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Impact of Maternal Obesity on Pregnancy Outcomes: A Hospital-Based Study

Talat Parveen[1*], Quratulain[1], Saba Yasmin Usmani[2], Samina[1], Sadaf Un Nisa[1] and Nergis Taj[2]

[1]Department of Obstetrics and Gynaecology, Bahawal Victoria Hospital, Bahawalpur, Pakistan
[2]Department of Obstetrics and Gynaecology, Sadiq Abbasi Hospital, Quaid e Azam Medical College, Bahawalpur, Pakistan

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***Corresponding Author:**
Talat Parveen
Department of Obstetrics and Gynaecology, Bahawal Victoria Hospital, Bahawalpur, Pakistan
talatjalal1964@gmail.com

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ABSTRACT

Obesity among pregnant women has emerged as a major global health issue and is closely associated with unfavorable outcomes for both the mother and the newborn. **Objectives:** To assess how maternal obesity influences pregnancy-related outcomes in both mothers and their newborns at a tertiary care facility. **Methods:** This hospital-based descriptive cross-sectional research was carried out in the Obstetrics and Gynaecology Department of Bahawal Victoria Hospital, Bahawalpur, during the period from 23-04-2024 to 22-10-2024. A total of 153 pregnant women with obesity (BMI ≥30 kg/m^2) and singleton pregnancies beyond 28 weeks of gestation were selected through non-probability consecutive sampling. Women with multiple gestations, fetal anomalies, or chronic illnesses unrelated to obesity were excluded. Data on maternal demographics, obstetric history, and outcomes were collected using a structured proforma. The evaluated outcomes comprised gestational diabetes mellitus (GDM), pregnancy-induced hypertension (PIH), type of delivery, preterm labor, postpartum hemorrhage (PPH), stillbirth, macrosomia, Apgar scores, neonatal intensive care unit (NICU) admissions, and congenital abnormalities. Data analysis was performed using SPSS-26, with a p-value less than 0.05 considered statistically significant. **Results:** The mean maternal age was 29.99 ± 6.26 years. GDM occurred in 26.8% and PIH in 15.0% of participants. Cesarean delivery was performed in 44.4%, and macrosomia was observed in 23.5% of neonates. Significant associations were noted between parity and PIH (p=0.024), ANC visits and NICU admission (p=0.005), and chronic illness with congenital anomalies (p=0.041). **Conclusions:** Maternal obesity is associated with increased risks of metabolic, obstetric, and neonatal complications.

INTRODUCTION

Rising rates of obesity among women of childbearing age have made maternal obesity a growing global health concern, with considerable implications for both maternal and neonatal well-being. As more pregnancies occur in the context of elevated maternal weight, complications linked to obesity have become increasingly common. A pre-pregnancy body mass index (BMI) of 30 kg/m^2 or higher is used to define maternal obesity, which has been correlated with numerous unfavorable health outcomes for both the mother and the developing fetus [1]. Pregnant women with obesity are more prone to developing complications such as gestational diabetes mellitus (GDM), hypertensive disorders, and preeclampsia [2, 3]. These maternal conditions contribute to an increased likelihood of cesarean section, early delivery, and greater maternal health risks [4]. One hospital-based cohort study documented notably higher incidences of GDM (23.7%) and hypertensive disorders (18.3%) among obese patients when compared with women of normal weight [5]. Such evidence supports the broader consensus that excess maternal weight amplifies metabolic disturbances during pregnancy [6]. In addition to maternal complications, obesity also imposes substantial risks on fetal health. Adverse neonatal outcomes such as macrosomia, low Apgar scores, stillbirth, and NICU admissions are frequently observed in pregnancies complicated by

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obesity [7, 8]. For instance, infants born to obese mothers are more likely to require neonatal resuscitation and intensive care, and they face a higher risk of metabolic disorders later in life [9]. Placental pathology studies also confirm abnormal changes such as increased chorangiosis and infarction in obese pregnancies, further linking maternal adiposity to poor fetal outcomes [10]. At the immunological level, maternal obesity fosters a pro-inflammatory state that disrupts the normal immunometabolic adaptations required for a successful pregnancy [11]. Obese women tend to exhibit elevated levels of IL-6, leptin, and MCP-1, contributing to chronic low-grade inflammation. This environment may impair placental function and fetal development by shifting immune responses from Th2-dominant to Th17-biased profiles, thereby increasing the risk of miscarriage and preeclampsia [11]. Moreover, the consequences of maternal obesity are not limited to the perinatal period. Longitudinal studies suggest that children born to obese mothers are more susceptible to obesity, insulin resistance, and neurodevelopmental disorders later in life, perpetuating a cycle of poor health across generations [12]. Given these extensive and multifactorial impacts, early identification and intervention are critical. Clinical management strategies should include preconception counseling, weight optimization, and tailored antenatal care to mitigate obesity-related risks.

