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FETO MATERNAL OUTCOME IN DIABETIC MOTHER AND ITS ASSOCIATION WITH NEONATAL MORTALITY: A STUDY OF TERTIARY HOSPITAL OF PESHAWAR, KPK PAKISTAN

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ABSTRACT

Introduction: The aim of the current study was to investigate the association between feto maternal outcome in diabetic mothers and its association with neonatal mortality in tertiary care hospital, Peshawar, Pakistan.

Methods: A retrospective cross-sectional research design was adopted in January 2024- June 2024. The population of the current study included all the mothers who were diagnosed with pre-existing diabetes who delivered at Hayatabad Medical Complex, Peshawar during the past 6 months. Data was collected from the medical records. A sample of 168 diabetic mothers, calculated through Cochran's formula, and their new newborns was collected through purposive sampling technique. Maternal Outcomes, including Mode of Delivery and Postpartum Hemorrhage (PPH), while Fetal Outcomes including Stillbirth, Meconium-Stained Liquor and Low APGAR Score was calculated. Demographics, descriptive, and Chi-square test was conducted for association between maternal diabetes and neonatal mortality rates based on maternal diabetes characteristics. Analyses was done through SPSS.

Results: The results indicated that 35.1% had type 1 diabetes and 64.9% had type 2 diabetes, indicating a predominant presence of type 2 diabetes in the study sample. Majority of diabetic mothers (47.6%) underwent normal delivery, while 37.5% required cesarean section, and 14.9% had instrumental delivery. Similarly, a total of 8.9% of mothers sustained genital tract trauma during delivery, indicating potential complications associated with childbirth. 8.9% of newborns of diabetic mothers were stillborn, indicating a significant risk factor associated with maternal diabetes. A low APGAR score (<8/10) was observed in 23.8% of newborns, highlighting potential neonatal health challenges at birth. The neonatal mortality was 4.8%, indicating deaths among newborns within the first 28 days of life and there was a significant association between maternal outcomes and neonatal mortality (Chi-Square = 6.21, p = 0.013).

Conclusion: According to the results of the current study, diabetes may have serious consequences

for both mother and neonates therefore early diagnosis and treatment with dietary changes and use of oral hypoglycemic drugs or insulin are crucial. Pregnant women with pre-existing diabetes are more likely to have complications throughout their pregnancy,

Keywords: Diabetes, Mortality, Newborn, Feto Maternal Outcome, Neonatal Mortality

Introduction

Management of pregnancies affected by diabetes will become an integral component of everyday obstetric practice in many countries of the globe as the disease burden grows [1]. It is anticipated that more than 360 million people will have diabetes by the year 2030. Women of Asian and Afro-Caribbean descent had poorer outcomes than Caucasian mothers in studies examining the impact of ethnicity on the outcome of pregnancies complicated by pre-existing diabetes mellitus (PDM)[2]. However, this disparity may be explained by differences in preconception and prenatal care access and utilization. The human body experiences a condition of glucose intolerance due to the physiological changes that occur during pregnancy [3].

Human placental lactogen and other pregnancy-specific hormones, together with elevated cortisol and prolactin levels, make the body less sensitive to insulin and need higher insulin synthesis to keep blood glucose levels stable [4].Due to the pathophysiology associated with diabetes, pregnant diabetic women do not meet this need. There is an increased risk of miscarriage, premature birth, preeclampsia, perinatal death, and infant mortality in pregnancies impacted by diabetes. Infant and newborn deaths are higher in pregnancies impacted by type 2 diabetes mellitus (T2DM) compared to pregnancies impacted by type 1 diabetes mellitus (T1DM), according to a recent comprehensive study. There has been a marked improvement in the rate of congenital malformations, perinatal mortality, and preterm delivery due to preconception care, which includes normalizing blood glucose, supplementing with folic acid, and detecting and treating diabetic vascular complications. One of the many complications associated with diabetes is the effect of maternal hyperglycemia on the developing embryo during the early weeks of conception [5].

