development of Gestational diabetes mellitus, Pre-eclampsia, Gestational hypertension, and Anaemia. Gestational diabetes screening was conducted at 24-28 weeks gestation using a 50-g glucose test; blood sugar was measured after 1 h of glucose intake. Blood sugar $>140\text{mg/dL}$ was considered significant and diabetes was confirmed on glucose tolerance test. PIH was defined as persistently elevated blood pressure (systolic blood pressure $>140\text{mmHg}$ and diastolic pressure $>90\text{mmHg}$ on more than two occasions) with proteinuria or edema or both.

Labour induction and their indication, Mode of delivery (Vaginal / Caesarean delivery), intrapartum complications like Shoulder dystocia, abruption placenta were recorded. Post-partum complications like Wound Infection Atonic Pph, Anemia, Ghtn, Hellp/Aki, and fever

were recorded. Among neonates Gestational age at birth, birth weight, Apgar at birth and Admission in NICU and indications for admission were analysed. P-value < 0.05 was considered statistically significant. IBM SPSS version 22 was used for statistical analysis.

RESULTS

The mean of Age was 23 ± 3.53 among controls and it was 25 ± 4.44 among cases the majority of the participants belonged to 20-24 years. A maximum number of cases 72 (93.51%) and controls 60 (82.19%) belong to class III socioeconomic status and the difference between 2 groups was statistically significant (P-value 0.033). 54.79% were primiparity among cases and 40 (51.95%) participants were multiparity among controls. A greater number of participants gave birth in the Gestational age of 37 to 40 weeks. When anti Partum complications were considered among cases majority had 16 (20.78%) Gestational hypertension, followed by 8 (10.39%) had gestational diabetes, 4 (5.19%) had Anaemia and 3 (3.9%) had Severe Preeclampsia. (Table 1)

Table 1 : Comparison of baseline maternal parameters between study group (n=150)

Baseline maternal parameters	Study Group		P-value
	Control (N=73)	Obese (N=77)	
Maternal Age (n%)			
• <20	5(6.85%)	2(2.6%)	0.134
• 20-24	45(61.64%)	40(51.95%)	
• 24-29	17(23.29%)	20(25.97%)	
• >30	6(8.22%)	15(19.48%)	
Age (Mean $\pm$ SD)	23 ± 3.53	25 ± 4.44	0.134
Socio-Economic Status (n%)			
Class III	60(82.19%)	72(93.51%)	0.033
Class IV	13(17.81%)	5(6.49%)	
Obstetrics (n%)			
• Primigravida	33(45.21%)	40(51.95%)	0.409
• Multigravida	40(54.79%)	37(48.05%)	
Gestational Age (n%)			
• <37	3(4.11%)	8(10.39%)	0.332
• 37-40	56(76.71%)	56(72.73%)	
• >40	14(19.18%)	13(16.88%)	
Antepartum Complication (n%)			
• GHTN	0(0%)	16(20.78%)	*
• Severe Preeclampsia	1(1.37%)	3(3.9%)	
• GDM	0(0%)	8(10.39%)	
• Anaemia	9(12.33%)	4(5.19%)	

*No statistical test was applied- due to 0 subjects in the cells

The majority of the participants had a cephalic fetal presentation. Labour was induced 12 (16.44%) Participants in the control group and 24 (31.17%) in cases and the difference between 2 groups was statistically significant (P-value 0.035). Natural labour was reported in 46 (63.01%) in the control group and 20 (25.97%) among cases. Primary Caesarean was reported 13 (17.81%) controls and 32 (41.56%) among cases. Among controls, 2 (2.74%) had increased BP as an intrapartum complication. Whereas among cases, 2 (2.6%) participants had Abruptio Placenta as an intrapartum complication. When postpartum complications are observed, 4 (5.48%) controls had Anemia. Among cases, 5 (6.49%) participants had Wound Infection, 2 (2.6%) had Atonic Pph, 1 (1.3%) had Anemia, Ghtn, Hellp/Aki, and fever. (Table 2)

Table 2 : Comparison of prenatal parameters between study group (n=150)