This study aimed to explore the specific impact of maternal obesity on pregnancy outcomes, thereby contributing to evidence-based practices and policy formulation in maternal health care.

METHODS

A descriptive cross-sectional study was carried out in the Obstetrics and Gynaecology Department of Bahawal Victoria Hospital, Bahawalpur, spanning a duration of six months from 23-04-2024 to 22-10-2024. Ethical approval for the study was obtained from the Institutional Ethical Review Committee (Approval No.2386/DME/QAMC Bahawalpur), and written informed consent was secured from all participants. Patient confidentiality was maintained throughout the study. The primary aim was to assess both maternal and neonatal outcomes in women with obesity during pregnancy. The sample size was calculated using Open Epi version 3.01, referring to the findings of Neal et al. who reported a pregnancy-induced hypertension (PIH) rate of 11.2% among obese expectant mothers. With a 95% confidence level, a 5% margin of error, and a power of 80%, the required sample size was estimated to be 153. This ensured adequate power to detect significant associations between maternal obesity and adverse pregnancy outcomes [13]. A non-probability consecutive sampling technique was used. All pregnant women presenting during the study period who fulfilled the inclusion criteria were enrolled until the desired sample size was reached. Inclusion criteria were pregnant women with a BMI of 30 kg/m^2 or more, singleton pregnancy, gestational age of 28 weeks or more, and willingness to provide informed consent. Women with multiple gestations, known fetal anomalies diagnosed on ultrasound, or pre-existing chronic illnesses unrelated to obesity, such as type 1 diabetes, chronic hypertension, thyroid disorders, or renal disease, and those with incomplete records were excluded. Data were collected using a structured proforma that was developed after reviewing relevant literature and in consultation with subject experts. The proforma was pretested on 10 cases (not included in the final analysis) to ensure clarity and comprehensiveness. Gestational diabetes mellitus (GDM) was diagnosed according to WHO/ADA criteria based on oral glucose tolerance testing, while pregnancy-induced hypertension (PIH) was defined as new-onset hypertension (≥140/90 mmHg) after 20 weeks of gestation, in line with ACOG guidelines. Other maternal and neonatal outcomes were recorded from hospital records and cross-verified by the attending obstetrician to enhance reliability. Maternal characteristics recorded included age, parity, gestational age at delivery, number of antenatal visits, history of chronic illness, and socioeconomic status. Maternal outcomes studied were gestational diabetes mellitus, pregnancy-induced hypertension or preeclampsia, mode of delivery, preterm delivery, postpartum hemorrhage, and stillbirth. Fetal and neonatal outcomes included macrosomia, Apgar score at 5 minutes, NICU admission, and presence of congenital anomalies. Families with an income of ≤30,000 PKR/month were categorized as low, those with 30,001–70,000 PKR/month as middle, and those earning >70,000 PKR/month as high socioeconomic status. Data were compiled and analyzed using SPSS version 26.0. For continuous variables such as maternal age, gestational age, and neonatal birth weight, results were presented as mean ± standard deviation. Categorical variables, including parity, mode of delivery, and various outcomes, were described using frequencies and percentages. To identify possible effect modifiers, stratification was applied across variables such as maternal age, parity, number of antenatal visits, existing chronic illnesses, and socioeconomic status. Associations between maternal factors and pregnancy outcomes were examined using the chi-square test or Fisher's exact test for categorical data, and the independent t-test or Mann–Whitney U test for continuous data, depending on normality. A p-value below 0.05 was regarded as statistically significant.

