ORIGINAL ARTICLE

Influence of Body Mass Index in Pregnancy on Maternal and Fetal Outcome

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ABSTRACT

Background: Obesity in women is on the rise, which is a serious public health issue. Researchers have shown that these changes have a significant influence on pregnancy outcomes in these women, as confirmed by several studies.

Objectives: To examine the relationship of the body mass index (BMI) in pregnancy with the feto-maternal outcome

Material Methods: We surveyed 230 women for this study, which was both prospective and cross-sectional. The study covered all pregnant women who met the inclusion criteria. At least 16 weeks into the pregnancy, the singleton pregnancy must have a complete medical record to be eligible. Throughout the first trimester, researchers measured and calculated the BMI of pregnant women. Using the formula kg/m2, the body mass index (BMI) of an individual can be calculated. According to the Asian-Pacific cutoff points8, BMI was divided into four categories: underweight (18.5 kg/m2), normal weight (18.5-22.9 kg/m2), overweight and obesity (23–26.9 kg/m2), and obese (>25 kg/m2). SPSS version 23.0 was used to analyse all of the data.

Results: A total of 230 women were selected in this study. Out of these, 30 (13%) were underweight (less than or equal to 18.5kg/m^2), 124 (54%) belonged to normal BMI (>18.5 -24.9 kg/m), while 50 (22%), 21 (9%) and 5 (2%) women were from the overweight (25-29.9 kg/m^2), obese (30-34.9 kg/m^2) and the morbidly obese (> 35 kg/m^2) categories respectively. Increasing BMI was associated with an increase in gestational diabetes (GDM) and pre-eclampsia. However, BMI >18.5 kg m2 had an adjusted odds ratio of 0.21 (95 percent CI 0.22, 0.68) for pre-eclamptic syndrome and GDM and appeared to influence the development of these complications. This was a protective effect. Overweight and obese women were more likely to give birth through instrumental delivery, with ORs of 3.4 (95 % CI, 1.1, 22.2) and 3.5, respectively (95 % CI 0.3, 15.8). A severely obese woman was more likely to have a large-gestational-age baby as her weight increased. The odds ratio for underweight women having babies that are smaller than average for their gestational age (SGA) is 5.7 (95 % CI 6.2, 9.2).

Conclusion: According to the findings of this study, 50% of pregnant women had abnormal BMIs. Several pregnancy issues might arise for women with an abnormally high BMI, such as preeclampsia, gestational diabetes, cesarean section, inducement of labor, and macrosomic newborns with obesity and anemia.

Keywords: Body Mass Index, Obesity, fetal outcome, maternal outcome

INTRODUCTION

Across the globe, the prevalence of obesity and overweight has increased dramatically. Obesity has become a worldwide problem. Obesity in pregnant women is now a significant problem for obstetricians.[1] According to the Pregnancy Risk Assessment Monitoring System (PRAMS), up to 22% of women in the United States were obese before becoming pregnant, a rise of 69.3% from a decade earlier.[2] Obesity is on the rise among Pakistani women, according to a population-based poll, and the tendency has risen with age.[3] More than one-third of Pakistani women over the age of 20 have abnormal BMIs, according to a recent study.[4] A sample found that 26% of Pakistani women and 19% of males were obese, respectively.[4] 4.5% and 53.7% of women in the 2011 Pregnancy Nutrition Surveillance had a pre-pregnancy body mass index (BMI) in the underweight and overweight categories, respectively, according to the data.[5] It is suggested by the American College of Obstetricians and Gynecologists (ACOG) that all pregnant women should have their body mass index (BMI) recorded at their first prenatal appointment, and that pregnant women and their unborn children should be informed of the dangers of having an excessively high BMI. Premature birth is associated with a mother's obesity.