Prenatal parameters	Study Group		P-value
	Control (N=73)	Obese (N=77)	
Fetal Presentation (n%)			
• Cephalic	73(100%)	76(98.7%)	*
• Transverse Lie	0(0%)	1(1.3%)	
Induction (n%)			
• Yes	12(16.44%)	24(31.17%)	0.035
• No	16(83.56%)	53(68.83%)	
Mode of Delivery			
• Labour Natural	46(63.01%)	20(25.97%)	*
• Primary Caesarean	13(17.81%)	32(41.56%)	
• Repeat Caesarean	9(12.33%)	17(22.08%)	
• Forceps	0(0%)	5(6.49%)	
• Vacuum	4(5.48%)	3(3.9%)	
• VBAC	1(1.37%)	0(0%)	

Intrapartum Complication (n%)			
• Shoulder Dystocia	0(0%)	1(1.3%)	*
• Increase BP	2(2.74%)	1(1.3%)	
• Abruptio Placenta	0(0%)	2(2.6%)	
Postpartum Complication (n%)			
• Wound Infection	0(0%)	5(6.49%)	*
• Anemia	4(5.48%)	1(1.3%)	
• GHTN	0(0%)	1(1.3%)	
• HELLP/AKI	0(0%)	1(1.3%)	
• Atonic PPH	0(0%)	2(2.6%)	
• Fever	0(0%)	1(1.3%)	

*No statistical test was applied- due to 0 subjects in the cells

The majority of cases 72 (93.51%) and controls 69(94.52%) delivered on the term. Birth weight was above 2.5kgs among 70 (90.91%) cases and 64 (87.67%) controls. Apgar score at 5 mins was more than 7, among all 73 (100%) controls and 75 (97.4%) cases. Among controls, 22 (30.14%) and 30 (38.96%) cases were admitted in NICU. Majority 7 (9.59%) of cases and controls had NNH for NICU admission. The mean of Stay in NICU was 3.64 ± 2.59 in controls and 3.5 ± 2.74 in cases. Among controls, 67 (54.03%) had a hospital stay less than or equal to 7 days and 6 (23.08%) had was more than 7 days of hospital stay. Whereas among cases, 57 (45.97%) had a hospital stay less than or equal to 7 days and 20 (76.92%) had was more than 7 days hospital stay and the difference between 2 groups was statistically significant (P-value 0.004). (Table 3)

Table 3 : Comparison of post-natal parameters between study group (n=150)

Post-natal parameters	Study Group		P-value
	Control (N=73)	Obese (N=77)	
Term/Pre-term (n%)			
• Term	69(94.52%)	72(93.51%)	
• Pre-term	3(4.11%)	5(6.49%)	
• Post Dated	1(1.37%)	0(0%)	
Birth weight			
• <1.99	2(2.74%)	3(3.9%)	
• 2-2.49	7(9.59%)	4(5.19%)	
• 2.5 and above	64(87.67%)	70(90.91%)	
Apgar at 5 min. (n%)			
• <7	0(0%)	2(2.6%)	
• >7	73(100%)	75(97.4%)	
Admission in NICU(n%)			
• Yes	22(30.14%)	30(38.96%)	
• No	51(69.86%)	47(61.04%)	
Duration of Hospital stay (n%)			
• ≤ 7	67(54.03%)	57(45.97%)	
• >7	6(23.08%)	20(76.92%)	
Stay in NICU (n=52) (Mean $\pm$ SD)	3.64 ± 2.59	3.5 ± 2.74	

*No statistical test was applied- due to 0 subjects in the cells

DISCUSSION

Our study found that increasing maternal BMI was associated with adverse health outcomes for both the mother and her baby. These findings are consistent with those of previous studies conducted by Glatiere-Dereure F et al, Kabiru W et al, in showing an association between increasing maternal BMI and an increased risk of hypertensive disorders of pregnancy, GDM, pre-eclampsia, induction of labour, caesarean section, postpartum complications like wound infection, Atonic Pph, longer length of maternal stay in hospital and preterm birth.

The mean age among the obese cases was 25 ± 4.44 and most of them belonged to the lower middle class (class III). Statistically, a significant association was observed between obesity and socioeconomic status which is in accordance Dinsa GD et al, who conducted a systematic review and reported that maternal obesity is disproportionately a problem of the poor at a lower level of economic development and further research needs to the interrelationship between SES and obesity in developing countries.