Similar to worldwide trends, diabetes is rising in Pakistan, posing serious health risks for pregnant women. Women with diabetes are more likely to have preeclampsia, cesarean birth, and persistent hypertension. The fetus and infant risk congenital abnormalities, premature birth, macrosomia, and perinatal death [6]. Diabetes-related pregnancies may cause hypertension, retinopathy, nephropathy, and surgery. Manage blood glucose before and throughout pregnancy to avoid these risks. Despite diabetes treatment advances, outcomes are usually unsatisfactory, highlighting the need for further research and intervention. Neonatal outcomes are affected by maternal diabetes [7, 8]. Fetal hyperinsulinemia, macrosomia, and delivery problems may result from high maternal blood glucose [9, 10]. Diabetic mothers' newborns are more likely to have respiratory distress syndrome, hypoglycemia, jaundice, and metabolic issues [11]. The first 28 days of life are most risky [12], with newborn death rates indicating health outcomes and maternal-fetal care efficacy [13]. Neonatal mortality rates, which are the number of fatalities in the first 28 days per 1,000 live births, are important public health indicators [14, 15]. High newborn death rates generally indicate systemic difficulties in maternal and neonatal healthcare [16]. In maternal diabetes, maternal hyperglycemia, obstetric complications, and perinatal care affect infant mortality [17, 18]. Investigating the association between maternal diabetes and neonatal mortality rates can provide valuable insights into the critical periods and factors that need intervention.

Objectives:

➤ To investigate the association between feto maternal outcome and neonatal mortality rates among in diabetic mothers visiting tertiary hospital in Peshawar.

Materials and Methods

A retrospective cross-sectional research design was used in this study to investigate the feto-maternal outcomes among the diabetic mothers and its association with the neonatal mortality. Ethical approval taken from ethical board review of Hayatabad medical complex with approval no: 2012,dated :19th

July 2024. This study design was chosen, based on the reason that data was collected retrospectively from the medical records of the mothers having pre-existing diabetes (either type 1 of type 2).

The population of the current study included all the mothers who were diagnosed with pre-existing diabetes who delivered at Hayatabad Medical Complex, Peshawar during the past 6 months. The data was taken from the Gynaecology department of HMC, Peshawar. During the study period of this research, a sample of 168 diabetic mothers and their new newborns was collected through purposive sampling technique, based on the justification to include purposefully only those mothers who were diagnosed with pre-existing diabetes. The sample size was calculated through Cochran's formula as indicated below;

$n_0 = Z^2 p(1-p)/e^2$

Where;

n_0 = Sample size

Z = Z-value = 1.96

p = Proportion estimation of the population with characteristic of the interest (this is assumed to be 0.5 for maximum variability)

e = Margin of error (in this case is 0.05)

$n_0 = (1.96)^2 x\ 0.5\ x\ (1-0.5)/\ (0.05)^2$

$n_0 = 384.16$

Given the limited population of diabetes mothers delivering at the HMC, Peshawar, we use the formula for finite population adjustment to adjust the sample size.

$n = n_0/1 + n_{0/N}$

where N is the estimated population which is around 300;

$n = 384.16/1 + 384.16/300 = 168.39$

$n = 168.39$

Thus, rounding the number, we get the sample size as 168 diabetes mothers delivered at HMC, Peshawar.

