ORIGINAL ARTICLE

RELATIONSHIP OF MATERNAL MORBIDITY AND MORTALITY TO HIGH BODY MASS INDEX (BMI) PREGNANCIES IN PAKISTAN

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Background: The average BMI is shifting upwards even in low-resource countries like Pakistan causing an increase in pregnancy-related complications. This study was planned to elaborate the association of maternal morbidity and mortality during pregnancy and puerperium with high BMI. **Methods:** A descriptive longitudinal study was performed in the Obstetrics and Gynaecology Unit 2 of D. Ruth K. M. Pfau Civil Hospital, Karachi, Pakistan from 1st August 2022 to 31st January 2023. Women delivering in Obstetric Unit 2 having a 1st-trimester record of weight were included. Demographic data, antenatal, intrapartum and postpartum complications noted. Participants were further stratified into 2 groups based on BMI, i.e., overweight (25.0-29.9) and obese (30.0 or more) and demographics and clinical characteristics compared. Univariate and multivariate logistic regression analysis was done. Data was entered and analyzed on SPSS version 21. **Result:** The frequency is calculated to be 15.7%. The observed complications included pre-eclampsia 16.7%, PIH 13%, eclampsia 7%, GDM 18.9%, induction of labour 19.5%, PPH in 15.2% and infected caesarean wound in 19.2% of participants. The caesarean section was the predominant mode of delivery in 55.7%. A significant relationship was found with advancing maternal age, DM/ GDM, hypertension, Pre-eclampsia, IOL, caesarean section, PPH and wound infection. The univariate and multivariate logistic regression models also showed two times higher odd in obese groups as compared to overweight groups. **Conclusion:** Our study underscores a strong association between maternal obesity in early pregnancy and several threatening complications during pregnancy, delivery, and the postpartum period.

Keywords: Obesity; Maternal morbidity; Mortality; BMI

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INTRODUCTION

The global pervasiveness of obesity in reproductive age women has risen dramatically. Over recent years overweight and obesity in pre-conception period has drawn more attention as a major determinant of pregnancy outcomes for both maternal and child health. Overweight and obesity are defined as abnormal or excessive fat accumulation that presents a health risk. A body mass index (BMI) over 25 is considered overweight and over 30 is obese.[1] Worldwide the prevalence of obesity has risen by three times over the last few decades with 39% of adults being overweight and 13% obese[1]. It has been postulated for many decades that only the developed world faces obesity, but concerning issues from underdeveloped countries now have been reported. The prevalence of overweight and obesity is higher in women as compared to men.[1] With changes in eating habits and sedentary lifestyle even in Pakistan 24% of women are overweight and 6.3 % are obese.[2]

Body mass index (BMI) is a simple index of weight-for-height that is commonly used to classify overweight and obesity in adults. It can be calculated by taking weight in kilograms divided by the square of height in meters (kg/m^2). BMI provides the most useful population-level measure of overweight and obesity. During pregnancy, BMI is computed using pre-pregnancy weight. If this is unknown, the first-trimester weight in the prenatal clinic can be used instead as little weight is gained during this period.[3] It has been well reported that maternal obesity is associated with an increased risk of gestational diabetes, pre-eclampsia, eclampsia, induction of labour[4], postpartum haemorrhage, instrumental delivery and caesarean section.[5] The recent confidential enquiry into maternal deaths revealed a high chance of Intensive Care admissions in mothers with a BMI of $35kg/m^2$ or more.[6] Nearly a quarter (23%) of the women who died were obese and a further 29% were overweight.[6] Women planning a pregnancy should receive pre-conceptional advice for weight optimization and counselled for related complications.

Several researches have been conducted throughout the world to determine the adverse effects of maternal obesity on maternal health.

Because established recommendations on gestational weight gain are inconsistent and vary according to ethnicity, environmental conditions and many other factors we aimed this study to analyze the relevance between baseline BMI and pregnancy outcome in the Pakistani population. This will benefit women of childbearing age and help contribute local data.

