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IMPACT OF MATERNAL DIABETES ON NEONATE

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ABSTRACT

Background: Maternal diabetes, including gestational diabetes mellitus (GDM) and pregestational diabetes, is a major determinant of neonatal complications. **Aim:** This study aimed to evaluate the immediate complications in infants of diabetic mothers (IDM). **Materials and Method:** A hospital-based observational study was conducted at the Department of Pediatrics, Medical College for Women and Hospital, from July 2024 to July 2025. A total of 120 neonates born to mothers with GDM or pregestational diabetes were included. Data on maternal diabetes type, glycemic control, mode of delivery, neonatal birth weight, clinical presentation, and complications—such as hypoglycemia, hyperbilirubinemia, hypocalcemia, respiratory distress, and polycythemia-were collected. Statistical analysis was performed using SPSS 26. **Results:** Of the 120 neonates, 54.17% were male. Most mothers had GDM (70.83%) and good glycemic control (HbA1c <6.5% in 47.5%). Preterm births comprised 27.5%. Respiratory distress was the most frequent complication (40%), followed by hypoglycemia (23.33%), hyperbilirubinemia (18.33%), and hypocalcemia (12.5%). Most neonates were appropriate for gestational age (63.33%), while 25.83% were large for gestational age (LGA) and 10.83% small for gestational age (SGA). No congenital anomalies or neonatal deaths were observed. The majority of neonates (92.5%) were discharged in good health, while 4.17% left against medical advice (LAMA). Immediate complications were slightly more common in neonates of pregestational diabetic mothers. **Conclusion:** Maternal diabetes significantly affects neonatal outcomes, with frequent immediate complications including respiratory distress, hypoglycemia, hyperbilirubinemia, and hypocalcemia. Close monitoring and effective glycemic control during pregnancy are essential to minimize risks for infants of diabetic mothers.

Keywords: Maternal diabetes, Neonatal outcomes, Hypoglycemia, Respiratory distress, Neonatal complications.

INTRODUCTION

Diabetes mellitus (DM) is a long-term metabolic condition marked by high blood sugar levels, which can lead to various health complications if not properly managed [1]. During pregnancy, diabetes is classified into two main types: pregestational diabetes mellitus (pre-GDM) and GDM. Pre-GDM includes both type 1 and type 2 diabetes that are diagnosed before pregnancy, with type 1 diabetes caused by autoimmune destruction of pancreatic β-cells and Insulin resistance–induced type 2 diabetes and β-cell dysfunction[2].

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In contrast, GDM is a pregnancy-related condition marked by impaired glucose tolerance, usually emerging in the second or third trimester, and significantly predisposes women to type 2 diabetes in the future[1,3].

Globally, the burden of diabetes has been steadily increasing. According to the International Diabetes Federation (IDF), approximately 10.5% of adults aged 20–79 was living with diabetes in 2021, with projections indicating a rise to 11.3% by 2030 [4]. In Bangladesh, the prevalence of diabetes among adults is notably high, approximately 8.4% of the adult population affected by the disease [5]. Furthermore, the prevalence of GDM in Bangladesh is also a growing concern. A study by Rahman et al. found that 9.5% of Expectant women were identified as having GDM, with rates expected to rise as risk factors such as obesity, older maternal age, and sedentary lifestyles increase[6].

Maternal diabetes, when glycemic control is insufficient, poses significant risks affecting both mothers and newborns. Uncontrolled diabetes during pregnancy is linked to various adverse outcomes, such as preterm birth, macrosomia, and a higher likelihood of cesarean delivery[7]. Neonates of mothers with poorly regulated diabetes may experience complications such as respiratory distress syndrome, hypoglycemia, and jaundice, among others [8]. Both pregestational and gestational diabetes are associated with elevated risks of persistent health conditions, including pediatric obesity and type 2 diabetes [8,9].

In Bangladesh, emerging evidence demonstrates that maternal diabetes contributes to adverse neonatal outcomes; however, research concentrating on regional disparities, particularly within rural and semi-urban regions, remains limited. This investigation seeks to evaluate the impact of maternal diabetes on neonatal health in Bangladesh, with a specific focus on a healthcare facility located in Dhaka, one of the nation's major urban centers. The study's results will enhance understanding of the local prevalence of maternal diabetes, its influence on neonatal outcomes, and the capacity of the healthcare system to address these cases effectively.

MATERIALS AND METHOD

Study Settings and Population

This was a hospital-based observational study carried out at the Department of Pediatrics, Medical College for Women and Hospital, from July 2024 to July 2025. We carefully selected a total of 120 neonates using a convenience sampling method. The study focused on live neonates born to mothers diagnosed with either GDM or pre-gestational diabetes. We included neonates admitted to the Neonatal Intensive Care Unit (NICU), cabins, and postnatal wards of the hospital, ensuring a broad understanding of the situation. We excluded neonates from twin pregnancies and babies with rare or complex complications so that we could clearly study the typical, immediate problems that babies of diabetic mothers usually face.