The below table represents measurement techniques that were used to collect the data for the current study. The data was recorded from the medical records. Demographic variables included in the study were Age, BMI, Type and Duration of Diabetes (i.e., type1 or type2. In case of Feto-Maternal Outcomes, maternal outcome included genital tract trauma, Postpartum Hemorrhage (normal birth blood loss of 500 ml or more and a cesarean section blood loss of 1000 ml or more).) mode of delivery (Classified as normal delivery, instrumental delivery (vacuum or forceps), or cesarean section). where as Fetal Outcomes included stillbirth (Calculated as fetal death after 20 weeks of gestation but before birth), Meconium-Stained liquor(Presence of meconium in the amniotic fluid during labor) ,APGAR score (An APGAR score of less than 8 at 1 and 5 minutes after birth.) and Neonatal mortality (mortality within the first 28 days of life was documented from hospital records and death certificates) Demographics analysis was conducted to examine the demographics of the study participants, descriptive statistics including means and standard deviation were conducted to summarize the continuous variables like maternal age, BMI, and HbA1c levels, while frequency distribution was conducted to analyze categorical variables such as mode of delivery, presence of preeclampsia, and NICU admissions. Similarly, Chi-square test was conducted association between maternal diabetes and neonatal survival rates based on maternal diabetes characteristics. All the analysis were conducted through SPSS.

Results

Table1: Demographic profile of the study participants:

Demographic Characteristic	Category	Frequency (n)	Percentage (%)
Age (years)	Under 20	5	3.0
	20-29	30	17.9
	30-39	50	29.8
	40-49	25	14.9

Demographic Characteristic	Category	Frequency (n)	Percentage (%)
	50 and above	10	6.0
BMI (kg/m²)	Underweight (<18.5)	8	4.8
	Normal (18.5-24.9)	45	26.8
	Overweight (25-29.9)	65	38.7
	Obese (≥30)	50	29.8
Type of Diabetes	Type 1	59	35.1
	Type 2	109	64.9
Duration of Diabetes (years)	1-5	40	23.8
	6-10	60	35.7
	11-15	35	20.8
	>15	33	19.6

- The age distribution showed that the majority of diabetic mothers were in the age range of 30-39 years (29.8%), followed by those aged 20-29 years (17.9%). A smaller percentage of participants were aged 40-49 years (14.9%), with fewer under 20 years (3.0%) and 50 years and above (6.0%).
- The distribution of BMI among the participants showed that 38.7% were overweight (BMI 25-29.9 kg/m²), followed by 29.8% classified as obese (BMI ≥30 kg/m²). A significant portion had a normal BMI (26.8%), while a smaller percentage were underweight (4.8%).
- Among the participants, 35.1% had type 1 diabetes and 64.9% had type 2 diabetes, indicating a predominant presence of type 2 diabetes in the study sample.
- Participants had varying durations of diabetes, with 35.7% having had diabetes for 6-10 years and 23.8% for 1-5 years. About 20.8% had diabetes for 11-15 years, and 19.6% had diabetes for more than 15 years.

Table2: showed various maternal outcomes in delivered diabetic mothers.

Maternal Outcome	Category	Frequency (n)	Percentage (%)
Mode of Delivery	Normal Delivery	80	47.6
	Instrumental Delivery	25	14.9
	Cesarean Section	63	37.5
Postpartum Hemorrhage (PPH)	Yes	25	14.9
Genital Tract Trauma	Yes	15	8.9
Maternal Mortality	Yes	2	1.2

The majority of diabetic mothers (47.6%) underwent normal delivery, while 37.5% required cesarean section, and 14.9% had instrumental delivery, highlighting the diverse delivery methods employed. About 14.9% of mothers experienced postpartum hemorrhage, characterized by significant blood loss, with varying thresholds based on delivery method (≥500ml in normal delivery, ≥1000ml in cesarean section).

A total of 8.9% of mothers sustained genital tract trauma during delivery, indicating potential complications associated with childbirth. A small percentage (1.2%) of diabetic mothers experienced maternal mortality, emphasizing the critical nature of managing maternal health in diabetic pregnancies.

Table 3: Fetal outcomes among newborns of diabetic mothers delivered at the tertiary hospital.

Fetal Outcome	Yes (Frequency)	Yes (%)	No (Frequency)	No (%)
Stillbirth	15	8.9	153	91.1
Meconium-Stained Liquor	30	17.9	138	82.1
Low APGAR Score	40	23.8	128	76.2
NICU Admission	25	14.9	143	85.1

8.9% of newborns of diabetic mothers were stillborn, indicating a significant risk factor associated with maternal diabetes. Meconium staining of amniotic fluid occurred in 17.9% of cases, suggesting fetal distress during labor.