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RESULTS

The study comprised 153 obese pregnant women. The mean maternal age was 29.99 ± 6.26 years. The average gestational age at delivery was 38.04 ± 1.51 weeks, and the mean number of antenatal care (ANC) visits was 4.14 ± 1.48. Among the participants, 74 (48.4%) were primigravida and 79 (51.6%) were multigravida. Chronic medical illness was reported in 33 (21.6%) women, while the remaining 120 (78.4%) had no comorbidities. Regarding socioeconomic status, 52 (34.0%) belonged to the low-income group, 72 (47.1%) to the middle-income group, and 29 (19.0%) to the high-income group. In terms of maternal outcomes, gestational diabetes mellitus (GDM) was observed in 41 (26.8%) participants, and pregnancy-induced hypertension (PIH) occurred in 23 (15.0%). Cesarean section was performed in 68 (44.4%) cases, while 85 (55.6%) underwent vaginal delivery. Preterm birth was documented in 17 (11.1%) women, postpartum hemorrhage in 16 (10.5%), and stillbirth in 6 (3.9%) cases. Regarding fetal and neonatal outcomes, macrosomia was identified in 36 (23.5%) newborns. NICU admission was required for 19 (12.4%) neonates, Low Apgar scores (<7 at 5 minutes) were recorded in 138 (90.2%) of neonates, which is substantially higher than rates reported in the general obstetric population (typically 1–10% at 5 minutes in large-scale studies). This finding underscores the markedly increased risk of neonatal compromise associated with maternal obesity and congenital anomalies were present in 10 (6.5%) neonates (Table 1).

Table 1: Frequency Distribution of Maternal and Fetal Variables (n=153)

Variables	Category	n (%)
Parity	Primigravida	74 (48.4%)
	Multigravida	79 (51.6%)
Chronic Illness	No	120 (78.4%)
	Yes	33 (21.6%)
Socioeconomic Status*	Low	52 (34.0%)
	Middle	72 (47.1%)
	High	29 (19.0%)
Maternal Outcomes		
GDM	No	112 (73.2%)
	Yes	41 (26.8%)
PIH	No	130 (85.0%)
	Yes	23 (15.0%)
Mode of Delivery	Vaginal	85 (55.6%)
	Cesarean	68 (44.4%)
Preterm Delivery	No	136 (88.9%)
	Yes	17 (11.1%)
Postpartum Hemorrhage	No	137 (89.5%)
	Yes	16 (10.5%)
Fetal/Neonatal Outcomes		
Stillbirth	No	147 (96.1%)
	Yes	6 (3.9%)
Macrosomia	No	117 (76.5%)
	Yes	36 (23.5%)
NICU Admission	No	134 (87.6%)
	Yes	19 (12.4%)
Apgar Score (5 min)	Low (<7)	138 (90.2%)
	Normal (≥7)	15 (9.8%)
Congenital Anomalies	No	143 (93.5%)
	Yes	10 (6.5%)

*Socioeconomic status was classified based on monthly household income: Low (≤30,000 PKR), Middle (30,001–70,000 PKR), High (>70,000 PKR).

Subgroup analysis revealed a statistically significant association between parity and PIH, with 9 (12.2%) cases among primigravidas and 14 (17.7%) among multigravidas (p=0.024). GDM was more prevalent in women with chronic illness (25; 75.8%) compared to those without (16; 13.3%) (p = 0.063). Cesarean deliveries were more frequent in women aged ≥30 years (40; 63.5%) versus those aged <30 years (28; 31.1%) (p=0.072). No significant association was noted between parity and macrosomia (p=0.119) (Table 2).

Table 2: Association of Independent Variables with Maternal Outcomes among Obese Mothers (n=153)

Outcomes	Independent Variable	Category	Yes, n (%)	No, n (%)	p-Value
PIH	Parity	Primigravida (n=74)	9 (12.2%)	65 (87.8%)	0.024
		Multigravida (n=79)	14 (17.7%)	65 (82.3%)	
GDM	Chronic Illness	No (n=120)	16 (13.3%)	104 (86.7%)	0.063
		Yes (n=33)	25 (75.8%)	8 (24.2%)	
Cesarean Delivery	Age Group	<30 years (n=90)	28 (31.1%)	62 (68.9%)	0.072
		≥30 years (n=63)	40 (63.5%)	23 (36.5%)	
Macrosomia	Parity	Primigravida (n=74)	18 (24.3%)	56 (75.7%)	0.119
		Multigravida (n=79)	18 (22.8%)	61 (77.2%)	

Preterm birth showed no significant difference by socioeconomic status, occurring in 5 (9.6%) women from the low-income group and 12 (11.9%) from the middle/high-income group (p=0.385). NICU admission was significantly more common in neonates of mothers who had ≥4 ANC visits (15; 16.1%) compared to those with <4 visits (4; 6.7%) (p=0.005). A statistically significant association was also observed between maternal chronic illness and congenital anomalies, which were present in 7 (21.2%) neonates of affected mothers versus 3 (2.5%) of those without comorbidities (p=0.041) (Table 3).