Study Procedure

Following the acquisition of written informed consent from the parents or guardians of the neonates, data regarding maternal diabetes history, complications during labor, and neonatal health outcomes were collected. Clinical assessments, including APGAR scores, were conducted for each neonate. Blood tests for glucose levels, packed cell volume (PCV), serum calcium, and serum bilirubin were performed. Neonates with respiratory distress underwent chest X-ray, and echocardiographic assessment was conducted on the neonates with suspected congenital heart diseases.

Data Collection

Data collection was conducted using structured forms and included maternal history, diabetes subtype, complications during pregnancy, and neonatal outcomes

such as birth weight, clinical presentation (e.g., respiratory distress, lethargy, hypoglycemia), and the type of delivery. Neonatal complications were recorded, and further investigations were performed as clinically indicated.The collected information was stored in hospital records and analyzed later.

Statistical Analysis

Data entry and statistical analysis were performed using SPSS version 26.Descriptive statistics, including frequencies, percentages, and mean ± standard deviation (SD), were used to summarize the findings. The analysis focused on the maternal characteristics, neonatal complications, clinical presentations, and birth outcomes, and associations were drawn based on the data.

Ethical Considerations

The study received ethical clearance from the Institutional Ethical Review Board (IERB) of the Medical College for Women and Hospital. Prior to the neonates' inclusion, parents or legal guardians provided written consent. The study was conducted in accordance with the ethical standards set by the institution and adhered to the principles of the Declaration of Helsinki.

RESULTS

Table 1 delivers an outline of the maternal and neonatal characteristics of 120 mothers with diabetes during pregnancy. A majority of the neonates were male (54.17%), and most mothers had GDM (70.83%). Half of the mothers had an HbA1c level below 6.5%, while 41.67% had levels above 6.5%, indicating poor glucose control. Most mothers were primigravida (65%), and a significant proportion of neonates were born preterm (27.5%). The most of deliveries were via Lower Segment Caesarean Section (LSCS) (70.83%).

Table 1: Characteristics of the neonates (N=120) and their mothers (suffering from diabetes)

Maternal and neonatal characteristics	Frequency (N=120)	Percentage
Gender of neonates		
Male	65	54.17
Female	55	45.83
Type of DM suffered by the mothers		
GDM (Gestational Diabetes Mellitus)	85	70.83
Pregestational DM	35	29.17
HbA1c (of the mothers)		
Not applicable	14	11.67
>6.5	50	41.67
<6.5	57	47.50
Gravida		
Multigravida	41	34.17
Primigravida	78	65.00
Gestational age		
Preterm	33	27.50
Term	87	72.50
Type of delivery		
LSCS (Lower Segment Caesarean Section)	85	70.83
NVD (Normal Vaginal Delivery)	35	29.17

N=Number of neonates; DM=Diabetes Mellitus; HbA1c=Glycated hemoglobin

Maternal Diabets effect on neonate

Table 2 illustrates the clinical signs and birth weights of neonates of mothers affected by diabetes. Among the clinical signs, respiratory distress was the most common, affecting 40.00% of the neonates, followed by lethargy at 20.00% and asymptomatic cases at 25.00%. Fewer neonates displayed issues like refusal to feed (9.17%), jitteriness (4.17%), and palsy (1.67%). Regarding birth weight, most neonates (63.33%) were classified as appropriate for gestational age (AGA). In comparison, 25.83% were large for gestational age (LGA), and 10.83% were small for gestational age (SGA).

Table 2: Clinical Presentation and Birth Weight of Neonates (N=120)

Clinical presentation and Birth weight	Frequency (N=120)	Percentage
Clinical presentation		
Asymptomatic	30	25.00
Lethargy	24	20.00
Refuse to feed	11	9.17
Jitteriness	5	4.17
Respiratory distress	48	40.00
Palsy	2	1.67
Birth weight		
AGA (Appropriate for Gestational Age)	76	63.33
SGA (Small for Gestational Age)	13	10.83
LGA (Large for Gestational Age)	31	25.83

N=Number of neonates

Table 3 outlines the distribution of neonates with complications related to maternal diabetes. The most common complication was hypoglycemia, affecting 23.33% of neonates, followed by hyperbilirubinemia in 18.33%, and hypocalcemia in 12.5%. A smaller proportion (5.83%) of neonates experienced polycythemia. The mean severity of these complications varied, with hypoglycemia showing a mean value of 13.38 ± 6.19, hyperbilirubinemia at 6.37 ± 2.10, hypocalcemia at 3.05 ± 0.17, and polycythemia at 30.37 ± 5.80.