MATERIAL AND METHODS

This descriptive study was performed in the Obstetrics and Gynaecology Unit II of DRKMP Civil Hospital Karachi and Dow University of Health Sciences, Pakistan, from 1st September 2022 to 28th February 2023 over six months. Approval from the institutional review board (IRB) was taken. Women admitted from outpatient and emergency department and delivering in our unit were recruited. Women with singleton pregnancies carrying 1st-trimester antenatal records and BMI of 25 or above and delivering at term were included. Patients with twin pregnancies, who did not consent, did not carry 1st trimester antenatal record or pre-pregnancy weight and who were lost to follow-up were excluded. The patients were characterized according to BMI, as recommended by the Institute of Medicine (IOM 2009) guidelines as overweight from 25 to 29.9, class 1 obese from 30 to 34.9, class 2 from 35 to 39.9 and class 3 from 40 and above. Informed consent was taken at the time of admission. A proforma was designed which included demographic details, BMI at 1st booking visit, antepartum, intrapartum and postpartum complications i.e. hypertensive disorders, gestational diabetes, abruptio placentae, induction of labour, instrumental vaginal delivery, caesarean section, wound infection, postpartum haemorrhage and death. All patients with spontaneous vaginal delivery were kept under observation for one day and those who had undergone caesarean section for three days to observe early postpartum complications and were followed after one and six weeks to record any late complications. The women were further divided into two groups based on BMI, i.e., overweight (BMI 25.0-29.9) and obese (30.0 or more). A comparison was made between these groups based on demographics characters, ante/postnatal complications, labour interventions and maternal morbidity and mortality.

Analysis was done on statistical analyses using SPSS 21.0 software (SPSS Inc., Chicago, Illinois) Categorical variables were summarized using percentages and frequencies, while continuous variables were represented by means and standard deviations. We utilized the Chi-square test or Fisher's exact test for categorical variables. To determine the factors associated with the risk of obesity, we initially conducted univariate binary logistic regression analysis for all subjects. Elements with a p-value less than 0.1 were then included in the multivariate regression model. This allowed us to calculate Odds ratios (OR) and their 95% confidence intervals (CI). For statistical significance, we considered a *p*-value less than 0.05

RESULTS

A total of 323 women were enrolled in our study out of 2047 total deliveries during six months. There were 196 overweight and 127 obese hence frequency is calculated to be 9.5% and 6.2% respectively. The mean age was 28±5 (range18–45) years and two-thirds belonged to the 26–35 age group. About three-fourths were multigravida. The major ethnic groups were Muhajir 135 (41.8%), Pathan 65 (20.1%), Sindhi 31 (9.6%), Baloch 29(9%) and the rest were of other different ethnicities. There were 196 (60.7%) overweight, 19(5.9%) class 1, 7(2.2%) class 2 and 127 (39.3%) class 3 obese participants. Table 1 compares overweight vs. obese according to different demographics and clinical characteristics. Patients belonging to the older age group, i.e., >25 years tend to have raised BMI and showed a significantly higher percentage of obesity as compared to young. Hypertensive disease of pregnancy (PIH/ pre-eclampsia) and Gestational diabetes were the most common antenatal comorbidities while caesarean wound infection was identified as the most common postnatal complication. Induction of labour had to be carried out in one-fifth of patients for various obstetric reasons and more than half underwent caesarean section mostly due to previous history of caesarean section. Unfortunately, one case of maternal mortality was also documented due to abruptio placentae. Pre-existing diabetes & HTN, pre-eclampsia, GDM, caesarean delivery, PPH and wound infection were significantly found more in the obese group as compared to the overweight indicating a direct relationship between BMI and pregnancy-related complications. The remaining variables, including thyroid disease, thalassemia, PIH, instrumental vaginal delivery and hepatitis had insignificant relationships as shown in Table 1. The uni and multivariate models were applied to see the significant impact of obese vs. overweight groups among different demographic variables and other risk factors as displayed in Table 2.

Table-1: Compares overweight vs. obese according to different demographics and clinical characteristics.

