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Original Article

Problems and Immediate Outcome of The Infants of Diabetic Mothers - A Hospital Based Study

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ABSTRACT

Background: *Maternal diabetes, including gestational and pregestational diabetes, is a significant contributor to adverse perinatal outcomes, affecting both mothers and their infants. This study aimed to evaluate the problems and immediate outcomes of the infants of diabetic mothers.* ***Methods & Materials:*** *This was a hospital-based cross-sectional study conducted at the Department of Pediatric, Noakhali Medical College, Noakhali, Bangladesh, from January 2022 to January 2023. The study aimed to assess the impact of maternal diabetes, including gestational diabetes mellitus (GDM) and pregestational diabetes mellitus (PGDM), on neonatal outcomes. Data were entered and analyzed using the Statistical Package for Social Sciences (SPSS) version 22.0. Descriptive statistics summarized demographic and clinical characteristics, with categorical variables expressed as frequencies and percentages.* ***Result:*** *The majority of diabetic mothers (69.9%) were aged between 16 and 25 years, with gestational diabetes mellitus (54.4%) being more prevalent than pregestational diabetes mellitus (45.6%). Male infants were slightly predominant (61.2%). Intra-natal complications included birth asphyxia (21.3%) and birth trauma (10.7%), while postnatal complications like poor feeding (22.3%), hypoglycemia (21%), and hyperbilirubinemia (24%) were common. Infants of mothers with pregestational diabetes were more likely to be large for gestational age (34%) compared to those with gestational diabetes (14.3%), a statistically significant difference (p = 0.038).* ***Conclusion:*** *Maternal diabetes, particularly pregestational diabetes, strongly influences neonatal outcomes, with pregestational diabetes associated with higher rates of macrosomia and related complications. Poor feeding and infection risks further compounded neonatal morbidity.*

Keywords: *Gestational Diabetes Mellitus, Birth Asphyxia, Hypoglycemia, Hyperbilirubinemia*

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INTRODUCTION

Infants of diabetic mothers (IDMs) are at a higher risk for various metabolic and structural complications due to the effects of maternal hyperglycemia during pregnancy. The prevalence of diabetes in pregnancy, including gestational diabetes mellitus (GDM) and pregestational diabetes mellitus (PGDM), has increased globally, largely driven by rising obesity rates, delayed childbearing, and changing lifestyle patterns [1]. Maternal diabetes affects fetal development, often leading to complications such as macrosomia, neonatal hypoglycemia, respiratory distress syndrome (RDS), and congenital malformations. As such, IDMs require specialized neonatal care to manage and prevent these potential complications [2]. Globally, the incidence of diabetes in pregnancy ranges from 0.5% to 5%, with substantial variation between high- and low-income countries. The rising prevalence of obesity and lifestyle factors have been associated with the increasing number of pregnancies complicated by diabetes [1]. When maternal diabetes is poorly controlled, the risks to the neonate are significantly heightened, with complications like macrosomia and RDS becoming more frequent [3,4]. In poorly controlled diabetes, the fetus is exposed to elevated levels of glucose, which leads to fetal hyperinsulinemia. This condition, in turn, increases the likelihood of macrosomia (excessive birth weight) and various other complications like birth trauma, shoulder dystocia, and cesarean section delivery [2]. Furthermore, studies suggest that maternal hyperglycemia significantly elevates the risk for congenital malformations in IDMs [5]. Hypoglycemia is observed in approximately 30–60% of IDMs, requiring immediate intervention with glucose supplementation [6]. Additionally, IDMs are prone to hypocalcemia, which occurs in 10–43% of cases, and polycythemia, which affects up to 35% [7]. Other metabolic complications include hyperbilirubinemia, which leads to neonatal jaundice [8]. Congenital malformations are also more frequent in IDMs, with neural tube defects and cardiac anomalies being the most common [9]. The risk for these structural abnormalities is significantly higher