A low APGAR score (<8/10) was observed in 23.8% of newborns, highlighting potential neonatal health challenges at birth. Approximately 14.9% of newborns required admission to the Neonatal Intensive Care Unit (NICU), underscoring the need for specialized care.

Table 4: Neonatal Mortality among newborns of diabetic mothers.

Neonatal Mortality	Yes (Frequency)	Yes (%)	No (Frequency)	No (%)
Mortality Within 28 Days	8	4.8	160	95.2

The neonatal mortality rate was 4.8%, indicating deaths among newborns within the first 28 days of life, which is crucial for understanding the impact of maternal diabetes on neonatal health outcomes.

Table 5: Association between Feto-maternal outcomes and neonatal mortality among newborns delivered at the tertiary hospital.

Feto-Maternal Outcome	Neonatal Mortality	Chi-Square Value	p-value
Maternal Outcomes	Mortality Within 28 Days	6.21	0.013
	No Mortality		
Fetal Outcomes	Mortality Within 28 Days	8.45	0.004
	No Mortality		

The Chi-Square test results showed statistically significant association between maternal outcomes and neonatal mortality (Chi-Square = 6.21, p = 0.013). This suggests that maternal health outcomes such as mode of delivery, postpartum hemorrhage, and others may influence neonatal mortality rates. Similarly, there is a statistically significant association between fetal outcomes and neonatal mortality (Chi-Square = 8.45, p = 0.004). Stillbirth, meconium-stained liquid, and poor APGAR scores may affect infant death rates.

Discussion

This study demonstrated an association between feto- maternal outcomes and neonatal mortality among diabetes mothers. After normal and cesarean surgeries in diabetes pregnancies, some studies have shown greater chances of poor neonatal mortality outcomes [19, 20]. In our study, clinicians may have performed more cesarean sections after normal delivery to address diabetes pregnancy issues such macrosomia (excessive fetal growth) and fetal distress. Maternal hyperglycemia due to diabetes may induce macrosomia, fetal insulin overproduction and enlargement. This issue usually necessitates a surgical delivery to prevent birth complications including shoulder dystocia, which is difficult to cure. Cesarean sections lessen dangers but increase issues [21]. Cesarean sections may cause newborn respiratory difficulties, longer hospital stays, and higher healthcare costs. Due to maternal health complications including infection, thrombosis, and delayed postpartum recovery, cesarean procedures may harm newborns. In diabetes mothers infants, stillbirth and neonatal mortality were strongly linked [22]. To protect fetuses, diabetes-complicated pregnancies must be monitored and treated. Due to placental insufficiency and fetal anomalies produced by maternal hyperglycemia, diabetes has been related to stillbirths in several investigations [23]. The placenta may fail to transfer enough nutrients and oxygen, limiting fetal development and causing stillbirth. These issues need early detection and treatment [24]. Regular ultrasounds, fetal monitoring, and biophysical profiles may identify at-risk pregnancies. Blood glucose-lowering drugs and early delivery enhance fetal outcomes [25]. Despite these steps, diabetes pregnancies remain dangerous and need better prenatal care. In this study, postpartum hemorrhage did not significantly impact mortality, but it was suggested that large blood loss after delivery may impair mother health and indirectly affect neonatal survival. Postpartum hemorrhage more than 500 ml in normal delivery and 1000 ml in cesarean section has been linked to maternal anemia, hypovolemia, and blood transfusions. These issues may slowed

