

Comparison of Metabolic and Haematological Profile of Infants Born to Gestational and Pregestational Diabetic Mothers: A Hospital Based Study

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Abstract

Background: The most prevalent metabolic condition that makes pregnancy more difficult is diabetes mellitus. Complications during the early newborn period are common in infants of diabetes mothers (IDMs). The purpose of the study was to characterize and contrast the metabolic and hematological parameters of newborns born to mothers with gestational diabetes mellitus (GDM) and pregestational diabetes mellitus (PGDM).

Methods: From August 2025 to July 2026, the hospital-based prospective study was carried out at the pediatrics department of Darbhanga Medical College and Hospital in Laheriasarai, Bihar. In order to conduct pertinent biochemical and hematological investigations, blood samples were obtained.

Results: Of the 68 newborns, 38.2% came from mothers with PGDM and 61.8% from mothers with GDM. With regard to GDM, 33.3% were Large for Gestational Age (LGA), 4.8% were Small for Gestational Age (SGA), and 61.9% were Appropriate for Gestational Age (AGA). 53.8% of infants with PGDM and 71.4% of neonates with GDM experienced hypoglycemia. 69.2% of newborns with PGDM and 47.6% of newborns with GDM had hypocalcemia. Neonates born to women with GDM had considerably higher rates of hypoglycemia, polycythemia, and hyperbilirubinemia (p values 0.01, 0.02, and <0.001, respectively), whereas neonates born to mothers with PGDM had significantly higher rates of hypocalcemia (p value 0.02).

Conclusion: Compared to infants with PGDM, neonates with GDM had significantly higher rates of hypoglycemia, polycythemia, and hyperbilirubinemia; however, newborns with PGDM had significantly higher rates of hypocalcemia.

Keywords: Gestational diabetic mother (GDM), Hypoglycemia, Hypocalcemia, Hyperbilirubinemia, Polycythemia, Pregestational diabetic mother (PGDM).

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Introduction

The most frequent health issue during pregnancy is diabetes mellitus (DM). It is a long-term metabolic condition brought on by either absolute or relative insulin insufficiency or peripheral tissue resistance to insulin's effects.[1] Pregnant women are classified as either gestational diabetic mothers (GDM) or pregestational diabetic mothers (PGDM), depending on whether they were diagnosed with diabetes before to becoming pregnant.[2]

Diabetes mellitus complicates 1–14% of pregnancies, with GDM accounting for 90% of these cases.[1] GDM often manifests in the second trimester of pregnancy (24–28 weeks), while mothers who are more susceptible may have symptoms earlier. According to the World Health

Organization (WHO), the prevalence of diabetes would rise by 35% globally between 1995 and 2025.[3] Additionally, Asian women have the highest prevalence of GDM, with up to 17% of them at risk compared to 4% of European and white American women.[4,5] The 7th International Diabetes Federation Diabetes Atlas from 2015 states that 20.9 million (16.2%) live births had hyperglycemia during pregnancy, with GDM accounting for an estimated 85.1% of those cases.[6]

IDMs are susceptible to a number of hematological and metabolic problems, including polycythemia and hyperbilirubinemia, as well as hypoglycemia and hypocalcemia. Pregnant women with diabetes now have better outcomes thanks to the

development of insulin and oral hypoglycemic medications, but abnormal fetal metabolism during pregnancy compounded by maternal diabetes mellitus causes a number of neonatal sequelae, such as abnormalities of growth, cardiorespiratory function, bilirubin metabolism, and congenital anomalies.[7]

Higher maternal serum glucose during pregnancy causes higher fetal serum glucose. Fetal hyperglycemia causes pancreatic stimulation and subsequent fetal islet cell hyperplasia because insulin cannot pass through the placenta.[8] Neonatal hypoglycemia is caused by the abrupt disruption of glucose supply experienced by newborns of diabetic mothers (GDM & PGDM) during the postpartum period, which is coupled with elevated neonatal insulin levels. Neonatal hypoglycemia's impact on the developing brain raises serious concerns because it may cause long-term harm.[9] Brain dysfunction and delayed motor development are known to be linked to hypoglycemia.[10] As a result, hypoglycemia is directly linked to newborn death and occasionally to long-term illness, both of which are readily avoided if identified early in life.