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compared to non-diabetic pregnancies, especially when glycemic control during the first trimester is suboptimal [10]. Studies show that good maternal glycemic control reduces the risk of these malformations, emphasizing the importance of early prenatal care [11]. Respiratory distress syndrome (RDS) is a well-known complication in IDMs due to delayed lung maturity caused by hyperinsulinemia, which interferes with surfactant production. As a result, IDMs are at an increased risk of developing RDS, especially if delivered prematurely. Timely administration of antenatal corticosteroids to mothers at risk of preterm delivery has been shown to reduce the incidence of RDS, but this remains a significant challenge in the management of IDMs [12]. Macrosomia, a condition in which the neonate has an excessive birth weight of greater than 4,000 grams, affects 15–45% of IDMs and is one of the most common challenges associated with maternal diabetes. This condition significantly increases the risk of labor complications such as shoulder dystocia, birth trauma, and cesarean section delivery [13,14]. Proactive management, including careful monitoring of fetal growth, timely induction of labor, and consideration of planned cesarean delivery, is necessary to reduce the risk of these complications. This study aimed to evaluate the problems and immediate outcomes of the infants of diabetic mothers.

METHODS & MATERIALS

This was a hospital-based cross-sectional study conducted at the Department of Pediatric, Noakhali Medical College, Noakhali, Bangladesh, from January 2022 to January 2023. The study aimed to assess the impact of maternal diabetes, including gestational diabetes mellitus (GDM) and pregestational diabetes mellitus (PGDM), on neonatal outcomes. Ethical approval was obtained from the Institutional Review Board, and informed consent was obtained from all participating mothers. The study included 103 diabetic mothers during the study period. Both gestational diabetes and pregestational diabetes cases were included, along with the neonates born to these mothers.

Inclusion Criteria:

- Pregnant women diagnosed with GDM or PGDM based on WHO criteria.
- Singleton pregnancies.
- Deliveries were conducted at the study hospital.

Exclusion Criteria:

- Pregnancies complicated by other systemic diseases (e.g., hypertension, renal disease).
- Multiple pregnancies.
- Deliveries outside the study hospital.

Data were collected prospectively using a structured questionnaire and medical records. Maternal demographic details, type of diabetes, glycemic control during pregnancy, obstetric history, and delivery information were recorded. Neonatal outcomes were assessed through clinical examination and medical documentation.

Maternal data included age, parity, type of diabetes (GDM or PGDM), antenatal glycemic control (including HbA1c levels and glucose monitoring), obstetric history, and mode of delivery. Neonatal data included birth weight (categorized as small for gestational age, appropriate for gestational age, or large for gestational age), sex, and details of perinatal complications such as birth trauma, hypoglycemia, and hyperbilirubinemia. Postnatal outcomes, including feeding patterns, infection rates, and other metabolic abnormalities, were also documented. The primary outcomes were the incidence of intra-natal complications, such as birth trauma, birth asphyxia, and congenital anomalies, and postnatal complications, including poor feeding, hypoglycemia, hyperbilirubinemia, and infections. Data were entered and analyzed using the Statistical Package for Social Sciences (SPSS) version 22.0. Descriptive statistics summarized demographic and clinical characteristics, with categorical variables expressed as frequencies and percentages. Chi-square tests were used to analyze associations between birth weight and type of diabetes.

RESULTS

Table – I: Distribution of the diabetic mothers by age (*n*=103)

Age group	n	%
<16 years	9	8.7
16-20 years	38	36.9
21-25 years	34	33.0
26-30 years	10	9.7
>30 years	12	11.7
Total	103	100.0

The table shows the distribution of the diabetic mother by age. Among the mothers, 8.7% were aged <16 years 36.9% were aged between 16-20 years, 33.0% were aged between 21-25 years, 9.7% were aged between 26-30 years, and 11.7% were aged about >30 years. [**Table I]**

Table – II: Distribution of the infants by sex (*n*=100)

Sex	n	%
Male	63	61.2
Female	40	38.8
Total	103	100.0

The table shows the distribution of the infants by sex. Out of 103 infants of diabetic mothers, 61.2% were male and 38.8% were female. [**Table II]**