Gestational diabetes and preeclampsia are more common in obese women who are expecting, as are infections, surgical vaginal birth, and cesarean delivery.[6] An unfavorable pregnancy outcome might be exacerbated by an abnormally low or high BMI. Obesity has been linked to the development of pregnancy problems such as gestational diabetes, pregnancy-induced hypertension, postpartum haemorrhage, macrosomia, and stillbirth in many studies.[5,6] Anemia and intrauterine growth retardation are more likely in pregnancies with low body mass index (BMI).[7] Women with a higher BMI were more likely to develop pre-eclampsia and gestational diabetes mellitus during pregnancy, as well as premature rupture of membranes (PROM), placental abruption, and stillbirths.[8–10] Maternal BMI, weight growth, and developmental risks have been linked by Hapsburg et al. (2019).[11] On the other hand, US-based research found no link between maternal obesity and cesarean birth but found a link between BMI and a spike in pregnant women's PROM (Prostate-Specific Antigen).[12]

Obesity has been linked to a variety of pregnancy outcomes in various studies. When it comes to obstetric outcomes, pregnant women need to know if their BMI is too low or too high, so that they may make informed decisions about whether or not they should have a baby. Pregnant women in developing countries have less access to data on their weight growth trends as a result. As a result, this study was done to assess the outcomes of pregnancy among overweight women with a BMI of more than 30 at a rural hospital in Tando Muhammad Khan in Sindh, Pakistan.

MATERIAL AND METHODS

For this study, researchers enrolled the births of 230 singletons between February 2020 and January 2021. The ethical committee of Indus Medical College's obstetrics and gynaecology department in Tando Muhammad Khan accepted this study. All pregnant women who matched the inclusion criteria were included in the research. To be eligible, a singleton pregnancy has to be scheduled at least 16 weeks into the pregnancy and have a complete medical record. Multiple pregnancies, booking beyond 16 weeks of gestation, and medical conditions such as The study did not include participants with any form of essential hypertension, diabetes mellitus, or kidney disease.

A predesigned proforma was used to acquire data from the prior medical record. Maternal height and weight were recorded throughout the first trimester, and the BMI was computed. A person's BMI was estimated by distributing their weight in kilograms by their height in meters squared (kg/m2). BMI was categorized into four categories based on the Asian-Pacific cutoff

points8: underweight ((< 18.5 kg/m2), normal weight (18.5-22.9 kg/m2), overweight and obesity (23–26.9 kg/m2), and obese (>25 kg/m2). It was shown that pre-eclampsia and gestational diabetes were associated with a higher incidence of cesarean section and postpartum hemorrhage, while minor for gestational age and big for gestational age were found to be associated with lower rates of instrumental delivery. Gestational age was calculated using the latest menstrual cycle date, which was verified by ultrasound. Patients with multiple pregnancies, prior cesarean sections, or an inadequate medical history were excluded from the research.

Statistical Analysis: To do the statistical analysis, SPSS version 23 was used. Frequency data is reported as a percentage of total data. Different groups were associated using ANOVA and chi-squared tests correspondingly, for categorical and continuous variables A p-value 0.05 was used to indicate statistical significance. To account for possible confounds, logistic regression was employed. As an adjusted odd ratio with 95% confidence intervals, the risks of problems associated with pregnancy have been calculated.

RESULTS

This study enlisted the participation of 230 women. 30 (13%) were underweight (less than or equal to 18.5 kg/m2), 124 (54%) had a normal BMI (>18.5 -24.9 kg/m), and 50 (22%), 21 (9%), and 5 (2%), respectively, were overweight (25-29.9 kg/m2), obese (30-34.9 kg/m2), and morbidly obese (> 35 kg/m2). Table-I shows how the women's selected demographic variables were divided into five groups based on their BMI.

The nominated demographic characteristics of the women have been categorized into five groups according to their BMI as shown in **Table-I** In this study, most of the women 18(36.0%, n=21) had overweight and 8(38.09%) women had obesity who were found in the age group 20 to 25 years. However, 2(40.0%,) women had morbidly obese who were found in the age group 26 to 35 years and >35 years respectively.

