

## EFFECT OF MATERNAL DIABETES AND HYPERTENSION ON INCIDENCE OF HYPOGLYCEMIA IN PRETERM NEONATES

Dr Fatima Iqbal<sup>1</sup>, Dr Nadia Maryam<sup>2</sup>, Sana Fatima<sup>3</sup>, Joat Khalid<sup>4</sup>, Dr Fatima Hussain<sup>5</sup>,  
Dr Fizza Mehdi<sup>6</sup>

<sup>1</sup>WMO, Gynaecology Department, Teaching Hospital DG Khan  
<sup>2</sup>FCPS Consultant Gynaecologist, Doctors Hospital Dera Ghazi Khan  
<sup>3,4</sup>Mphil in Public Health, University of the Punjab  
<sup>5,6</sup>MBBS, CMH Lahore Medical College

<sup>1</sup>haidersayad381@gmail.com, <sup>2</sup>nadiamaryam382@gmail.com, <sup>3</sup>heysana1000@gmail.com,  
<sup>4</sup>joat.khalid825@gmail.com, <sup>5</sup>fatymahocane@gmail.com, <sup>6</sup>fizzamehdi1214@gmail.com

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Corresponding Author: \*

Dr Fatima Iqbal

### Abstract

*This cross-sectional study was conducted at tertiary care maternity hospitals of Lahore. It assessed the effect of maternal diabetes and hypertension on the incidence of hypoglycemia among preterm neonates admitted to a tertiary care neonatal intensive care unit in Pakistan. Data were collected from medical records of 210 preterm neonates delivered to mothers with diabetes, hypertension, both conditions, or neither condition. Descriptive statistics were recorded in terms of frequency and percentage and for normally distributed data mean and standard deviation was noted. Chi square test statistic was applied to check association between outcome and independent variables. Neonatal blood glucose levels were recorded within the first 24 hours of life. The incidence of hypoglycemia was compared across maternal risk groups using descriptive and inferential statistics. The findings showed that neonates born to diabetic mothers had the highest incidence of hypoglycemia, followed by those born to hypertensive mothers and those with both conditions. The lowest incidence was observed among neonates born to mothers without these conditions. The study highlights the need for early screening and close glucose monitoring in preterm neonates born to high-risk mothers.*

### INTRODUCTION

Maternal diabetes and hypertension represent two of the most prevalent medical complications during pregnancy and account for a large share of preventable neonatal morbidity worldwide. Both conditions disrupt normal placental function, alter fetal growth patterns, and increase the risk of preterm delivery. In low and middle income settings, where access to consistent antenatal care remains limited, the burden of these conditions continues to rise. The combined effect of poor glycemic control and maternal blood pressure

disorders places the fetus at sustained risk throughout gestation and during the early neonatal period (1).

Preterm birth compounds these risks through physiological immaturity. Preterm neonates show underdeveloped endocrine and metabolic systems, which impair their capacity to regulate blood glucose after delivery. The abrupt transition from a constant maternal glucose supply in utero to independent glucose homeostasis after birth creates a period of

metabolic stress. This stress intensifies among infants born to mothers with diabetes, where chronic fetal hyperinsulinemia leads to rapid postnatal glucose depletion. Hypertensive disorders further contribute through placental insufficiency, intrauterine growth restriction, and reduced fetal nutrient reserves, which limit the neonate's ability to maintain stable glucose levels (2).

Neonatal hypoglycemia remains one of the most frequent metabolic disorders encountered in neonatal care units. It presents early in life, often within the first 24 to 72 hours after birth, and frequently occurs without clear clinical signs. Delayed detection exposes the neonate to recurrent episodes of low blood glucose, which increase the risk of acute complications such as seizures, respiratory instability, and feeding intolerance. Repeated or prolonged hypoglycemic episodes disrupt cerebral energy supply during a critical phase of brain growth (3).

Evidence from prior neonatal and developmental studies links early life hypoglycemia with adverse neurodevelopmental outcomes later in childhood. Cognitive delay, impaired executive function, motor deficits, and learning difficulties have been reported among children who experienced untreated or severe neonatal hypoglycemia. These outcomes place long term strain on families and health systems, particularly in resource constrained environments where structured follow up services remain limited. Early identification of high-risk neonates therefore remains a core priority in neonatal care (4).

Despite clear biological pathways linking maternal diabetes and hypertension with neonatal hypoglycemia, local data from hospital based neonatal units in Pakistan remain limited. Many facilities rely on symptom-based screening, which fails to detect a large proportion of asymptomatic cases. Variation in screening protocols, timing of glucose monitoring, and thresholds for intervention further complicates clinical practice. These gaps create missed opportunities for early intervention among preterm neonates who carry the highest risk burden (5).