Up to 50% of IDM (GDM & PGDM) cases have been observed to have neonatal hypocalcemia.[11] Prematurity, birth asphyxia, reduced placental transfer of calcium due to significant maternal urine excretion of calcium, decreased neonatal production of PTH, and limited intake and impaired absorption of ingested calcium are among the multifactorial causes of hypocalcemia.[12] Maternal hypomagnesemia and subsequent fetal hypomagnesemia may be somewhat linked to transient neonatal hypocalcemia, which has been primarily observed in neonates of pregestational insulin-dependent diabetic mothers. Since the neonates' calcium concentration was inversely correlated with the mother's HbA1c levels, the degree of hypocalcemia also seemed to be correlated with the severity of the mother's diabetes.[13]

Neonates with both GDM and PGDM are susceptible to polycythemia and potentially hyperviscosity syndrome. Research indicates that prenatal oxygen availability may be impacted by fetal hyperinsulinemia and fluctuations in fetal glucose concentrations, perhaps leading to an increase in erythropoiesis.

Due in part to their propensity for large red cell mass, IDMs (GDM & PGDM) are quite likely to have hyperbilirubinemia [14].

Although both GDM and PGDM newborns frequently have metabolic and hematologic problems, opinions differ. Some authors found that newborns with GDM had a greater incidence of

these anomalies, while other authors found that infants with PGDM had a higher incidence. Infants with gestational diabetes mellitus have a hypoglycemia incidence of 12.9% to 59.4%, while infants with PGDM had an incidence of 14.5% to 42%.[15–17] Fetal hyperinsulinism and severe hypoglycemia would likely be avoided if moms with PGDM maintained appropriate glycemic control since they were diagnosed before becoming pregnant and were informed about potential pregnancy problems.

Hypocalcemia affects 24% to 25% of newborns with PGDM and 6.7% to 17.4% of moms with gestational diabetes [16, 17]. Infants with GDMs had an incidence of polycythemia ranging from 25.8% to 49.2%, whereas those with PGDMs have an incidence of 9.5 to 11.5%.18,20 Hyperbilirubinemia affects 29% to 33.3% of newborns with PGDM and 31.8% to 49.3% of women with gestational diabetes [16,17].

Numerous studies have been conducted worldwide to examine the metabolic and hematological profiles of infants of diabetes mothers; however, there is a dearth of information on these profiles in infants of GDM and PGDM diabetic moms in Bangladesh. In order to lower neonatal mortality and morbidity, the current study compares the metabolic and hematological profiles of newborns born to diabetic mothers.

Materials and Methods

From August 2025 to July 2026, a prospective observational study was carried out in the pediatrics department of Darbhanga Medical College and Hospital in Laheriasarai, Bihar. The study comprised sixty-eight infants admitted to the pediatrics department and born to moms with diabetes. By obtaining a history and reviewing prior records, infants with GDM and PGDM were classified. The study excluded neonates of diabetic mothers with pregnancy-induced hypertension (preeclampsia) or eclampsia, as well as neonates of diabetic mothers with medical problems such as chronic heart disease and chronic kidney disease.