In this study, most of the women 24(48.0%) had overweight and 12(57.14%) women had obesity who were found with the parity of 1-4. **Table I**

Table III: shows the Pregnancy problem risk given as an odds ratio for each BMI category compared to the normal BMI

Increasing BMI was associated with an increase in gestational diabetes (GDM) and pre-eclampsia. In comparison to women with a normal BMI, the adjusted odds ratios for gestational

diabetes and preeclampsia in the morbidly obese population are 13.1 (95% CI: 2.4, 26.8) and 6.2 (95% CI: 1.0, 13.2), respectively. However, BMI >18.5 kg m2 had an adjusted odds ratio of 0.21 (95 % CI 0.22, 0.68) for pre-eclamptic syndrome and GDM and appeared to influence the development of these complications. This was a protective effect. Similarly for gestational diabetes.

When it comes to labor induction, underweight women are less likely to need it, whereas those who are morbidly obese are more likely to need it, according to the study. Cesarean sections, whether planned or unplanned, are more common in women who are overweight or obese as their BMI rises. Overweight and obese women were more expected to give birth through instrumental delivery, with ORs of 3.4 (95 % CI, 1.1, 22.2) and 3.5, respectively (95 % CI 0.3, 15.8). In the underweight group, the risk of postpartum hemorrhage is 2.27 (95 % CI 0.67, 3.1), whereas the morbidly obese category had a risk of postpartum hemorrhage of 2.4 (95 %CI 0.29–21.4). There was a 3.74 adjusted relative risk of anemia in the underweight group (95% confidence interval of 1.5–2.7). Anemia may be a factor in the increased risk of PPH in underweight individuals. Severely obese mothers were more likely to produce big gestational age infants as their weight increased. With odds ratios of 5.7, underweight mothers are more likely to give birth to infants who are smaller than normal for their gestational age (SGA) (95 % CI 6.2, 9.2). **Table IV**
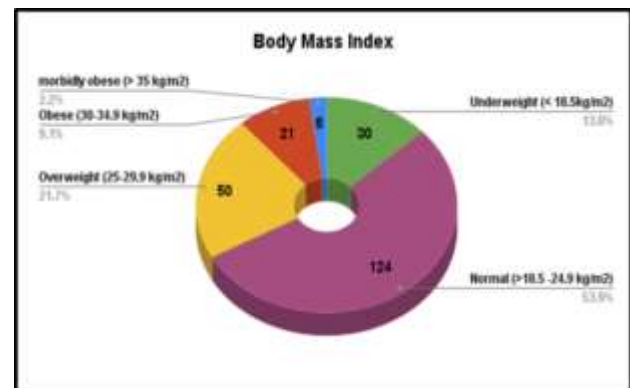

Figure 1: Distribution of patients with regards to frequency of Body Miass Index (kg/m2) with different classification (n= 230)

Table-1: Maternal demographic characteristics in the various body mass index groups

Variables	Underweight n = 30	Normal weight n = 124	Overweight n = 50	Obesity n = 21	Morbidly obese n = 5
Age (years)					
<19	2 (6.66%)	10 (8%)	17 (34%)	0.46 (2.2%)	0.25(5%)
20-25	17 (56.66%)	58(46.77%)	18 (36%)	8 (38.09%)	1(20%)
26-35	9 (30%)	42 (33.87%)	22 (44%)	8 (38.09%)	2 (40%)
>35	2 (6.66%)	14 (11.29%)	9 (18%)	4 (19.04%)	2(40%)
Parity					
Nulliparous	6 (20%)	42(33.87%)	23 (46%)	12 (57.14%)	3(60%)
1-4	17 (56.66%)	60(48.38%)	24 (48%)	7 (33.33%)	2(40%)
>5	7 (23.33%)	22 (17.74%)	4 (8%)	2 (9.52%)	0

Table-2: The frequency of obstetrics complications in body mass index group.