Preterm delivery in obese women was 6.49% compared to the control group 4.1%. A study by Hendler I et al evaluated the relationship between pre-pregnancy BMI and spontaneous preterm birth and found a significant occurrence of preterm birth (11.3%) among obese pregnant women. Birth weight was more in obese

mothers (90.9%) consistent with study conducted by Athukorala C et al, in which Mean birth weight of babies born to overweight and obese mothers were significantly greater than babies born to women with a normal BMI MD 99.7 [95%CI 21.3, 178.2], $p=0.01$).

Comparing the antepartum complications, obese women were at increased risk of gestational hypertension (20.78%) gestational diabetes (10.39%), pre-eclampsia (3.9%), and Caesarean delivery (41.56%), consistent with other studies conducted by Perlow JH et al. Ehrenberb HM et al. The present study is in line with a prospective multicenter study conducted by Wiess JL et al in which more than 16,000 pregnant women who were obese were 2.5 times and 1.6 times more likely to develop gestational hypertension and preeclampsia, respectively. It has long been known that insulin resistance and hyperinsulinemia are hallmark features of gestational diabetes and obesity. Fasting and post-absorptive plasma insulin levels are higher in obese pregnant women.

Induced labour and Caesarean section rate increased, along with maternal BMI, in most studies including the present one (31.17% and 41.56%). Statistically, a significant association was observed between cases and controls for labour induction ($p=0.035$). Ekblad U et al reported an increased incidence of induced labours and emergency caesarean sections (<0.05). Reasons reported for surgery generally include macrosomia- associated cephalopelvic disproportion, fetal distress, and stagnation of induced labor. The higher caesarean section rate in obese women carries the extra risk of higher perioperative morbidity, including anaesthetic problems, infections, blood loss, and prolonged hospitalization.

When considering the intrapartum complications Shoulder Dystocia (1.3%), Abruptio Placenta (2.6%) were observed in the present study which are in concurrence with Bianco AT et al who reported Abruptio Placenta (0.5%) and Shoulder Dystocia (1.6%). Wound infection 6.49%, 2 (2.6%) had Atonic PPH, 1 (1.3%) had anemia. Robinson HE et al reported a 4-fold increase in wound infection (adjusted OR 4.79, 95% CI 3.30–6.95) among obese subjects.

Obese subjects (76.92%) had statistically significant (P -value 0.004) more than 7 days hospital stay and reported 7.07% neonatal Hyperbilirubinemia, respiratory distress (7.07%), idiopathic diabetes mellitus (4.04%), macrosomia (1.01%). Whereas in a study conducted by reported by Radhakrishnan U et al complications like macrosomia, hypoglycemia, and hyperbilirubinemia (jaundice). In the current study statistically, a significant association was observed with socioeconomic status (0.033), induced labour (0.035) prolonged hospital stay (0.004) indicating that maternal obesity is a major risk factor for antepartum, intrapartum and postpartum complications.

CONCLUSION

Pregnancy complications related to maternal BMI is a growing problem. Maternal obesity is a risk factor for gestational diabetes, preeclampsia, labour induction, caesarean for Fetal distress and wound infection. Pre- pregnancy counselling, health programs, and appropriate multidisciplinary management should be done to bring awareness among pregnant women.