Informed written consent was obtained from parents/caregivers prior to enrollment of their babies in the study. Status of glycemic control of mother was determined by taking history. Of all neonates included in the study, detailed examination was performed by the on-duty medical officer at the time of admission and then daily during hospital stay and finally at time of discharge from hospital. Birth weight of each baby was recorded by digital baby weighing scale and gestational age was calculated from New Ballard's gestational scoring chart, subsequently they were grouped as Appropriate for Gestational Age (AGA), Large for Gestational Age (LGA) and

Small for Gestational Age (SGA) by plotting their weight and gestational age on Lubchenco charts. Immediately after admission all neonates underwent investigations like complete blood count, metabolic profile including blood sugar, serum calcium. Wherever indicated, serum bilirubin, X-ray chest, ABG analysis & hematocrit was done on need basis. Blood sugar was done immediately after admission and then 6 hourly for 1st 24 hours of life followed by 12 hourly upto 72 hours of life. Blood sugar was done by Glucostick method & any abnormal values if found were sent to laboratory of DMCH for confirmation by glucose oxidase method. If any abnormality was found, it was managed as per unit protocol.

Hypoglycemia was defined as blood glucose level below 2.6 mmol/l, while hypocalcemia was defined as a total serum calcium concentration below 7 mg/dl.[18] Polycythemia was defined as venous hematocrit level 65% or more and hyperbilirubinemia was defined according to Consensus based bilirubin threshold chart for management of hyperbilirubinemia.[18] All data

was recorded systematically in preformed data collection form and quantitative data was expressed as mean and standard deviation and as numbers (%) for categorical data. Statistical analyses of the results were obtained by using window based computer software devised with Statistical Packages for Social Sciences (SPSS-23). Statistical tests for significance of difference were done using Chi square test. A 'p' value <0.05 was considered as significant.

Results

Mothers with GDM accounted for 61.8% (42/68) of the 68 newborns of diabetes mothers admitted during the study period, while mothers with PGDM accounted for 38.2% (26/68).

Males made up the majority of the neonates (55.9%) in the study. Of the neonates, 79.4% (54/68) were delivered via lower segment cesarean section. 58.8% of the mother's glycemic control was achieved with medication (Insulin and OHA). Term neonates made up the majority (76.5%). [Table 1].

Table 1: Baseline characteristics of infants of diabetic mother (n=68)

Characteristics	No. of cases	Percentage
Diabetic status of mother		
• GDM	42	61.8%
• PGDM	26	38.2%
Gender of Neonates		
• Male	38	55.9%
• Female	30	44.1%
Mode of delivery		
• NVD	14	20.6%
• LSCS	54	79.4%
Glycemic control of mother		
• Diet and exercise	28	41.2%
• Drug	40	58.8%
Gestational age		
• Term	52	76.5%
• Preterm	16	23.5%

In case of GDM 4.8% were SGA, 61.9% were AGA and 33.3% were LGA. In case of PGDM the proportion of SGA, AGA and LGA were 15.4%, 61.5% and 23.1% respectively. (Table 2)

Table 2: Frequency of neonates based on weight for gestational age (n=68)

Diabetic status of mother (n=68)	Small for gestational age (SGA)	Appropriate for gestational age (AGA)	Large for gestational age (LGA)
	Number (%)	Number (%)	Number (%)
GDM(42/68)	2(4.8%)	26(61.9%)	14(33.3%)
PGDM(26/68)	4(15.4%)	16(61.5%)	6(23.1%)

Table 3: Distribution of metabolic abnormalities in IDMs (n=68)

Metabolic abnormality	Diabetic status of mother (n=68)	Number (%)	P value
Hypoglycemia	GDM(n=42)	30(71.4%)	0.01*
	PGDM(n=26)	14(53.8%)	
Hypocalcemia	GDM(n=42)	20(47.6%)	0.02*
	PGDM(n=26)	18(69.2%)	

*Chi square test was done to measure the level of significance

Hypoglycemia was the most common metabolic abnormality seen in 71.4% (30/42) of neonates with GDM and 53.8% (14/26) of neonates with PGDM. 47.6% (20/42) of neonates with GDM and 69.2% (18/26) of neonates with PGDM had other metabolic abnormalities, such as hypocalcemia.

Neonates born to women with GDM had a considerably greater incidence of hypoglycemia (p value 0.01), while those delivered to mothers with PGDM had a significantly higher incidence of

hypocalcemia (p value 0.02) (Table III). 33.3% (14/42) of newborns with GDM and 23.1% (6/26) of newborns with PGDM had polycythemia, while 66.7% (28/42) of newborns with GDM and 38.5% (10/26) of newborns with PGDM had hyperbilirubinemia.