Pregnancy Complications	Underweight n = 30	Normal weight n = 124	Overweight n = 50	Obesity n = 21	Morbidly obese n = 5	p-value
Anaemia	17 (56.66%)	42 (33.87%)	9 (18%)	3 (14%)	0.35(7%)	0.002
Gestational Diabetes Mellitus	0.3 (1%)	5 (4%)	3 (6%)	2 (9.52%)	2 (40%)	<0.005
Preeclampsia	0.9 (3%)	11 (8.87%)	6 (12%)	3 (14.28%)	2 (40%)	0.001
Large for Gestational Age	0.24 (0.8%)	2 (1.61%)	4 (8%)	3 (14.28%)	1 (20%)	<0.005
Small for Gestational Age	6 (20.7%)	6 (4.83%)	4 (8%)	1 (4.76%)	0.35 (7%)	<0.005
Postpartum Hemorrhage	1 (3.33%)	2 (1.61%)	0.5 (1%)	0.46 (2.19%)	0.25 (5%)	0.36

Spontaneous Vaginal Delivery	26 (86.66%)	101 (81.45%)	36 (72%)	1(4.76%)	2(40%)	<0.005
Induced labour	7 (23.33%)	33 (26.61%)	17 (34%)	9 (42.85%)	3(60%)	0.003
Ceasarian Section						
Emergency Ceasarian section	2 (6%)	10(8.06%)	6 (12%)	6 (28.57%)	2(40%)	<0.005
Elective Ceasarian section	1(3.33%)	11 (8.87%)	7 (14%)	2 (9.52%)	2(40%)	<0.005
Instrumental delivery	0.24 (0.8%)	1 (0.80%)	2 (4%)	0.46 (2.19%)	0	0.16

Table-3: Adjusted odds ratio of pregnancy complications in the abnormal body mass index groups compared to the normal body mass index group.

Pregnancy Complication	Underweight	Overweight	Obese	Mobidly Obese
Anaemia	3.74 (1.5,2.7)	0.2 (0.35, 0.67)	0.265(0.13, 0.499	0.12 (0.12,0.68)
Gestational Diabetis Mellitus	0.27 (0.13, 2.6)	2.31 (0.48, 3.7)	1.9 (1.15, 4.9)	13.0 (2.4, 26.8)
Preeclampsia	0.21 (0.22, 0.68)	2.73 (0.81, 2.04)	1.45 (0.86, 2.03)	6.2 (1.0, 13.2)
Large for Gestational Age	0.43 (0.12, 3.7)	2.8 (2.7, 6.2)	7.6 (3.1, 16.8)	10.0 (2.1, 36.8)
Small for gestational age	5.7 (6.2, 9.2)	2.21 (0.59, 1.9)	1.02 (0.28, 2.81)	20.4(7.1, 54.0)
Postpartum Hemorrhage	2.91 (1.7, 3.5)	0.66 (0.098-3.00)	1.08 (0.24, 6.0)	2.4 (0.29, 21.4)
Spontaneous Vaginal Delivery	2.27 (0.67, 3.1)	0.49 (0.5, 0.8)	0.32 (0.16, 0.55)	0.20 (0.07, 0.45)
Induced labor	0.78 (0.46, 2.53)	2.26 (0.89, 1.7)	1.0 (1.31, 3.26)	2.6(1.1, 5.7)
Caesarian Section				
Emergency Ceasarian section	2.74 (0.28, 2.31)	1.59 (2.0, 3.8)	1.71 (0.89, 2.3)	6.8 (2.3, 18.5)
Elective Ceasarian section	0.87 (0.36, 1.8)	1.71 (0.88, 2.6)	5.8 (2.7, 7.6)	4.7 (1.3, 15.4)
Instrumental delivery	0.76 (0.89-6.15)	3.4 (1.1-22.2)	3.5 (0.3-15.8)	0

DISCUSSION

According to the findings of this study, women who have a low BMI, as well as a high BMI, are more likely to have a difficult time getting pregnant. Overweight and obesity are related with an increased risk of pre-eclampsia, gestational diabetes, and the need for an emergency cesarean section (increased BMI). Obesity is a risk factor for prenatal hypertension and gestational diabetes, according to the findings of this study. Several studies have found a correlation between obesity and hypertension and hyperglycemia.[13,14] The risk of pre-pregnancy hypertension increased with each 5-7 kg/m2 rise in BMI, according to a meta-analysis.[15] Obese and morbidly obese women have a risk of pre-eclampsia three and seven times greater, respectively, while underweight women have a risk of pre-eclampsia that is significantly lower.