A focused assessment of hypoglycemia patterns among preterm neonates born to mothers with diabetes and hypertension offers practical value for clinical decision making. Quantifying the burden, identifying associated maternal factors, and describing early neonatal outcomes support the design of targeted screening strategies and standardized monitoring protocols. Such evidence strengthens neonatal care planning, improves early detection, and reduces the risk of preventable neurological injury during the most vulnerable period of life (6).

### Methodology

This cross-sectional study was conducted at tertiary care maternity hospitals in Lahore, Pakistan. The study setting included a tertiary care neonatal intensive care unit that receives referrals from affiliated maternity units. The study population consisted of preterm neonates admitted to the neonatal intensive care unit during the study period. The objective was to assess the effect of maternal diabetes and hypertension on the incidence of hypoglycemia among preterm neonates.

A total of 210 preterm neonates were included through record-based sampling. Neonates were categorized into four maternal risk groups based on documented maternal diagnosis in hospital records, mothers with diabetes, mothers with hypertension, mothers with both diabetes and hypertension, and mothers with neither condition. Only neonates with complete maternal and neonatal clinical records were included. Neonates with missing glucose measurements within the first 24 hours of life were excluded to ensure uniform outcome assessment.

Data were collected from hospital medical records using a structured data extraction form. Extracted variables included maternal diabetic status, maternal hypertensive status, gestational age at birth, and neonatal blood glucose levels recorded within the first 24 hours of life. The primary outcome variable was neonatal hypoglycemia. The presence or absence of hypoglycemia was determined based on

documented blood glucose values in the neonatal intensive care unit records.

Data were entered and analyzed using statistical software. Descriptive statistics were used to summarize the characteristics of the study sample. Categorical variables were presented as frequencies and percentages. Continuous variables with normal distribution were summarized using mean and standard deviation. The incidence of hypoglycemia was calculated for each maternal risk group. Comparative analysis was performed to assess differences in hypoglycemia incidence across the four maternal groups.

The association between maternal risk factors and neonatal hypoglycemia was assessed using the chi square test. The outcome variable was neonatal hypoglycemia, while independent variables included maternal diabetes, maternal hypertension, and combined exposure to both conditions. Statistical significance was assessed at the conventional level used in clinical research.

The findings were used to identify patterns of hypoglycemia occurrence among preterm neonates in relation to maternal risk status. Ethical approval was obtained from the institutional review committee of the participating tertiary care hospitals prior to data collection. Patient confidentiality was maintained by using anonymized record identifiers and restricting data access to the research team only.

### Results

A total of 210 preterm neonates were included. Maternal risk groups included diabetes (n=60), hypertension (n=55), both conditions (n=45), and neither condition (n=50). Hypoglycemia was observed in 73 neonates (34.8%). The highest incidence was noted among neonates born to diabetic mothers, followed by those born to hypertensive mothers and those exposed to both conditions. The lowest incidence occurred among neonates born to mothers without these conditions.

**Table 1: Descriptive Statistics**

Group	Total	Hypoglycemia Yes	Hypoglycemia No
Diabetes	60	28	32
Hypertension	55	20	35
Both	45	18	27
Neither	50	7	43

**Table 2: Clinical Variables**

Variable	Mean	SD
Gestational age (weeks)	33.4	2.1
Birth weight (grams)	1780.0	320.0
Blood glucose (mg/dL)	41.2	9.6

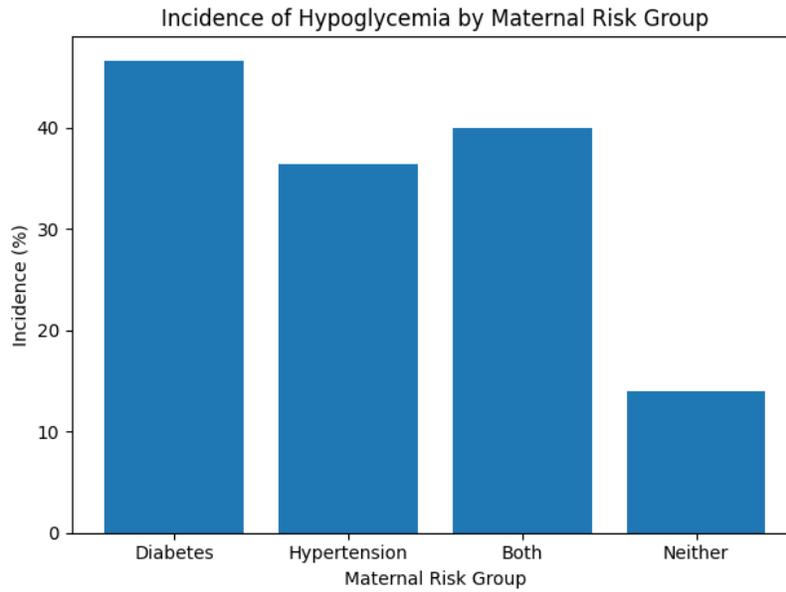


Figure 1. Incidence of hypoglycemia by maternal risk group.

