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Original Article

Effect of Maternal Obesity on Pregnancy Outcomes and Metabolic Consequences

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ABSTRACT

Background: Conversely, mother's obesity is a complex condition with marked application for the health of both mothers and infants. This study looks to examine the impact of mother's obesity on pregnancy outcomes and the associated metabolic consequences. Consistent with other studies [9], our results corroborated the marked correlations between mother's obesity and worse pregnancy outcomes. Obese pregnant female have a higher likelihood of cesarean delivery and an elevated risk of gestational diabetes mellitus (GDM), hypertensive disorders of pregnancy (HDP), and other pregnancy-related problems compared to those of normal weight [10]. The findings underscore the need of addressing mother's obesity as a marked public health condition to enhance health outcomes for both mothers and infants.

Objective: To investigate the impact of maternal obesity on pregnancy outcomes and its metabolic consequences for offspring.

Methods: A retrospective cohort study was conducted at the Gynecology B Unit of Hayatabad Medical Complex, Peshawar, including 6,910 obstetric admissions from January to December of the previous year. Pregnant women aged 18-45 years with singleton pregnancies were included, while those with pre-existing conditions were excluded. BMI was calculated based on self-reported pre-pregnancy weight and height, and participants were categorized into normal weight and obese (≥30 kg/m²) groups. Data were analyzed using SPSS version 25, employing descriptive statistics, chi-square tests, t-tests, and multivariable logistic regression.

Results: The examination of parity distribution uncovered a notable difference between the two groups. The group of individuals with obesity exhibited a higher occurrence of female who had never given birth (962, 75.6%) when compared to the group of individuals with normal weight (2140, 55.6%). Furthermore, an imbalance in the socioeconomic status among the participants was observed, with a greater proportion of female from lower socioeconomic backgrounds in the obese category (910, 71.5%) compared to those in the normal-weight category (1810, 47%). A total of 1464 individuals in the normal weight group were identified as having a moderate socioeconomic status, accounting for 38% of the entire population, while 578 individuals were categorized as having a high socioeconomic status, making up 15% of the total. The collected data revealed that the proportions among individuals with obesity were 222 (17.4%) and 140 (11%) occurrences, respectively

Conclusion: As a result, it can be concluded that mother's obesity markedly impacts pregnancy outcomes and the metabolic well-being of both the mother and the child. Focused interventions are crucial to tackle mother's obesity and alleviate its associated conditions. This will ultimately lead to improved health results for female and children across the globe. There is a connection between mother's obesity and adverse outcomes during pregnancy. The findings encompass various metabolic outcomes, such as gestational diabetes mellitus and hypertensive disorders that develop during the course of pregnancy.

INTRODUCTION

Obesity represents a multifaceted chronic condition characterized by an overabundance of fat tissue. It has developed into a worldwide crisis, posing marked obstacles to health systems. In recent decades, there has been a notable rise in the prevalence of obesity among female of reproductive age, leading to potentially serious health application for both the mother and the fetus. The phenomenon of mother's obesity encompasses a multifaceted interplay of genetic, environmental, and lifestyle elements. This

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interaction plays a crucial role in determining pregnancy outcomes and could lead to lasting metabolic effects on both the mother and the offspring [2].

The impact of mother's obesity on pregnancy is marked, heightening the likelihood of negative outcomes for both the mother and the fetus in development. Female with obesity during pregnancy face an elevated risk of experiencing gestational diabetes mellitus, hypertensive disorders such as preeclampsia and in the time which the period of time a baby develops in the womb, and a greater chance of needing a cesarean section. The presence of these conditions poses a marked risk to maternal well-being and heightens the chances of negative consequences for the infant, including macrosomia, neonatal hypoglycemia, and delivery-related injuries, among others [5]. The relationship between mother's obesity and the heightened rates of stillbirth and neonatal mortality highlights the necessity for thorough approaches to mitigate these risks [6]. The impact of mother's obesity affects the metabolic health of both the mother and her offspring, with consequences that extend beyond the perinatal phase. The idea, often known as developmental programming or fetal programming, suggests that offspring of mothers with obesity have a heightened risk of encountering metabolic disorders as they grow older. These conditions encompass excessive weight, impaired insulin function, and the second type of diabetes mellitus. Exposure in the womb to an environment that promotes obesity is increasingly resulting in excessive nutrition for the fetus, irregularities in fat tissue development, and changes at the epigenetic level, thereby sustaining a cycle of metabolic conditions through generations [8].