Many previous studies[16] found a correlation between induced labor and cesarean section and abnormal BMI, and our study likewise found a similar correlation. Obesity increases the likelihood of an emergency cesarean section while decreasing the likelihood of spontaneous labor. High perioperative morbidity, such as anesthetic difficulties, infections, and an extended hospital stay, were all associated with an elevated BMI. In our study, like in Butwick's, the risk of postpartum hemorrhage was higher in obese women.[17] Overweight and obese women were found to have a 19% greater risk of bleeding in this study. According to an Indonesian cohort study,[18] which is comparable to our own, the risk of anemia increased with a low body mass index (BMI).

A substantial correlation between BMI and fetal weight was established by our researchers. A BMI of greater than 30 was linked to a higher chance of small-for-gestational-age babies, whereas a BMI of less than 20 was linked to a higher risk of large-for-gestational-age newborns. Studies[19,20] have confirmed the link between maternal obesity and fetal development, finding an 18-26% greater chance of delivering a baby with macrosomia without having gestational diabetes in women who were obese throughout pregnancy.[21] A single-center research involving women of diverse ethnic and socioeconomic backgrounds is one of the study's strengths. With only one location, the consequences of clinical practice variation and the outcomes they produce were minimized. Like any other observational research, this one has a few drawbacks. It is one of the restrictions that pre-pregnancy BMI should be optimal for assessment. To limit the effects of gestational weight increase, we involved all women who recorded before 16 weeks of pregnancy in our research. Another drawback of this study was that it was retroactive, making it impossible to determine some socio-demographic appearances like education level and socio-economic position.[22]

CONCLUSION

According to the findings of this study, 50% of pregnant women had abnormal BMIs. Several pregnancy issues might arise for women with an abnormally high BMI, such as preeclampsia, gestational diabetes, cesarean section, inducement of labor, and macrosomic newborns with obesity and anemia. To enhance pregnancy outcomes, pre-pregnancy weight loss, dietary education, and lifestyle adjustment should be prioritized.

REFERENCES

1. K. DB, N. DG, G DPP, Dhingra DS, D. DV. A study on pre pregnancy body mass index and its effect on maternal and perinatal outcome. Obs Rev J Obstet Gynecol. 2019 Oct 31;5(4):181–5.
2. Sun Y, Shen Z, Zhan Y, Wang Y, Ma S, Zhang S, et al. Effects of pre-pregnancy body mass index and gestational weight gain on maternal and infant complications. BMC Pregnancy Childbirth. 2020 Dec 6;20(1):390.
3. Short V, Geller S, Moore J, McClure E, Goudar S, Dhaded S, et al. The Relationship between Body Mass Index in Pregnancy and Adverse Maternal, Perinatal, and Neonatal Outcomes in Rural India and Pakistan. Am J Perinatol. 2018 Jul 24;35(09):844–51.
4. Amin Baig A. Obesity in Pakistan; Current and Future Perceptions. Curr Trends Biomed Eng Biosci. 2018 Nov 14;17(2).
5. Wang T, Li L, Wu C, Cao R, Li Q, Yu L, et al. Body Mass Index and Gestational Weight Gain Are Associated with Maternal and Neonatal Outcomes Based on Chinese Women. Chiefari E, editor. J Diabetes Res. 2021 Nov 24;2021:1–9.
6. S R. A study of body mass index in pregnancy and its correlation with maternal and perinatal outcome. New Indian J OBGYN. 2019 Jan;5(2):120–5.
7. Patel A, Prakash AA, Das PK, Gupta S, Pusdekar YV, Hibberd PL. Maternal anemia and underweight as determinants of pregnancy outcomes: cohort study in eastern rural Maharashtra, India. BMJ Open. 2018 Aug 8;8(8):e021623.
8. Chae S, Kayembe PK, Philbin J, Mabika C, Bankole A. The incidence of induced abortion in Kinshasa, Democratic Republic of Congo, 2016. Dangal G, editor. PLoS One. 2017 Oct 2;12(10):e0184389.
9. Mercado A, Marquez B, Abrams B, Phipps MG, Wing RR, Phelan S. Where Do Women Get Advice About Weight, Eating, and Physical Activity During Pregnancy? J Women's Heal. 2017 Sep;26(9):951–6.
10. Goldstein RF, Abell SK, Ranasinha S, Misso M, Boyle JA, Black MH, et al. Association of Gestational Weight Gain With Maternal and Infant Outcomes. JAMA. 2017 Jun 6;317(21):2207.
11. Hauspurg A, Countouris ME, Jeyabalan A, Hubel CA, Roberts JM, Schwarz EB, et al. Risk of hypertension and abnormal biomarkers in the first year postpartum associated with hypertensive disorders of