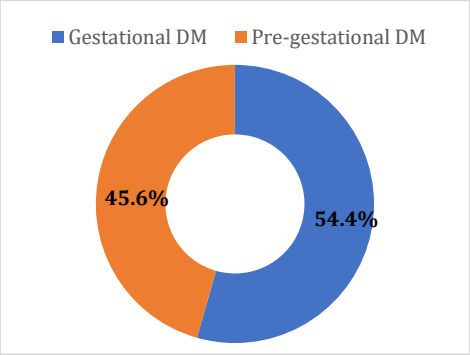

Figure – 1: Type of diabetes

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The table shows the distribution of diabetic mothers by type of diabetes. Out of 103 mothers 54.4% were diagnosed to have gestational diabetes mellitus and 45.6% had Pre-gestational diabetes mellitus.

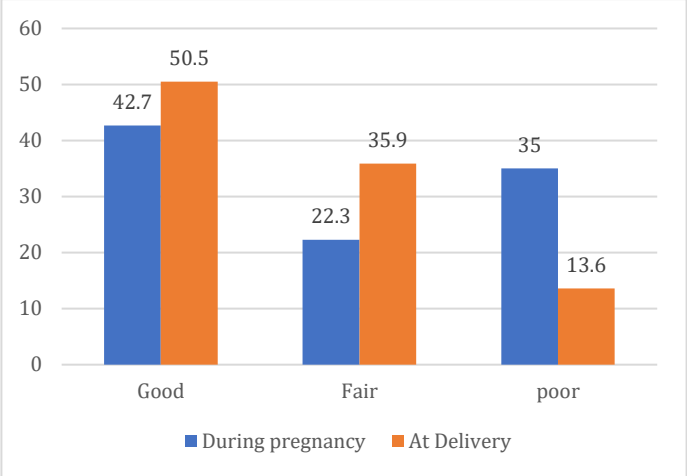

Figure – 2: Maternal glycemic control status

Figure 2 demonstrate the status of glycemic control during period of pregnancy and at delivery. During the gestational period 42.7% had good diabetic control and 22.3% had fairly controlled and 35% achieved Poor control of blood glucose. At delivery 50.5% had good glycemic control 35.9% had fair and 13.6% had good diabetic control.

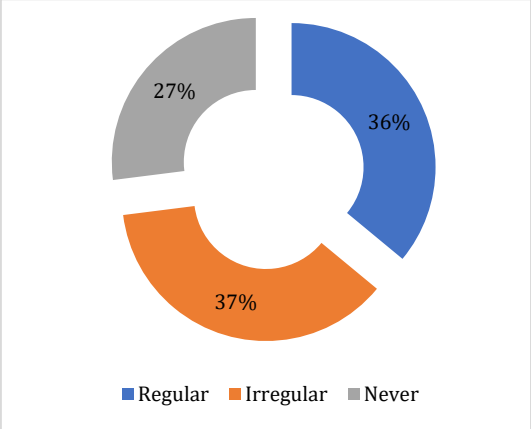

Figure – 3: Status of ANC visit

Figure illustrates the distribution of status of ante natal care visit if diabetic mother during the current pregnancy. Among the occasionally and 36% regularly attended ANC visit. Diabetic mothers 27% never paid a visit to health facility or personnel for an ante natal care, while 37% visited.

