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Research Article

Association of Serum Calcium and Magnesium Levels in Infants Born to Early and Late Onset Gestational Diabetic Mothers Admitted In Tertiary Care Hospital

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ABSTRACT
Background: Gestational diabetes mellitus (GDM) is significant health concerns affecting maternal and neonatal outcomes worldwide, babies born to mothers with gestational diabetes are at increased risk of metabolic imbalances, like hypoglycemia, hypocalcaemia and hypomagnesaemia. Adequate levels of serum calcium and magnesium are crucial for various physiological functions, including bone development, muscle function, and neuromuscular stability in newborns. Studies suggest that gestational diabetes may impact these mineral levels in infants, potentially leading to complications such as hypocalcaemia and hypomagnesaemia.
Objective: This study aims to compare serum magnesium levels and its association with serum calcium level in infants born to mothers with early GDM and late GDM, providing insights into the impacts of maternal diabetes on newborns.
Methodology: This retrospective cohort study was conducted at the jjm medical College Davangere . Total 105 infants within 72 hours of birth were selected from the pediatrics departments. Serum levels of magnesium and calcium were measured. Data were analyzed using t-tests and chi-square tests to assess differences between infants of late onset GDM and early onset GDM mothers and to understand correlation between these two parameters in IDMs.
Results: The study revealed that hypomagnesaemia and hypocalcaemia were higher in infants of PGDM mothers compared to GDM mothers. Association of hypomagnesaemia and hypoglycemia were significant in early GDM infants than in late GDM infants (90% vs. 35.29% p=0.001, 60% vs. 43.1% p=0.010).
Conclusion: Infants of early onset GDM mothers are at a higher risk of hypomagnesaemia and hypocalcaemia. In order to improve neonatal outcome of those admitted in NICU, these findings help in the individualized and timely prenatal care depending on the type of maternal diabetes

Keywords: Gestational Diabetes Mellitus, Early Onset-Gestational Diabetes Mellitus, Hypomagnesaemia, Hypocalcaemia, Infant Of Diabetic Mother.

INTRODUCTION

Gestational diabetes mellitus (early onset and late onset) is significant health concerns in developing countries like India. These conditions along with maternal health also have profound complications in newborn. One of the key areas of interest in neonatal health is the role of micronutrients, such as magnesium and calcium, which are critical for many physiological functions, including neuromuscular activities, bone development, and enzyme reactions. Magnesium deficiency has been linked to various metabolic disorders, and its status in infants born to mothers with GDM warrants investigation (1-4)

Diabetes affects millions of people worldwide. It is also one of the most common pregnancy complications. Diabetes first detected at any time during pregnancy is classified as gestational diabetes mellitus. Although the incidence of both gestational diabetes mellitus and pregestational diabetes mellitus is rising, gestational diabetes mellitus is much more common than pregestational diabetes mellitus.(5)

Gestational diabetes mellitus accounts for 85% of diabetes in pregnancy, while the remaining are due to pregestational diabetes mellitus. Maternal diabetes is a significant risk factor for

preterm birth. It is also associated with adverse fetal, maternal and perinatal outcomes.

Magnesium and calcium plays an essential role in fetal growth, with magnesium being vital for enzyme function and neuromuscular regulation, and calcium being critical for bone formation and cardiovascular health. The reference range for serum magnesium in newborns typically falls between 0.65 to 1.05 mmol/L (1.58 to 2.55 mg/dL), and for calcium, the normal serum levels range from 2.1 to 2.7 mmol/L (8.5 to 10.8 mg/dL). When serum magnesium levels fall below 0.65 mmol/L, this is considered hypomagnesaemia, while hypocalcaemia is defined by serum calcium levels below 2.1 mmol/L. Both these deficiencies, if present in newborns, can lead to complications such as neuromuscular irritability, seizures, and cardiovascular issues (5-8).

Diabetes during pregnancy alters maternal and fetal metabolism, which may influence the transfer of essential nutrients, including magnesium, calcium and other nutrients, from mother to fetus. In GDM, blood glucose levels rise during pregnancy due to insulin resistance can impact the nutritional status of the infant, potentially leading to imbalances in vital minerals. Since magnesium and calcium are crucial for fetal development, their deficiencies lead to serious complications (9-12), including an increased risk of neurological and metabolic disorders in infants. Several studies have indicated that infants born to mothers with diabetes, particularly those with poorly controlled blood sugar levels, may experience altered levels of these critical micronutrients

However, the relationship between maternal diabetes and serum magnesium and calcium levels in newborns required more research, but maternal malnutrition and limited healthcare access may further exacerbate these issues. Investigating these relationships could provide valuable information in improving maternal and neonatal outcomes in area where diabetes is prevalent, highlighting the need for better prenatal care and monitoring of micronutrient levels to reduce neonatal complications(14).