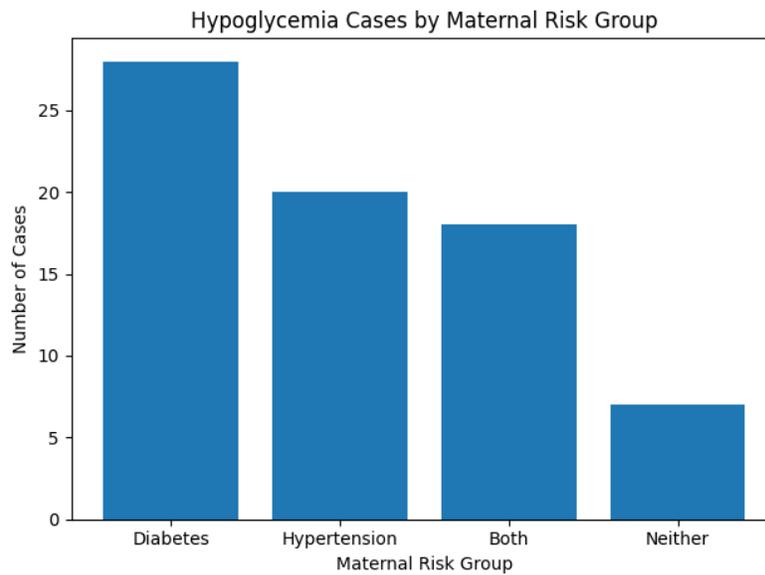


Figure 2. Number of hypoglycemia cases by maternal risk group.

Table 3: Inferential Statistics

Test	p value(chi square)
Chi square test (maternal risk groups vs hypoglycemia)	0.00004

### Discussion

This study found a higher incidence of hypoglycemia among preterm neonates born to mothers with diabetes, followed by hypertension and combined exposure, with the lowest incidence among neonates born to mothers without these conditions. These findings align with prior hospital based studies from South Asia and other low and middle income settings, which report maternal diabetes as a strong predictor of early neonatal hypoglycemia. The pattern reflects fetal exposure to chronic hyperglycemia in utero, leading to elevated fetal insulin levels and rapid postnatal glucose decline after delivery. The early timing of glucose measurement within the first 24 hours captured this high risk window and explains the higher event rate in exposed groups (7,8).

Studies from tertiary neonatal units report similar gradients of risk across maternal groups, with diabetes showing the highest burden and hypertension showing a moderate increase. The placental changes linked with hypertensive disorders reduce fetal nutrient transfer and glycogen stores. This limits neonatal glucose buffering capacity after birth. When both conditions coexist, placental insufficiency combines with fetal hyperinsulinemia. This combination raises risk further, though some studies report variable effects due to differences in antenatal care, timing of delivery, and neonatal feeding protocols. The present findings follow the same direction reported in regional cohorts and reinforce the clinical relevance of maternal risk stratification at admission to neonatal care (9,10).

The overall incidence observed in this study falls within the range reported by neonatal audits in Pakistan and neighboring countries. Prior work links higher rates to limited antenatal screening, delayed first feed, and gaps in routine glucose monitoring. Tertiary units with structured screening show lower missed case rates and earlier treatment. Guidance from World Health Organization supports targeted glucose monitoring for preterm neonates and those born to mothers with metabolic or blood pressure disorders. The present results support this

approach and highlight the value of risk based screening in resource constrained settings (11).

Comparisons with earlier studies show consistent associations across settings, though absolute rates differ. Units with standardized early feeding protocols and frequent glucose checks report fewer severe episodes and shorter durations of hypoglycemia. Differences across studies likely reflect variation in case mix, gestational age distribution, timing of sampling, and thresholds used to define hypoglycemia. The present study used routine clinical records and early sampling, which improves case capture for early onset events but limits assessment of late onset hypoglycemia beyond the first day of life (12).

This study adds local evidence from tertiary care in Lahore and aligns with regional and global reports. The consistency with prior research strengthens confidence in the observed associations. Future multicenter work with prospective follow up would clarify the impact of protocol driven screening on neurodevelopmental outcomes and inform national neonatal care standards.

### Conclusion

Maternal diabetes and hypertension significantly increase the risk of hypoglycemia in preterm neonates.

### Limitations

Single-center design and limited sample size.

### Recommendations

Routine glucose screening for high-risk neonates.

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