

Original Research Article**Association of Maternal Diabetes with Neonatal Hypoglycemia****Dr. Hasina Khatun^{1*}, Dr. Md. Mehedi Hasan²**¹Medical Officer, Department of Obstetrics and Gynaecology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh²Medical Officer, Sibchar Health Complex, Madaripur, Bangladesh***Corresponding Author:**

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Abstract: Background: Neonatal hypoglycemia is a common metabolic complication in infants born to diabetic mothers. The risk is influenced by the type of maternal diabetes, glycemic control during pregnancy, and neonatal birth weight. This study aimed to evaluate the incidence and associated factors of neonatal hypoglycemia in relation to maternal diabetes in a Bangladeshi population. **Methods:** This cross-sectional study was conducted on 120 mother-neonate pairs at BSMMU, Dhaka, and Sibchar Health Complex, Madaripur, from June 2015 to May 2016. Data on maternal age, gravida, residence, type of diabetes (gestational or pre-gestational), glycemic control, and neonatal birth weight were collected. Neonatal blood glucose was monitored within the first 24 hours of birth to detect hypoglycemia. Associations were analyzed using descriptive statistics and chi-square tests. **Results:** Among the neonates, 40.0% developed hypoglycemia. The incidence was significantly higher in infants born to mothers with pre-gestational diabetes (60.0%) compared to gestational diabetes (25.7%). Poor maternal glycemic control was associated with a higher rate of neonatal hypoglycemia (72.0%) than good control (17.1%). The highest rate of hypoglycemia was observed in macrosomic infants (>4.0 kg) at 85.7%, followed by normal-weight (40.6%) and low birth weight infants (20.8%). **Conclusion:** Pre-gestational diabetes, inadequate glycemic control during pregnancy, and macrosomia are strongly associated with neonatal hypoglycemia. Early diagnosis and tight glycemic control are essential to reduce the risk of neonatal complications in diabetic pregnancies.

Keywords: Neonatal hypoglycemia, gestational diabetes, pre-gestational diabetes, glycemic control, macrosomia, birth weight.

INTRODUCTION

Diabetes mellitus is among the most common metabolic diseases that complicate pregnancy, with increasing global prevalence due to lifestyle, dietary, and maternal age alterations [1]. Pre-existing (Type 1 or Type 2) or gestational diabetes mellitus (GDM) diagnosed for the first time during pregnancy maternal diabetes is a severe risk factor for both maternal and neonatal health [2]. Of the many complications in the neonate, hypoglycemia remains a major issue due to its potential impact on neurodevelopment and overall neonatal outcomes [3].

Neonatal hypoglycemia is a state of a plasma glucose level less than the normal physiological level, which can result in diverse clinical presentations ranging from jitteriness and lethargy to apnea, seizures, and even permanent neurological impairment if not early detected and treated [4]. Hypoglycemia occurs much more frequently in infants of diabetic mothers (IDMs) than in infants of non-diabetic mothers[5]. This increased risk is partly caused by fetal hyperinsulinemia, a stress reaction to chronic in utero maternal hyperglycemia. Postpartum, the sudden withdrawal of maternal glucose availability, with continued high levels of insulin, makes the neonate susceptible to sudden decreases in blood glucose levels [6].

Numerous studies have re-established that uncontrolled glycemia in pregnancy raises the rate of neonatal complications exponentially, one of which is hypoglycemia [7, 8]. Preterm birth, birth weight disorder (macro and low birth weight), delivery mode are other neonatal glucose homeostasis determinants [9]. Despite the improved diabetes control through advancements in pregnancy screening and management, newborn hypoglycemia is an all too frequent and sometimes neglected issue in low-resource health care environments [10].

Bangladesh, being an emerging country, has a twofold challenge of rising cases of diabetes with a lack of neonatal facility in peripheral perinatal care centers. If high-risk babies are not early detected and dealt with appropriately, complications may develop [11]. However, there is hardly any published work from Bangladesh assessing the relationship of maternal diabetes and neonatal hypoglycemia in urban tertiary care versus rural areas.