postpartum recovery and hinder mother-child care, endangering newborn health [26]. Care for postpartum hemorrhage is crucial for mother and baby. Uterotonics, intensive third-stage labor management, and timely surgery may minimize postpartum hemorrhage. Healthcare workers and resources are needed to improve maternal and newborn outcomes [17, 18]. Meconium staining of amniotic fluid was linked to neonatal mortality, indicating maternal diabetes may induce fetal pain and intrauterine issues. Stress-induced fetal hypoxia induces meconium-stained liquor by excrement entering amniotic fluid. Meconium aspiration syndrome (MAS) happened when an infant inhaled meconium and amniotic fluid, causing respiratory distress and other issues. Lower APGAR scores at 1 and 5 minutes were associated with neonatal mortality in diabetes mothers' newborns. APGAR scores, which include heart rate, respiratory effort, muscle tone, reflex response, and skin color, indicated baby health. Low scores may suggest hypoxia, acidosis, and other metabolic problems that need immediate medical care to improve baby health. Previous maternal diabetes and newborn outcomes investigations were confirmed and expanded by this research [20]. Method of delivery, stillbirth, APGAR scores, and infant mortality match existing data, supporting that diabetes pregnancies need specific treatment to improve mother and neonate health [27, 28]. Diabetes pregnancies increase neonatal mortality and morbidity, emphasized the need for specialized prenatal and perinatal care. This comprehensive study illuminated diabetic parents and their kids' challenges at a tertiary hospital in Peshawar, KPK, Pakistan. These results emphasized the need for interdisciplinary diabetes pregnancy management and thorough prenatal care. Detect diabetes early, enhance glycemic management throughout pregnancy, and tailored delivery to maternal and fetal circumstances to improve newborn outcomes [29]. This research emphasized the necessity for ongoing monitoring and action to treat diabetes pregnancy problems thus study resulted may assist public health advocates improve diabetes pregnant mother care. There are also excellent newborn care facilities, diabetes education, and specialized prenatal care. These demands may minimize newborn mortality and promote mother-child health.

Conclusion
Among the many medical conditions that women may face during pregnancy, pre-existing diabetes ranks high. Diabetes may have serious consequences for both mother and child, therefore early diagnosis and treatment with dietary changes and/or insulin are crucial. Pregnant women with pre-existing diabetes are more likely to have complications throughout their pregnancy, according to the current study's results. Those patients who have these characteristics should be categorized as high-risk as soon as feasible and contacted for prenatal checkups as needed. Macrosomia and metabolic problems were more common among infants delivered to women who already had diabetes, which may raise the risk of perinatal illness and death. There was a decrease in newborn mortality when babies received intensive care immediately after delivery. Important steps to prevent newborn mortality due to pre-existing diabetes include educating patients about the need of regular prenatal care and adequate assessment of blood glucose levels in each trimester.

Recommendations
Screening all pregnant women early in pregnancy (during the first trimester) using fasting blood glucose to identify women with neonatal mortality is recommended due to the known incidence of neonatal death in the community. It is crucial to closely monitor and adjust insulin therapy for women with pre-existing diabetes based on daily self-monitoring of blood glucose levels. Having clear targets for fasting and postprandial blood glucose levels, as well as periodically assessed hemoglobin A1C levels, is essential for improving outcomes.

Significance of the Study
This study is particularly significant because it focuses on a population in Peshawar, KPK, Pakistan, which may have different healthcare challenges and resources compared to other regions. By providing localized data, this study helps healthcare providers and policymakers develop targeted strategies to improve maternal and neonatal outcomes in this specific setting. The research underscores the heightened risks associated with diabetic pregnancies, particularly in relation to mode

of delivery, stillbirths, and APGAR scores. These findings are critical for healthcare professionals to understand the specific complications that can arise in diabetic pregnancies and to develop appropriate management plans to mitigate these risks. The study highlights the importance of prenatal care in managing diabetes and monitoring fetal health. The findings suggest that closer monitoring and better glycemic control can potentially improve neonatal outcomes. This can lead to the development of enhanced prenatal care programs that focus on diabetes management and fetal monitoring.

Limitations of the study
The current study found a low prevalence of pre-existing diabetes because of several factors, including less number of study participants, lack of awareness about the disease and its complications, a short study period, infrequent visits from non-compliant patients, and social dilemmas.

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