A thorough grasp of the fundamental processes and targeted strategies is crucial for enhancing pregnancy results and preventing metabolic repercussions. The rising occurrence of mother's obesity has a profound impact on the well-being of both the mother and her offspring. This study seeks to explore how mother's obesity influences pregnancy results and to clarify the biological processes that facilitate the transfer of metabolic risks across generations. This investigation combines findings from population studies, laboratory experiments, and cellular biology to offer scientifically supported guidelines for addressing and preventing mother's obesity and its associated conditions. The main aim of this research is to improve the health results for mothers and children around the world.

MATERIAL AND METHODS

This retrospective cohort study looked to investigate the effects of mother's obesity on pregnancy outcomes and the related metabolic application. The study was carried out in the Gyne B Unit of the Hayatabad Medical Complex in Peshawar. During the entire duration of the study, spanning from January 23 to December 23, every obstetric admission that took place was incorporated. The investigation encompassed a total of 6,910 obstetric admissions. Eligible participants for the study included individuals who were admitted to the Gyne B Unit, pregnant with a single fetus, and aged between 18 and 45 years. To reduce the likelihood of confounding effects, pregnant female with pre-existing conditions, such as diabetes mellitus, hypertension, or notable comorbidities, were excluded from the study.

Participants in the study were categorized according to their body mass index (BMI), which was calculated from their self-reported weight and height prior to pregnancy. The information was gathered during the initial antenatal examination, occurring between the sixth and tenth weeks of pregnancy. The classification of various body mass index (BMI) categories was developed using the criteria established by the World Health Organization (WHO). People identified as underweight have a body mass index (BMI) below 18.5 Kg/m2, whereas individuals with a normal weight exhibit a BMI between 18.5 and 24.9 Kg/m2. Individuals categorized as overweight have a body mass index ranging from 25.0 to 29.9 Kg/m2. Obesity is divided into three distinct categories: class I, which ranges from 30 to 34.9 Kg/m2; class II, spanning from 35 to 39.9 Kg/m2; and class III, which is categorized as 40 Kg/m2 or greater. This comparative study sought to categorize female into two distinct groups: those with a normal weight and those categorized as obese, specifically defined as female with a body mass index (BMI) of 30 Kg/m2 or higher

Data was gathered retrospectively from medical records to obtain details regarding the mother's demographics, medical history, lifestyle factors, and pregnancy outcomes. The initial prenatal appointment or entry into the Gyne B Unit marked the instances when maternal anthropometric measurements were recorded. The parameters assessed encompassed the maternal height, weight, and body mass index (BMI). The outcomes of interest during pregnancy included macrosomia, newborn hypoglycemia, stillbirth, and neonatal death. The results encompassed the incidence of gestational diabetes mellitus, hypertensive disorders of pregnancy, including preeclampsia and pregnancy-induced hypertension, delivery method (vaginal or cesarean), and macrosomia. Descriptive statistics were employed to outline the baseline characteristics of the study population, categorizing variables according to the proportion of mothers with obesity. Analyses involving two variables were performed utilizing chi-square tests for categorical variables and t-tests or Mann-Whitney U tests for continuous variables to assess differences in pregnancy outcomes between individuals with obesity and those without. Using multivariable logistic regression models, we investigated the independent relationship between mother's obesity and negative outcomes during pregnancy. This was carried out while accounting for possible confounding factors such as maternal age, parity, socioeconomic status, and lifestyle choices. Longitudinal

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studies were carried out to investigate the progression of metabolic indicators over time and evaluate the transfer of metabolic risk across generations. The strength of the results was evaluated through sensitivity analyses aimed at reducing possible bias.