Table – III: Presence of intranatal problems (*n*=103)

Intra natal problems	n	%
Fetal distress	4	3.9
Cardiac problem	4	3.9
Congenital anomaly	3	2.9
Birth trauma	11	10.7
Birth asphyxia	22	21.3

The table shows the frequency of intra-natal problems suffered by infants of diabetic mothers through multiple responses analysis. Among the infants born to diabetic mothers, 3.9% had fetal distress and 4 cases of congenital anomaly were found. Birth trauma was experienced by 10.7% baby, 21.3% experienced birth asphyxia and 3.9% of them experienced cardiac problems. **[Table III]**

Table – IV: Mode of delivery (n=103)

Mode of delivery	Frequency	Percent
Normal Vaginal delivery	25	24.3
Assisted vaginal delivery	10	9.7
Caesarean section	68	66
Total	103	100

Table shows the distribution of mode of delivery. Out of 103 diabetic mothers 24.3% had normal vaginal delivery, 9.7% had assisted vaginal delivery and majority (66%) had Caesarean section operation for delivering the child. **[Table IV]**

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Table – V: Distribution of biological abnormality revealed by laboratory investigation (*n*=103)

Conditions	Frequency	Percent
Hypoglycaemia	21	20.4
Hyper billirubinimia	24	23.3
Polycythemia	20	19.4
Hypocalcaemia	21	20.4

Table shows the distribution of problems in infants revealed through laboratory findings. Out of 103 subjects 20.4% developed hypoglycaemia, 23.3% developed hyper billirubinimia, 19.4% developed polycythemia and 20.4% developed hypocalcaemia.

Table – VI: Distribution of Postnatal complication of infant (*n*=103)

Post-natal complications	n	%
Poor feeding	23	22.3
Umbilical sepsis	4	3.9
Septicemia	5	4.9
Fever	6	5.8
Convulsion	2	1.9

Table 8 shows the distribution of post-natal complications in infants of diabetic mothers. Out of 103 diabetic infants, 22.3% didn't feed well in the postnatal period. Among other complications 3.9% developed Umbilical sepsis, 4.9% suffered from Septicemia, 5.8% developed fever, and 1.9% convulsion. **[Table VI]**

Table – VII: Birth weight and type of diabetes (*n*=103)

Birth Weight	Type of Diabetes		Total
	Gestational diabetes mellitus	Pre-gestational diabetes mellitus	
SGA	8(14.3%)	8(17.0%)	16(15.5%)
AGA	40(71.4%)	23(48.9%)	63(61.2%)
LGA	8(14.3%)	16(34.0%)	24(23.3%)
Total	56(100.0%)	47(100.0%)	103(100%)

Chi-Square 6.517 df 2 P=.038

The table shows the cross-tabulation of the birth weight of babies for gestational age and type of diabetes. Among the infants of mothers with Gestational diabetes mellitus 8(14.3%) were Small for Corresponding gestational age, 40(71.4%) were adequate in size and 8(14.3%) were large for gestational age. In pre-gestational diabetes mellitus the 8(17.0%) were small, 23(48.9%) were average and 16(34.0%) large for corresponding gestational age. The difference is statistically significant. (Chi-square 6.517 df 2 P<.05). Infants of mothers of pre-gestational diabetes mellitus were more likely to have large bay than those with gestational diabetes. **[Table VII]**

Table – VIII: Perinatal abnormality and type of diabetes (*n*=103)

Perinatal Abnormality	Type of diabetes		Total
	Gestational diabetes mellitus	Pre-gestational diabetes mellitus	
Cardiac abnormality	3	1	4
	75.0%	25.0%	100.0%
Birth trauma	6	5	11
	54.5%	45.5%	100.0%
Hypoglycaemia	11	10	21
	52.4%	47.6%	100.0%
Birth asphyxia	11	14	25
	44.0%	56.0%	100.0%
Polycythemia	13	7	20
	65.0%	35.0%	100.0%
Hyper billirubinima	11	13	24
	45.8%	54.2%	100.0%
Hypocalcaemia	13	8	21
	61.9%	38.1%	100.0%

Table shows the distribution of the perinatal abnormality in infant of diabetic mother by type of maternal diabetes. Among these who had problems, Cardiac abnormality (75%), Polycythemia (65.0%), Hypocalcaemia (61.9%) were found more in Gestational diabetes mellitus. The proportion of Birth trauma (54.5%) and Hypoglycaemia (52.4%) were similar in two groups. However, birth asphyxia (44.0%) Hyper billirubinimia (45.8%) was found more in Pre-gestational diabetes mellitus. **[Table VIII]**