This study was conducted to assess the association between maternal diabetes and neonatal hypoglycemia in newborns delivered at Bangabandhu Sheikh Mujib Medical University (BSMMU), a large tertiary care center in Dhaka, and Sibchar Health Complex, a rural secondary care center in Madaripur. By conducting clinical presentation and outcomes among urban and rural populations, the study will be utilized to highlight the prevalence of neonatal hypoglycemia in diabetic pregnancies and clarify significant neonatal and maternal risk factors. Findings will be utilized to provide crucial input in streamlining perinatal guidelines for optimization, ensuring early diagnosis, and guiding hypoglycemia management in neonates born by diabetic mothers in similar low-resource settings.

METHODOLOGY & MATERIALS

This was a cross-sectional observational study done in the Department of Obstetrics and Gynaecology of Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, and Sibchar Health Complex in Madaripur from June 2015 to May 2016 for one year's duration. 120 pregnant women with gestational or pre-gestational diabetes and their infants were enrolled in the study through purposive sampling. Multiparous women, those with known congenital abnormalities, and those with severe systemic disease were excluded to decrease confounding variables.

Detailed maternal history including age, parity, duration and type of diabetes, and glycemic control during pregnancy was noted on a questionnaire. Glycemic control was assessed from antenatal blood glucose recording and HbA1c levels. All neonates of these women were closely monitored for clinical signs of hypoglycemia and had their blood glucose levels measured in the initial hour of life and then at intervals for 24 hours or as clinically necessary.

Neonatal hypoglycemia was defined as a plasma glucose level below 40 mg/dL in the first 4 hours of life or below 45 mg/dL beyond the first 4 hours. The Apgar score, gestational age, and birth weight were also collected. Infants treated for hypoglycemia received either early feeding or intravenous glucose per standard neonatal care practice.

All data were collected and recorded with informed mother consent. Ethical approval was obtained from the Institutional Review Board of BSMMU prior to the commencement of the study. Data were analyzed with SPSS version 20. Descriptive statistics were used to describe demographic and clinical variables. Chi-square tests were used to find associations between maternal diabetes-related variables and neonatal hypoglycemia, and logistic regression was used to find significant predictors. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Table 1: Demographic Characteristics of the Study Population (n = 120)

Characteristics	Category	n	%
Maternal Age (years)	<25	28	23.30%
	25–34	66	55.00%
	≥35	26	21.70%
Parity	Primigravida	52	43.30%
	Multigravida	68	56.70%
Residence	Urban	74	61.70%
	Rural	46	38.30%
Type of Diabetes	Gestational Diabetes	70	58.30%
	Pre-gestational Diabetes	50	41.70%

Table 1 shows the demographic characteristics of the study population (n = 120). The majority of mothers (55%) were between 25–34 years of age, and more than half (56.7%) were multigravida. Most participants resided in urban areas (61.7%). Gestational diabetes was more common (58.3%) than pre-gestational diabetes (41.7%) among the study subjects.

Table 2: Neonatal Hypoglycemia Incidence in Relation to Maternal Diabetes Type

Type of Diabetes	Neonatal Hypoglycemia (n/%)	No Hypoglycemia (n/%)
Gestational Diabetes	18 (25.7%)	52 (74.3%)
Pre-gestational Diabetes	30 (60.0%)	20 (40.0%)
Total	48 (40.0%)	72 (60.0%)

Table 2 presents the incidence of neonatal hypoglycemia in relation to the type of maternal diabetes. Neonatal hypoglycemia was significantly more common among infants born to mothers with pre-gestational diabetes (60%) compared to those with gestational diabetes (25.7%). Overall, 40% of the neonates developed hypoglycemia.

Table 3: Association of Neonatal Hypoglycemia with Maternal Glycemic Control

Glycemic Control During Pregnancy	Neonatal Hypoglycemia (n/%)	No Hypoglycemia (n/%)
Good Control	12 (17.1%)	58 (82.9%)
Poor Control	36 (72.0%)	14 (28.0%)
Total	48 (40.0%)	72 (60.0%)

Table 3 shows the association between maternal glycemic control during pregnancy and neonatal hypoglycemia. Neonatal hypoglycemia was significantly more frequent in mothers with poor glycemic control (72%) compared to those with good control (17.1%). This indicates a strong correlation between poor maternal glycemic control and increased risk of hypoglycemia in neonates.