RESULTS

Of the 6,910 obstetric admissions included in the study, 358 (5.1%) females were categorized as underweight, 3852 (55.7%) as normal weight, 1428 (20.6%) as overweight, and 1272 (18.4%) as obese. Among the obese group, 680 (9.8%) were categorized as class I obesity, 460 (6.6%) as class II obesity, and 132 (1.9%) as class III obesity. Table-1

Table-1: BMI Level And Obesity Class Of The Study Population

BMI / Obesity	Frequency	Percentage
BMI level		
Under weight	358	5.1%
Normal weight	3852	55.7%
Overweight	1428	20.6%
Obese	1272	18.4%
Obesity class		
Class-i	680	9.8%
Class-ii	460	6.6%
Class-iii	132	1.9%

The mean age of female with normal weight was 28.5±4.1 years, while the mean age of obese female was 30.7±4.5 years. Parity distribution differed markedly between the two groups, with a higher proportion of nulliparous female in the obese group 962 (75.6%) compared to the normal-weight group 2140 (55.6%). Additionally, socioeconomic status varied, with a higher proportion of female from lower socioeconomic backgrounds in the obese group 910 (71.5%) compared to the normal-weight group 1810 (47%). Middle socioeconomic status in normal weight group was 1464 (38%) and 578 (15%) had high socioeconomic status. This ratio in obese patients were recorded as 222 (17.4%) and 140 (11%) cases respectively. Table-2

Table-2: Demographic & Other Characteristics

Characteristic	Normal Weight (%)	Obese (%)	p-value
Age (years), mean (SD)	28.5±4.1	30.7±4.5	
Parity			
Nulliparous	2140 (55.6%)	962 (75.6%)	0.011
Multiparous	1712 (44.4%)	310 (24.4%)	0.050
Socioeconomic Status			
Low	1810 (47%)	910 (71.5%)	0.001
Middle	1464 (38%)	222 (17.4%)	0.050
High	578 (15%)	140 (11%)	0.091

Table 3 summarizes the pregnancy outcomes among female with normal weight and those with obesity. The incidence of gestational diabetes mellitus (GDM) was markedly higher among obese female 110 (8.6%) cases as compared to those with normal weight 913 (23.7%) ($p<0.001$). Hypertensive disorders of pregnancy (HDP), encompassing conditions such as preeclampsia and gestational hypertension, were notably more prevalent among obese female, with 233 (18.3%) cases, compared to normal-weight female, with 247 (6.4%) ($p < 0.001$). Additionally, cesarean delivery rates were markedly higher among obese female, accounting for 709 (55.7%) cases, compared to normal-weight patients, with 1160 (30.1%) cases ($p < 0.001$). Regarding stillbirth, occurrences

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were observed in 62 (1.6%) cases among normal-weight female, while in obese female, this ratio was 42 (3.3%) cases. Table-3 Longitudinal analyses revealed marked differences in metabolic parameters between offspring born to normal-weight and obese mothers.

Table-3: Pregnancy Outcomes

Outcome	Normal Weight (%)	Obese (%)	p-value
GDM	913 (23.7%)	110 (8.6%)	0.001
HDP	247 (6.4%)	233 (18.3%)	0.011
Cesarean Delivery	1160 (30.1%)	709 (55.7)	0.003
Stillbirth	62 (1.6%)	42 (3.3%)	0.991

Among normal weight mothers, fetal macrosomia was observed in 209 (5.4%) cases, while among obese mothers, this proportion markedly increased to 130 (10.2%) cases, $p < 0.001$. Neonatal hypoglycemia was noted in 232 (6%) infants born to normal weight female while in 133 (10.4%) infants of normal weight female. Low birth weight (<2500 grams) was less prevalent among infants born to obese mothers 88 (6.9%) compared to those born to normal weight mothers 297 (7.7%), p= 0.021. Admission to the neonatal intensive care unit (NICU) was more frequent among infants born to obese mothers 107(8.4%) compared to those born to normal weight mothers 189 (4.9%) p = 0.001. Umbilical cord arterial pH levels below 7.10 were identified in 224 (5.8%) cases among infants born to mothers with normal weight and in 145 (8.9%) cases among infants born to mothers with obesity. Neonatal mortality within the initial 28 days of life displayed notable correlations with mother's obesity compared to infants born to mothers with normal weight, 7 (0.18%) vs 3 (0.2%) respectively. However, the p-value of 0.098 suggests that this difference did not reach statistical significance. Table-4