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Table 3: Association of Independent Variables with Fetal Outcomes among Obese Mothers (n=153)

Outcomes	Independent Variable	Category	Yes, n (%)	No, n (%)	p-Value
Preterm Delivery	Socioeconomic Status	Low (n=52)	5 (9.6%)	47 (90.4%)	0.385
		Middle/High (n=101)	12 (11.9%)	89 (88.1%)	
NICU Admission	ANC Visits	<4 visits (n=60)	4 (6.7%)	56 (93.3%)	0.005
		≥4 visits (n=93)	15 (16.1%)	78 (83.9%)	
Congenital Anomalies	ChronicIllness	No (n=120)	3 (2.5%)	117 (97.5%)	0.041
		Yes (n=33)	7 (21.2%)	26 (78.8%)	

DISCUSSIONS

The findings of our study affirm the well-documented association between maternal obesity and adverse pregnancy outcomes. In our cohort of obese pregnant women, the prevalence of gestational diabetes mellitus (26.8%) and pregnancy-induced hypertension (15.0%) was comparable to global data, underscoring obesity as an independent risk factor for metabolic complications [13]. Cesarean section was required in 44.4% of cases, consistent with prior reports linking obesity with increased surgical deliveries [14, 15]. Macrosomia was observed in 23.5% of neonates, in line with previous evidence showing maternal obesity as a major driver of excessive birth weight, even in the absence of gestational diabetes [16, 17]. NICU admissions were reported in 12.4% of neonates, comparable with literature describing higher morbidity in infants of obese mothers [18, 19]. A particularly striking finding of our study was the disproportionately high rate of low Apgar scores at 5 minutes (90.2%), far exceeding the 1–10% generally reported in population-based cohorts. This highlights the significant compromise in neonatal adaptation associated with maternal obesity. Congenital anomalies were identified in 6.5% of neonates, with a significant association in mothers with chronic illnesses. This finding aligns with previous reports that maternal obesity increases the risk of structural malformations, particularly neural tube defects, congenital heart disease, and orofacial clefts. Several mechanisms may contribute, including maternal hyperglycemia, altered folate metabolism, oxidative stress, and chronic low-grade inflammation that disrupts normal embryogenesis. Placental dysfunction in obese pregnancies, characterized by abnormal angiogenesis and increased inflammatory cytokines, may further impair fetal development. Neal et al. similarly reported higher rates of congenital malformations in class III obesity, independent of maternal diabetes [13]. Other studies have confirmed that obesity compounds risks in women with coexisting chronic conditions such as diabetes and hypertension, which may explain the stronger association in our cohort [20-22]. Other maternal complications included postpartum hemorrhage (10.5%); although consistent with international evidence that obesity predisposes to uterine atony, operative delivery, and prolonged labor, the limited number of cases in our study did not allow detailed subgroup analysis. This limitation has been acknowledged, and larger studies are needed to further explore the association between obesity and PPH. Preterm birth (11.1%) was also observed, aligning with prior data linking maternal obesity to increased risk of adverse obstetric outcomes [21]. Our study also provides insight into modifying factors. Parity was significantly associated with PIH, echoing systematic reviews that identify maternal age and parity as important risk modifiers in obese women [18]. Furthermore, socioeconomic disparities emerged, with low- to middle-income women disproportionately affected, consistent with global data that link obesity and adverse perinatal outcomes to lower socioeconomic strata [23]. Lastly, our results are aligned with longitudinal studies showing that both prepregnancy obesity and excessive gestational weight gain increase risks across successive pregnancies, reinforcing the need for early counseling and weight optimization before conception [24]. Collectively, these findings confirm obesity as a major, yet modifiable, public health risk factor while also highlighting unique aspects of our population, such as markedly elevated rates of low Apgar scores and SES-related differences in outcome

CONCLUSIONS

In conclusion, our study reinforces that maternal obesity significantly increases the risk of adverse pregnancy and neonatal outcomes, including gestational diabetes, pregnancy-induced hypertension, cesarean delivery, macrosomia, and NICU admissions. These findings are consistent with published literature highlighting the independent impact of obesity on both maternal and fetal health, even in the absence of other comorbidities. The significant associations observed in our cohort, particularly the influence of parity, chronic illness, and antenatal care on outcomes, underscore the multifactorial nature of obesity-related risks. These results emphasize the need for early identification, preconception counseling, and targeted interventions to optimize weight before and during pregnancy, thereby reducing the burden of obesity-associated complications and improving maternal and neonatal health outcomes.

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Authors Contribution

Conceptualization: TP
Methodology: TP, Q
Formal analysis: TP
Writing review and editing: SYU, S, SUN, NJ

All authors have read and agreed to the published version of the manuscript

Conflicts of Interest

All the authors declare no conflict of interest.

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