pregnancy among overweight and obese women. Pregnancy Hypertens. 2019 Jan;15:1–6.

12. Shen J, Zhang Z, Chen K, Lu M, Qian Q, Liu P, et al. Prepregnancy obesity status and risks on pregnancy outcomes in Shanghai. Medicine (Baltimore). 2018 Oct;97(40):e12670.

13. Soltani H, Lipoeto NI, Fair FJ, Kilner K, Yusrawati Y. Pre-pregnancy body mass index and gestational weight gain and their effects on pregnancy and birth outcomes: a cohort study in West Sumatra, Indonesia. BMC Womens Health. 2017 Dec 9;17(1):102.

14. Vernini JM, Moreli JB, Magalhães CG, Costa RAA, Rudge MVC, Calderon IMP. Maternal and fetal outcomes in pregnancies complicated by overweight and obesity. Reprod Health. 2016 Dec 27;13(1):100.

15. Poorolajal J, Jenabi E. The association between body mass index and preeclampsia: a meta-analysis. J Matern Neonatal Med. 2016 Nov 16;29(22):3670–6.

16. Xiong C, Zhou A, Cao Z, Zhang Y, Qiu L, Yao C, et al. Association of pre-pregnancy body mass index, gestational weight gain with cesarean section in term deliveries of China. Sci Rep. 2016 Dec 22;6(1):37168.

17. Carlhäll S, Källén K, Blomberg M. The effect of maternal body mass index on duration of induced labor. Acta Obstet Gynecol Scand. 2020 May 23;99(5):669–78.

18. Butwick AJ, Abreo A, Bateman BT, Lee HC, El-Sayed YY, Stephansson O, et al. Effect of Maternal Body Mass Index on Postpartum Hemorrhage. Anesthesiology. 2018 Apr 1;128(4):774–83.

19. Mocking M, Savitri AI, Uiterwaal CSPM, Amelia D, Antwi E, Baharuddin M, et al. Does body mass index early in pregnancy influence the risk of maternal anaemia? An observational study in Indonesian and Ghanaian women. BMC Public Health. 2018 Dec 13;18(1):873.

20. Zhang B, Yang S, Yang R, Wang J, Liang S, Hu R, et al. Maternal Prepregnancy Body Mass Index and Small for Gestational Age Births in Chinese Women. Paediatr Perinat Epidemiol. 2016 Nov;30(6):550–4.

21. Dai R, He X-J, Hu C-L. Maternal pre-pregnancy obesity and the risk of macrosomia: a meta-analysis. Arch Gynecol Obstet. 2018 Jan 28;297(1):139–45.

22. Gaudet L, Ferraro ZM, Wen SW, Walker M. Maternal Obesity and Occurrence of Fetal Macrosomia: A Systematic Review and Meta-Analysis. Biomed Res Int. 2014;2014:1–22.