Table 3: Distribution of Neonates by Complications (N=120)

Complications	Frequency (N=120)	Percentage	Mean ± SD
Hypoglycemia	28	23.33	13.38 ± 6.19
Hyperbilirubinemia	22	18.33	6.37 ± 2.10
Hypocalcemia	15	12.50	3.05 ± 0.17
Polycythemia	7	5.83	30.37 ± 5.80

N=Number of neonates

Table 4. Comparison of neonatal complications between GDM and pregestational DM mothers (N = 120)

Complication	Pre-GDM (n=85)	GDM (n=35)	Total (N=120)	*p*-Value*
Hypoglycemia	18 (21.2%)	10 (28.6%)	28 (23.3%)	0.36
Hyperbilirubinemia	14 (16.5%)	8 (22.9%)	22 (18.3%)	0.44
Hypocalcemia	9 (10.6%)	6 (17.1%)	15 (12.5%)	0.31
Polycythemia	4 (4.7%)	3 (8.6%)	7 (5.8%)	0.46

N=Number of neonates;*p-value calculated using Chi-square test

When complications were analyzed according to the type of maternal diabetes, neonatal morbidity was observed to be higher in infants of pregestational diabetic mothers compared to those of GDM mothers, however, these differences were not statistically significant ($p > 0.05$) as shown in Table 4.

DISCUSSION

This study evaluated the immediate complications of infants of diabetic mothers (IDM) in a cohort of 120 neonates. The findings highlight that maternal diabetes significantly impacts neonatal outcomes, particularly respiratory distress, abnormal birth weight, hypoglycemia, hyperbilirubinemia, and hypocalcemia.

In this cohort, 70.83% of mothers had GDM, while 29.17% had pre-GDM. A notable proportion (41.67%) had suboptimal glycemic control (HbA1c >6.5%), emphasizing the importance of strict maternal glucose management [10,11]. The majority of deliveries were by Lower Segment Caesarean Section (LSCS) (70.83%), reflecting concerns regarding fetal macrosomia and related delivery complications[12].

Neonatal Complications

Respiratory distress was the most common complication, affecting 40% of neonates. This aligns with previous studies demonstrating higher rates of respiratory morbidity in IDMs due to surfactant deficiency and delayed lung maturation [13,14]. Hypoglycemia occurred in 23.33% of neonates, consistent with the known effect of fetal hyperinsulinemia in response to maternal hyperglycemia [14]. Hyperbilirubinemia was observed in 18.33% of neonates, attributable to impaired bilirubin metabolism and increased red cell turnover [17]. Hypocalcemia was recorded in 12.5% of neonates, which may predispose to seizures, though no seizures were observed in this cohort [7,14]. Polycythemia was present in 5.83% of neonates, likely due to compensatory erythropoiesis in response to intrauterine hypoxia [18]. Although perinatal asphyxia (PNA) and birth trauma are well-recognized complications associated with macrosomia in infants of diabetic mothers, no such cases were observed in the present study[12].

Birth weight abnormalities

Most neonates (63.33%) were appropriate for gestational age (AGA), 25.83% were large for gestational age (LGA), and 10.83% were small for gestational age (SGA). LGA was slightly more frequent in neonates of mothers with GDM compared to pre-GDM, reflecting the effect of maternal hyperglycemia on fetal insulin-mediated growth [10,15]. SGA neonates were mostly born to mothers with poorly controlled diabetes, likely due to placental insufficiency[16].

Congenital anomalies

Although no congenital anomalies were observed in this study, infants of pre-GDM mothers are at higher risk of structural defects, particularly cardiac, renal, and neural tube anomalies [7,8].

GDM vs pre-GDM

In this study, immediate complications such as hypoglycemia, respiratory distress, and hypocalcemia were slightly more common in neonates of pregestational diabetic mothers, consistent with previous studies indicating higher neonatal morbidity in pre-GDM compared to GDM[8,9].

Other outcomes: All neonates were discharged alive; 92.5% were in good health, and 4.17% left against medical advice (LAMA). Macrosomia-related complications, such as perinatal asphyxia or birth trauma, were not observed in this cohort but remain established risks in IDMs [12]. These findings align with those in other scholarly works, which demonstrate that neonatal mortality and morbidity rates are elevated among

infants of diabetic mothers due to heightened risks of complications such as hypoglycemia, respiratory distress, and infections [13,19].

These findings reinforce the importance of rigorous maternal glycemic control, close monitoring of at-risk neonates for hypoglycemia, hypocalcemia, hyperbilirubinemia, and respiratory distress, and timely hospital-based interventions.

CONCLUSION

The study underscores the major risks posed by maternal diabetes and its potential impact on neonates, including increased risks of preterm birth, respiratory difficulties, and abnormal birth weights. Fortunately, the majority of infants were discharged in good health; however, this emphasizes the importance of proper management of maternal diabetes during pregnancy to help prevent complications for the infant. Future research should concentrate on enhancing prenatal care for diabetic mothers, particularly through improved blood sugar regulation and early detection of fetal growth abnormalities. Such efforts can ultimately contribute to ensuring a healthier start in life for a greater number of infants.

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CONFLICT OF INTEREST

There is no conflict of interest.

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