	Total	BMI		*p*-value
		Overweight	Obese	
Total	**323**	**196**	**127**	**-**
Age Groups				
18-25 years	72 [22.3%]	54 [27.6%]	18 [14.2%]	
26-35 years	233 [72.1%]	135 [68.9%]	98 [77.2%]	0.005*
36-45 years	18 [5.6%]	7 [3.6%]	11 [8.7%]	
Parity				
Primary Gravid	76 [23.5%]	48 [24.5%]	28 [22%]	
Multi Gravid	220 [68.1%]	143 [73%]	77 [60.6%]	<0.001*
Grand Multi Gravid	27 [8.4%]	5 [2.6%]	22 [17.3%]	
Comorbid				
None	286 [88.5%]	185 [94.4%]	101 [79.5%]	
Diabetes	11 [3.4%]	2 [1%]	9 [7.1%]	0.003*
Hypertension	16 [5%]	4 [2%]	12 [9.4%]	0.003*
Thyroid	4 [1.2%]	3 [1.5%]	1 [0.8%]	0.555
Thalassemia	1 [0.3%]	1 [0.5%]	0 [0%]	0.420
Cardiac disease	1 [0.3%]	0 [0%]	1 [0.8%]	0.213
Hepatitis	3 [0.9%]	1 [0.5%]	2 [1.6%]	0.330
HIV	1 [0.3%]	0 [0%]	1 [0.8%]	0.213
Complications				
Pregnancy-induced hypertension (PIH)	42 [13%]	21 [10.7%]	21 [16.5%]	0.129
preeclampsia	54 [16.7%]	26 [13.3%]	28 [22%]	0.039*
Abruption	2 [0.6%]	0 [0%]	2 [1.6%]	0.078
Induction of labour (IOL)	63 [19.5%]	31 [15.8%]	32 [25.2%]	0.038*
caesarean	180 [55.7%]	84 [42.9%]	96 [75.6%]	<0.001*
Instrumental vaginal delivery (IVD)	2 [0.6%]	2 [1%]	0 [0%]	0.253
Postpartum haemorrhage (PPH)	49 [15.2%]	19 [9.7%]	30 [23.6%]	<0.001*
Wound infection	62 [19.2%]	17 [8.7%]	45 [35.4%]	<0.001*
Gestational Diabetes Mellitus	61 [18.9%]	28 [14.3%]	33 [26%]	0.009*
mortality	1 [0.3%]	0 [0%]	1 [0.8%]	0.213
Previous Caesarean Section	122 [37.8%]	59 [30.1%]	63 [49.6%]	<0.001*

Table-2: Univariate and multivariate logistic regression analysis for Obese women

Factors	Univariate		Multivariate - Initial level		Multivariate - Final level	
	OR [95% CI]	P-value	OR [95% CI]	P-value	OR [95% CI]	P-value
Age ≥ 25 years	2.38 [1.19 -4.75]	0.014*	2.39 [1.01 -5.61]	0.046*	2.33 [1 -5.42]	0.05
Diabetes Mellitus (DM) (Yes)	7.4 [1.57 -34.83]	0.011*	6.31 [1.1 -36.08]	0.038*	5.86 [1.06 -32.29]	0.042*
Hypertension (HTN) (Yes)	5.01 [1.58 -15.9]	0.006*	3.88 [1.09 -13.78]	0.036*	4 [1.14 -14.08]	0.031*
Multi gravid	1.86 [1.18 -2.94]	0.008*	1.95 [1.1 -3.46]	0.022*	1.96 [1.13 -3.41]	0.017*
Pregnancy Induced Hypertension (PIH) (Yes)	2.23 [1.11 -4.46]	0.023*	2.97 [1.29 -6.84]	0.01*	2.72 [1.2 -6.17]	0.017*
Pre-eclampsia (Yes)	1.85 [1.03 -3.33]	0.041*	1.91 [0.9 -4.07]	0.093	-----	-----
Induction of labour (IOL) (Yes)	1.79 [1.03 -3.12]	0.039*	2.15 [1.08 -4.27]	0.028*	2.19 [1.12 -4.29]	0.022*
Caesarean Section (Yes)	4.13 [2.52 -6.77]	<0.001*	2.37 [1.21 -4.63]	0.012*	2.85 [1.59 -5.11]	<0.001*
Postpartum Haemorrhage (Yes)	2.88 [1.54 -5.39]	0.001*	2.83 [1.36 -5.89]	0.006*	2.63 [1.27 -5.43]	0.009*
Infection (Yes)	5.78 [3.12 -10.7]	<0.001*	3.63 [1.77 -7.44]	<0.001*	3.58 [1.76 -7.29]	<0.001*
Gestation Diabetes Mellitus (Yes)	2.11 [1.2 -3.7]	0.01*	2.02 [1.02 -3.99]	0.044*	1.95 [0.99 -3.82]	0.053
Previous Caesarean Section (Yes)	2.29 [1.44 -3.63]	<0.001*	1.23 [0.65 -2.34]	0.529	-----	-----
Binary Logistic regression: Dependent Variable: Obese vs Overweight**+. C.I: Confidence interval; OR: Odds Ratio						