Table 4: Birth Weight and Incidence of Neonatal Hypoglycemia

Birth Weight Category	Neonatal Hypoglycemia (n/%)	No Hypoglycemia (n/%)
Low Birth Weight (<2.5 kg)	10 (20.8%)	38 (79.2%)
Normal (2.5–4.0 kg)	26 (40.6%)	38 (59.4%)
Macrosomia (>4.0 kg)	12 (85.7%)	2 (14.3%)
Total	48 (40.0%)	72 (60.0%)

Table 4 illustrates the relationship between birth weight and the incidence of neonatal hypoglycemia. The highest incidence of hypoglycemia was observed in macrosomic infants (>4.0 kg), with 85.7% affected. In contrast, only 20.8% of low birth weight infants and 40.6% of normal-weight infants developed hypoglycemia.

DISCUSSION

This study evaluated the association between maternal diabetes and the incidence of neonatal hypoglycemia among 120 mother-neonate pairs. Our findings underscore significant relationships between the type of maternal diabetes, glycemic control, neonatal birth weight, and the risk of neonatal hypoglycemia.

Overall, 40.0% of neonates developed hypoglycemia, a rate that mirrors trends reported in earlier literature [12]. Notably, hypoglycemia was significantly more frequent among neonates born to mothers with pre-gestational diabetes (60.0%) compared to gestational diabetes (25.7%). This supports existing evidence that pre-gestational diabetes, with its longer duration of fetal exposure to maternal hyperglycemia, increases the risk of metabolic complications in neonates [13, 14].

Maternal glycemic control was another critical factor. Among mothers with poor glycemic control during pregnancy, 72.0% of their neonates developed hypoglycemia, compared to only 17.1% in those with good control. This marked contrast is in agreement with Durnwald et al., and González-Quintero et al., who emphasized the importance of maintaining optimal glucose levels to mitigate fetal hyperinsulinemia and subsequent neonatal hypoglycemia [15, 16]. These findings align with the recommendations by Langer et al. and Serlin et al., who advocate for proactive glycemic management to reduce neonatal complications [17, 18].

A strong association was also observed between birth weight and the risk of hypoglycemia. Neonates classified as macrosomic (>4.0 kg) had the highest incidence of hypoglycemia (85.7%), followed by those of normal birth weight (2.5–4.0 kg) at 40.6%, and low birth weight (<2.5 kg) at 20.8%. These findings echo those of Hedderson et al. and Esakoff et al., who reported that macrosomia is often a consequence of poorly controlled maternal diabetes and is closely linked to neonatal hypoglycemia due to excessive fetal insulin production [19, 20]. The Hyperglycemia and Adverse Pregnancy Outcome (HAPO) study also highlighted the dose-dependent effect of maternal hyperglycemia on birth weight and neonatal metabolic disturbances [21].

This pathophysiological basis is well-documented: maternal hyperglycemia stimulates fetal pancreatic β -cell hyperplasia, resulting in fetal hyperinsulinemia. At birth, with the abrupt cessation of maternal glucose supply but continued high insulin levels, neonates are vulnerable to hypoglycemia [12].

These results underscore the need for early detection, intensive glycemic control, and individualized management strategies for pregnant women with diabetes. Effective interventions, including diet, insulin or oral hypoglycemic agents, and close monitoring, have shown to significantly reduce adverse neonatal events [17, 22].

From a public health standpoint, these findings highlight the importance of strengthening prenatal care, especially in lower-resource settings like Bangladesh. Increased access to diagnostic services, regular antenatal follow-ups, and diabetes education programs are essential to reduce the burden of neonatal hypoglycemia and improve maternal-neonatal outcomes [18, 23].

Limitations of the Study

Despite the robust associations observed, our study had limitations. Being hospital-based and conducted in selected centers, the results may not be generalizable to the wider population. Additionally, we did not evaluate long-term neurodevelopmental outcomes of hypoglycemic neonates, which could be an area for future research.

CONCLUSION

In conclusion, our study reinforces that neonatal hypoglycemia is significantly associated with pre-gestational diabetes, poor maternal glycemic control, and fetal macrosomia. These findings stress the importance of early diagnosis, meticulous glucose monitoring, and appropriate therapeutic interventions in diabetic pregnancies to improve neonatal outcomes. Comprehensive diabetes care during pregnancy remains a cornerstone in reducing the burden of neonatal complications and ensuring better maternal and neonatal health outcomes.

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