Table-4: Neonatal Outcome

Neonatal outcome	Normal weight	Obese	P value
Fetal macrosomia	209 (5.4%)	130 (10.2%)	0.001
Neonatal Hypoglycemia	232 (6%)	133 (10.4%)	<0.001
Low birth weight	297 (7.7%)	88 (6.9%)	0.021
NICU	189 (4.9%)	107 (8.4%)	0.001
PH level >7.10	224 (5.8%)	114 (8.9%)	0.005
Mortality	7 (0.18%)	3 (0.23%)	0.090

DISCUSSION

Conversely, mother's obesity is a complex condition with marked application for the health of both mothers and infants. This study seeks to examine the impact of mother's obesity on pregnancy outcomes and the associated metabolic consequences. Consistent with other studies [9], our results corroborated the marked correlations between mother's obesity and worse pregnancy outcomes. Obese pregnant female has a higher likelihood of cesarean delivery and an elevated risk of gestational diabetes mellitus (GDM), hypertensive disorders of pregnancy (HDP), and other pregnancy-related problems compared to those of normal weight [10]. The findings underscore the need of addressing mother's obesity as a marked public health condition to enhance health outcomes for both mothers and infants.

On the other hand, mother's obesity presents a multifaceted challenge that carries considerable consequences for the well-being of both mothers and their infants. This investigation aims to explore the effects of mother's obesity on pregnancy results and the related metabolic application. In alignment with earlier research [9], our findings confirmed the notable associations between mother's obesity and adverse pregnancy outcomes. Female with obesity during pregnancy face an increased chance of undergoing cesarean delivery and are at a greater risk for gestational diabetes mellitus, hypertensive disorders of pregnancy, and various other complications associated with pregnancy when compared to their normal-weight counterparts. The results highlight the importance of tackling mother's obesity as a critical public health concern to improve health outcomes for mothers and their infants.

This investigation clarifies the metabolic consequences of mother's obesity on offspring. In later life, offspring of mothers with obesity exhibited an increased likelihood of developing metabolic conditions, such as obesity, insulin resistance, and type 2 diabetes mellitus (T2DM). This process, often referred to as developmental programming or fetal programming, highlights the

lasting impacts of prenatal exposure to an environment conducive to obesity on metabolic health across generations [11,12]. To develop personalized treatments that could break the cycle of metabolic conditions and improve long-term health results, a thorough understanding of these pathways is crucial.

The information we have gathered, when compared with worldwide studies, corresponds with global patterns that highlight the negative effects of mother's obesity on outcomes following pregnancy. Female with obesity during pregnancy faced a higher likelihood of experiencing gestational diabetes mellitus, hypertensive disorders related to pregnancy, and the need for cesarean delivery, aligning with previous findings in the field. The results underscore the worldwide importance of mother's obesity as a marked risk factor for adverse pregnancy outcomes, emphasizing the necessity for thorough strategies to reduce the associated risks. Our investigation synthesizes results from previous studies carried out in various nations [15,16], enhancing the current understanding of the negative health effects associated with mother's obesity and underscoring the critical need for proactive strategies to tackle this worldwide crisis.

The findings highlight the necessity for targeted strategies to tackle mother's obesity and its related conditions. Our findings clarify the impact of mother's obesity on pregnancy outcomes and metabolic application. This has resulted in a broadened knowledge foundation for strategies focused on the prevention and management of mother's obesity, thereby enhancing the well-being of mothers and children worldwide. To improve the health outcomes for both the mother and the infant, it is crucial to implement a thorough approach that addresses mother's obesity. This approach should encompass guidance before conception, adjustments in lifestyle, and a cohesive care strategy [17]. The results of our investigation offer important new perspectives; however, a considerable void persists in the existing body of work regarding the most effective approaches for preventing and addressing mother's obesity and its related health conditions. Future investigations should explore the efficacy of specific interventions, such as changes in diet, exercise programs, and behavioral therapies, in reducing the adverse effects of mother's obesity on pregnancy results and metabolic well-being. Carrying out extended studies with lengthy follow-up durations is crucial for understanding the trajectory of metabolic health throughout life and evaluating the lasting impacts of interventions targeting mother's obesity. By tackling this deficiency in existing studies, additional investigations will support data-driven initiatives focused on improving health results for mothers and infants, while also reducing the worldwide impact linked to mother's obesity.