Infants of mothers with GDM had significantly higher rates of polycythemia and hyperbilirubinemia (p values 0.02 and <0.001, respectively) (Table 4).

Table 4: Distribution of hematological abnormalities in IDMs

Hematological abnormality	Diabetic status of mother (n=68)	Number (%)	P value
Polycythemia	GDM (n=42)	14 (33.3%)	0.02*
	PGDM (n=26)	6 (23.1%)	
Hyperbilirubinemia	GDM (n=42)	28 (66.7%)	<0.001*
	PGDM (n=26)	10 (38.5%)	

*Chi square test was done to measure the level of significance

Discussion

Maternal and neonatal morbidity and mortality have long been linked to diabetes.[19] The metabolic and hematological profiles of IDMs were examined in this study. Significant variations in the outcomes for neonates were discovered when these factors were examined between IGDMs and IPGDMs. The number of neonates born by cesarean section was somewhat greater than those reported in earlier research since the majority of cesarean sections were performed on an emergency basis due to obstetric causes.[20, 21]

The majority of these newborns were appropriate for their gestational age and were delivered at term. Similar findings were found in the study by Mahmood CB et al. [18]. In contrast, the percentage of preterm births was higher in the study by Ranade et al., most likely as a result of the inclusion of all diabetic mothers with coexisting medical conditions such as PIH, chronic heart disease, and renal disease.[22]

The frequency of hypoglycemia was considerably higher in IGDM in the current investigation. This finding contrasted with previous research showing that IPGDMs had a higher incidence of hypoglycemia.[15,16] The majority of PGDM moms in the current study had good glycemic control, which likely avoided fetal hyperinsulinism and severe hypoglycemia. Mothers with PGDM may have had better glycemic control since they were diagnosed prior to becoming pregnant and were informed about potential pregnancy problems and neonatal outcomes, which allowed for stringent glycemic control with frequent follow-up. It is also noteworthy that the majority of hypoglycemia newborns in the current study did not exhibit any symptoms, most likely as a result of frequent feedings being introduced early. Babies born to moms using PGDM had a significantly greater

frequency of hypocalcemia in the current study. This could be because PGDMs with poor diabetes control excrete a significant amount of calcium in their urine, which reduces placental transfer of calcium. NiliFirouzeh et al.'s study revealed a similar finding [16].

66.7% of newborns with GDM and 38.5% of newborns with PGDM experienced neonatal jaundice (hyperbilirubinemia); all of these infants received phototherapy, with the exception of one instance that needed a double volume exchange transfusion. Similarly, 23.1% of newborns with PGDM and 33.3% of newborns with GDM had polycythemia, both of which were asymptomatic. According to Deorari AK et al.'s examination of 263 kids born to moms with diabetes, 11% of the neonates had polycythemia.[22]

Polycythemia and hyperbilirubinemia were considerably more common in IGDMs in the current investigation.

The study done by Mohsin et al. revealed a similar finding [17]. However, these results contradict the research conducted by Deorari AK et al. and Firouzeh N et al., who found no statistically significant differences between the two groups.[22, 23]

Conclusion

The risk of developing metabolic and hematological problems is still very significant for infants born to mothers with diabetes. The most prevalent biochemical abnormalities are still hypoglycemia and hypocalcemia, which are followed by hematological abnormalities including polycythemia and hyperbilirubinemia. GDM continues to be a significant factor in pregnancies complicated by diabetes. While the incidence of hypocalcemia was significantly higher in neonates with PGDM than in those with GDM, the

frequency of hypoglycemia, polycythemia, and hyperbilirubinemia was significantly higher in newborns with GDM. For neonates delivered to diabetic moms to have better outcomes, adequate glucose control both before and during pregnancy is essential.

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