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DISCUSSION

The findings of this study highlight the significant impact of maternal diabetes, both gestational and pregestational, on neonatal outcomes. The results demonstrate a range of intra-natal and post-natal complications in infants of diabetic mothers (IDMs), emphasizing the importance of glycemic control during pregnancy to mitigate these risks. The study shows that the majority of diabetic mothers were aged between 16 and 25 years (69.9%). This observation aligns with findings in populations where pregnancies occur earlier in life, though older maternal age remains a significant risk factor for GDM, as noted in prior studies [15]. The prevalence of gestational diabetes (54.4%) versus pregestational diabetes (45.6%) in this cohort reflects the increasing incidence of GDM worldwide due to lifestyle and dietary changes [16]. A male predominance among IDMs (61.2%) was noted, consistent with some studies suggesting that male infants may be more prone to adverse outcomes related to maternal diabetes [17]. However, other studies report no significant sex differences, indicating the need for further exploration of biological and environmental interactions influencing neonatal outcomes [5]. Birth asphyxia (21.3%) and birth trauma (10.7%) were the most prevalent intra-natal complications in this study. These findings are comparable to those in studies by other authors which also report higher rates of birth asphyxia in IDMs due to macrosomia and delivery challenges [7,13]. In the study among diabetic mothers 54.4% were diagnosed to have gestational diabetes mellitus and 45.6% had Pre-gestational diabetes mellitus. Among them 24.3% had Normal Vaginal delivery, 9.7% had assisted vaginal delivery and majority (66%) had Caesarean section operation for delivering the child. The observed cardiac problems (3.9%) and congenital anomalies (2.9%) are lower than in some reports, potentially reflecting improved prenatal screening and management. Post-natal complications were common, with poor feeding (22.3%) being the most frequent. This issue is well-documented in IDMs, often linked to hypoglycemia, birth trauma, and delayed metabolic adaptation [18]. Other complications, such as sepsis (3.9–4.9%) and fever (5.8%), mirror findings from prior studies that emphasize the susceptibility of IDMs to infections due to maternal hyperglycemia's effects on immune modulation [19]. The study found that infants born to mothers with pregestational diabetes were more likely to be large for gestational age (34%) compared to those with GDM (14.3%). This aligns with research by the HAPO Study Cooperative Group, which identified a strong association between pregestational diabetes and macrosomia [15]. The observed statistical significance (p=0.038) underscores the critical role of diabetes type in determining fetal growth patterns. Perinatal abnormalities such as polycythemia (20%), hyperbilirubinemia (24%), and hypoglycemia (21%) were prominent in this cohort. These complications are well-recognized outcomes of fetal hyperinsulinemia and chronic hypoxia, as highlighted in earlier studies [20,8]. These findings emphasize the importance of personalized prenatal care, particularly for women with pregestational diabetes, who are at greater risk of delivering macrosomic infants.

Limitations of The Study

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

CONCLUSION

This study highlights the multifaceted challenges faced by infants born to diabetic mothers (IDMs), highlighting significant intra-natal and post-natal complications such as birth asphyxia, birth trauma, hypoglycemia, polycythemia, and hyperbilirubinemia. Maternal diabetes, particularly pregestational diabetes, strongly influences neonatal outcomes, with pregestational diabetes associated with higher rates of macrosomia and related complications. Poor feeding and infection risks further compounded neonatal morbidity.

RECOMMENDATION

To improve outcomes for infants of diabetic mothers (IDMs), maternal diabetes management should focus on tight glycemic control before and during pregnancy, especially in pregestational diabetes cases. Regular prenatal monitoring, early detection of fetal growth abnormalities, and timely interventions for complications like macrosomia and hypoglycemia are critical. Delivery should be planned in equipped centers with neonatal intensive care units. Post-natal care should prioritize metabolic stabilization, infection prevention, and close monitoring for feeding difficulties and other complications. Public health efforts must address education and early screening for gestational diabetes.

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