REFERENCES

1. Athukorala C, Rumbold AR, Willson KJ, Crowther CA. The risk of adverse pregnancy outcomes in women who are overweight or obese. *BMC Pregnancy Childbirth*. 2010;10:56.
2. Bianco AT, Smilen SW, Davis Y, Lopez S, Lapinski R, Lockwood CJ. Pregnancy outcome and weight gain recommendations for the morbidly obese woman. *Obstet Gynecol*. 1998;91:97-102.
3. Brost BC, Goldenberg RL, Mercer BM, Iams JD, Meis PJ, Moawad AH, et al. The Preterm Prediction Study: association of cesarean delivery with increases in maternal weight and body mass index. *Am J Obstet Gynecol*. 1997;177:333-7.
4. Dinsa GD, Goryakin Y, Fumagalli E, Suhrcke M. Obesity and socioeconomic status in developing countries: a systematic review. *Obes Rev*. 2012;13:1067-79.
5. Doherty DA, Magann EF, Francis J, Morrison JC, Newnham JP. Pre-pregnancy body mass index and pregnancy outcomes. *Int J Gynaecol Obstet*. 2006;95:242-7.
6. Durnwald CP, Ehrenberg HM, Mercer BM. The impact of maternal obesity and weight gain on vaginal birth after cesarean section success. *Am J Obstet Gynecol*. 2004;191:954-7.
7. Ehrenberg HM, Dierker L, Milluzzi C, Mercer BM. Prevalence of maternal obesity in an urban center. *Am J Obstet Gynecol*. 2002;187:1189-93.
8. Ehrenberg HM, Mercer BM, Catalano PM. The influence of obesity and diabetes on the prevalence of macrosomia. *Am J Obstet Gynecol*. 2004;191:964-8.
9. Ekblad U, Grenman S. Maternal weight, weight gain during pregnancy and pregnancy outcome. *Int J Gynaecol Obstet*. 1992;39:277-83.
10. Galtier-Dereure F, Boegner C, Bringer J. Obesity and pregnancy: complications and cost. *Am J Clin Nutr*. 2000;71(5 Suppl):1242S-8S.
11. Hendler I, Goldenberg RL, Mercer BM, Iams JD, Meis PJ, Moawad AH, et al. The Preterm Prediction Study: association between maternal body mass index and spontaneous and indicated preterm birth. *Am J Obstet Gynecol*. 2005;192:882-6.
12. IBM Corp. Released 2013. IBM SPSS Statistics for Windows, Version 22.0. Armonk,

NY: IBM Corp.

13. Jensen DM, Damm P, Sorensen B, Molsted-Pedersen L, Westergaard JG, Ovesen P, et al. Pregnancy outcome and prepregnancy body mass index in 2459 glucose-tolerant Danish women. *Am J Obstet Gynecol*. 2003;189:239-44.
14. Kabiru W, Raynor BD. Obstetric outcomes associated with increase in BMI category during pregnancy. *Am J Obstet Gynecol*. 2004;191:928-32.
15. Kuczmarski RJ, Flegal KM, Campbell SM, Johnson CL. Increasing prevalence of overweight among US adults: The National Health and Nutrition Examination Surveys, 1960 to 1991. *JAMA*. 1994;272:205-11.
16. Lashen H, Fear K, Sturdee D. Obesity is associated with increased risk of first trimester and recurrent miscarriage: matched case-control study. *Hum Reprod*. 2004;19:1644-6.
17. NFHS-3 IIPS. International Institute for Population Sciences (IIPS) and Macro International. National Family Health Survey (NFHS-3) 2005-06 [Internet]. India: International Institute for Population Sciences (IIPS); 2007 [cited 2020 Jan 10]. Available from: <https://dhsprogram.com/pubs/pdf/FRIND3/FRIND3-Vol1AndVol2.pdf>.
18. Perlow JH, Morgan MA, Montgomery D, Towers CV, Porto M. Perinatal outcome in pregnancy complicated by massive obesity. *Am J Obstet Gynecol*. 1992;167:958-62.
19. Radhakrishnan U, Kolar G, Nirmalan PK. Cross-sectional study of gestational weight gain and perinatal outcomes in pregnant women at a tertiary care center in southern India. *J Obstet Gynaecol Res*. 2014;40:25-31.
20. Robinson HE, O'Connell CM, Joseph KS, McLeod NL. Maternal outcomes in pregnancies complicated by obesity. *Obstet Gynecol*. 2005;106:1357-64.
21. Weiss JL, Malone FD, Emig D, Ball RH, Nyberg DA, Comstock CH, et al. Obesity, obstetric complications and cesarean delivery rate—a population-based screening study. *Am J Obstet Gynecol*. 2004;190:1091-7.
22. WHO. Obesity: preventing and managing the global epidemic Report of a WHO Consultation (WHO Technical Report Series 894) [Internet]. World Health Organization; 2000 [cited 2020 Jan 13]. Available from: https://www.who.int/nutrition/publications/obesity/WHO_TRS_894/en/.
23. Wolfe H. High prepregnancy body-mass index—a maternal-fetal risk factor. *N Engl J Med*. 1998;338:191-2.