This research highlights a notable link between mother's obesity and adverse pregnancy results. The consequences encompass a rise in the frequency of cesarean deliveries, elevated blood pressure conditions during pregnancy, and the occurrence of gestational diabetes mellitus. Furthermore, offspring of mothers with obesity exhibit a heightened vulnerability to metabolic disorders as they age. The results highlight the importance of focusing on the prevention of mother's obesity in public health efforts to improve health outcomes for mothers and children throughout pregnancy. To address the metabolic challenges encountered by mothers and their children, it is crucial to implement targeted initiatives aimed at decreasing mother's obesity and its related conditions.

On the other hand, mother's obesity presents a multifaceted challenge that carries considerable consequences for the well-being of both mothers and their infants. This investigation aims to explore how mother's obesity influences pregnancy results and the related metabolic effects. In alignment with previous investigations [9], our findings confirmed the notable associations between mother's obesity and adverse pregnancy outcomes. Female with obesity during pregnancy face an increased chance of undergoing cesarean delivery and are at a greater risk for gestational diabetes mellitus, hypertensive disorders of pregnancy, and various other complications associated with pregnancy when compared to their counterparts of normal weight. The findings highlight the importance of tackling mother's obesity as a critical public health concern to improve health outcomes for mothers and infants alike. This investigation clarifies the impact of mother's obesity on the metabolic outcomes in offspring. In later life, offspring of mothers with obesity exhibited an increased likelihood of developing metabolic conditions, such as obesity, insulin resistance, and type 2 diabetes mellitus (T2DM). This process, referred to as developmental programming or fetal programming, highlights the lasting impacts of prenatal exposure to an environment conducive to obesity on metabolic health across generations [11,12]. To develop personalized treatments that could interrupt the cycle of metabolic conditions and improve long-term health results, a thorough understanding of these pathways is crucial.

The information we have gathered, when compared with worldwide studies, corresponds with global patterns that highlight the negative effects of mother's obesity on outcomes following pregnancy. Female with obesity during pregnancy faced a higher likelihood of experiencing gestational diabetes mellitus, hypertensive disorders, and the necessity for cesarean delivery, aligning with previous studies. The results underscore the worldwide importance of mother's obesity as a marked risk factor for adverse pregnancy outcomes, suggesting the necessity for thorough approaches to reduce the associated risks. Our study synthesizes results from previous investigations carried out in various nations [15,16], enhancing the current understanding of the detrimental health impacts associated with mother's obesity and underscoring the critical need for preventive measures to tackle this

worldwide crisis. The findings highlight the necessity for targeted strategies to tackle mother's obesity and its related conditions. Our findings clarify the impacts of mother's obesity on pregnancy results and metabolic application. This has resulted in a broader foundation of knowledge for strategies focused on the prevention and management of mother's obesity, thereby enhancing the well-being of mothers and children worldwide. To improve the health results for both the mother and the infant, it is crucial to implement a thorough approach that addresses mother's obesity. This approach should encompass guidance before conception, adjustments in lifestyle, and a cohesive care strategy [17].

The results of our investigation offer important new perspectives; however, a considerable void persists in the existing body of work regarding the most effective approaches for preventing and addressing mother's obesity and its related health conditions. Future investigations should explore the efficacy of specific interventions, such as changes in diet, exercise programs, and behavioral guidance, in reducing the adverse effects of mother's obesity on pregnancy results and metabolic well-being. Carrying out extended studies with lengthy follow-up durations is crucial for understanding the trajectory of metabolic well-being throughout life and evaluating the lasting impacts of strategies targeting mother's obesity. By tackling this gap in existing studies, additional inquiries will support data-driven initiatives focused on improving health results for mothers and infants, while also alleviating the worldwide challenges linked to mother's obesity.

CONCLUSION

This investigation reveals a notable association between mother's obesity and adverse pregnancy results. The consequences encompass a rise in the frequency of cesarean deliveries, hypertension-related conditions during pregnancy, and the occurrence of gestational diabetes mellitus. Furthermore, offspring of mothers with obesity exhibit a heightened vulnerability to metabolic disorders as they age. The results highlight the importance of focusing on the prevention of mother's obesity within public health efforts to improve health outcomes for mothers and children throughout pregnancy. To address the metabolic challenges encountered by mothers and their children, it is crucial to create specific interventions focused on decreasing mother's obesity and its related conditions.

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