DISCUSSION

Over the last few decades, obesity has grown as an epidemic and an important public health concern. Despite, increasing awareness of the consequences of obesity in the population only a few realize the threats it poses to the health of the mother and foetus. One-third of expectant mothers are observed to be overweight or obese.[7] According to RCOG, all prenatal patients should receive counselling about weight gain, diet, and exercise.[8] Obesity affects several abnormal metabolic and physiologic processes in embryonic and placental development in early pregnancy.[9] In addition, the children of mothers with a raised pre-conceptional BMI are at increased risk for obesity and cardiovascular dysfunction in later life.[10] We noted an increased incidence of obesity with advancing maternal age as stated by other previous studies.[11] The mean age closely approximated the one reported by a previous study from Pakistan by Farhatulain.[12] Our study also detected a higher incidence of obesity in multiparous women. The production of cytokines and adipokines by adipose tissue is linked to increased inflammation, insulin resistance and oxidative stress which predispose to the

development of gestational diabetes and hypertension. Our study results were also consistent with this observation.[5,13] We also reported the increased risk of preeclampsia as reported by other studies globally[5,14,15] as well as locally[12,15]. The increasing prevalence is owing to delayed motherhood, higher rates of obesity, environmental factors and a sedentary lifestyle. These pregnancies were more likely to be induced into labour mostly due to preexisting medical problems and post-dates which is to other studies.[15,16] Difficulties in normal delivery and increased rates of instrumental vaginal delivery had also been reported in the literature.[17] We observed more caesarean deliveries compared to vaginal ones which is supported by other studies from Pakistan reporting a higher risk.[12,18] The probable reasons related to this fact are a high number of referrals with pregnancy complications, a greater number of elective repeat caesareans, failure of induction of labour and a higher incidence of macrosomic babies in these women. Our study does not detect any difference in induction of labour and caesarean section rates among overweight and obese groups which is in contrast to another study.[19] We also did not encounter difficulty in normal vaginal deliveries as opposed to Nnoli *et al.*[17] Current studies found an increased incidence of maternal postnatal problems such as postpartum haemorrhage and wound infections which is consistent with other studies.[5,19,20] This has been postulated that inefficient uterine contractility leading to uterine atony along with disruption of hormonal balance play an important role in the development of PPH. Although obesity is associated with higher rates of deep venous thrombosis most of the studies reported from various parts of the world suggest a direct relationship between the two, which is in contrast to our findings[20]. No case of ante or postnatal thromboembolic event was noted in our patients probably due to adequate hydration, early mobilization, application of graduated stockings in all postnatal patients and initiation of thromboprophylaxis in carefully selected patients. Likewise, we also did not report third- or fourth-degree perineal tears as observed in a few previous studies.[12] Our study reported one case of maternal mortality owing to abruptio placentae. Accumulating evidence suggests that obesity is an increasing concern in pregnancy and is associated with morbidity, mortality and significantly higher cost of treatment.

Therefore, it is of greater significance to identify high-risk patients with fetomaternal complications. Active strategies for weight reduction, lifestyle modifications and regular follow-up after delivery are required to manage these women. Strict anti-obesity measures need to be observed in these women to prevent the consequences of obesity in reproductive years. The positive role of healthcare providers is also emphasising the importance of monitoring gestational weight gain and encouraging self-control. Women most likely follow advice from a physician as compared to family, friends or social media.[21] This can be facilitated through patient education, antenatal classes and information leaflets in an attempt to reduce the risk of excessive weight gain. The great strength of this study is the prospective nature of the study observing participants till after delivery closely for the development of any complications. Second, we included only those patients who had documented pre-pregnancy/first-trimester weights and did not rely on self-reported patient-provided information eliminating recall bias. Last but not least is generalizability as all of the participants were of Pakistani origin and results can be generalized to the overweight pregnant population. One of the limitations of our study is that it was conducted in a tertiary care and not population-based. The sample size was also small necessitating large-scale nationwide studies. The results may have been poorly applied to other ethnic groups having different metabolic health patterns and pregnancy risks.

CONCLUSION

Increased BMI was found to have higher chances of developing a myriad of complications anytime during pregnancy and puerperium. Careful preconception counselling to reduce weight is essential before embarking upon pregnancy. Furthermore, steps to optimize weight gain during pregnancy, nutritional and behavioural modification, exercise and referral to a dietician should also be emphasized. Further prospective studies are needed to develop a comprehensive, affordable and effective program on the community level for overweight/obese women and their care providers.

AUTHORS' CONTRIBUTION

Asra: Conceived, designed and wrote the content, and is responsible for the integrity of the research, data collection and literature search. SA: Reviewed & corrected manuscript and interpreted results. RJ: Review and final approval of the manuscript.

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