Now Advances in maternal and fetal care have improved the outlook of the infant of a diabetic mother (IDM) to the point at which most pregnant women with diabetes can expect to deliver a healthy child.

METHODOLOGY

This study was conducted in the Department of pediatrics, JJM medical college davangere from March 2021 to October 2022. From the admitted patients of department of pediatrics, davangere, around 105 newborns were selected aged within 72 hours of birth, according to inclusion and exclusion criteria. Data Collection Technique According to inclusion criteria. A structural questionnaire was filled up for each IDM after taking informed written consent from their guardian. Detail socioeconomic, maternal medical and diabetic status, drug, obstetrical and neonatal birth history were recorded. Infant's serum magnesium and calcium level were estimated in the laboratory of medical college.

At first blood was collected from the infants within 48-72 hours of birth in plain test tube to estimate serum magnesium and calcium level. Blood was transported to the laboratory immediately after collection and immediately measured serum magnesium and calcium in Auto analyzer in laboratory of medical college hospital. Statistical Analysis For comparison of characteristics, mean with standard deviation of serum magnesium and calcium were determined. Chi-square test was done to see any association between IPGDM and IGDM. All statistical tests were considered significant at the level of ($p \leq 0.05$) was considered as test of significance. Statistical analysis was performed with the help of software SPSS (statistical package for social science) for windows, 17 version.

RESULTS

The total numbers of participants were 105. Among them, 19% infant of early GDM mother and 81% were of lateGDM mother. 62.9% were male and 37.1% were female.

Table 1
Variable Frequency Percentage
IDM early onset 20 19%
IDM late onset 85 81%
Total 105 100

Variable	Frequency	Percentage	
IDM early onset	20	19%	
IDM late onset	85	81%	
Total	105	100	

Table 2
Variable Early onset GDM Late onset GDM
Male 11(55%) 52(61%)
Female 9 (45%) 33(39%)
Total 20 85

Variable	Early onset GDM	Late onset GDM	
Male	11(55%)	52(61%)	
Female	9 (45%)	33(39%)	
Total	20	85	

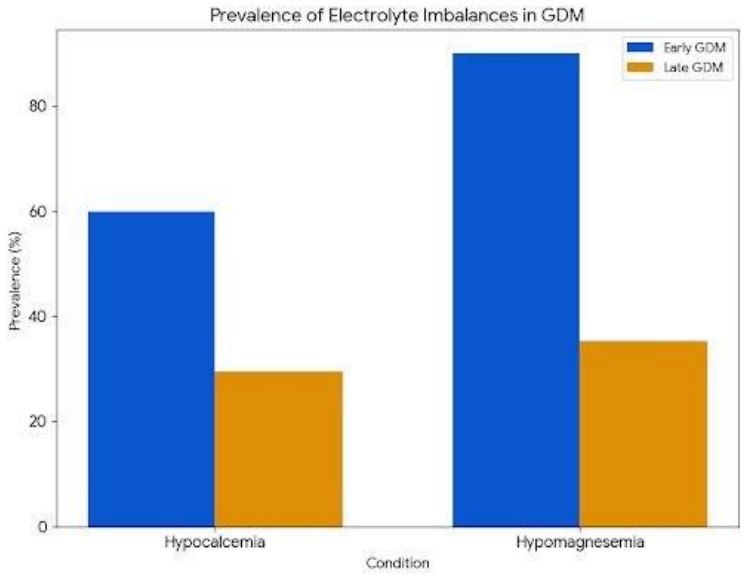
Table 1&2 shows the demographic distribution of early GDM (20) account for 19% of total study population and late onset GDM (85) is 81 % , among them in early onset GDM 55% were male and 45% female, in late onset GDM 61% male and 33% females no significant finding based on sex of the infants was found

Table 3
Infant of early GDM Infant of late GDM P value
Present 12 (60%) 25 (43%) hypocalcaemia absent 8 (40%) 60 (70.5%) 0.010 significant present 18(90%) 30 (35.29%) hypomagnesaemia absent 2 (10%) 55(64.7%) 0.001 significant

		Early onset GDM	Late onset GDM	
Hypocalcaemia	Present	12 [60%]	25[43%]	
	Absent	8 [40%]	60[70.5%]	
Hypomagnesemia	Present	18[90%]	30 [35.29%]	
	Absent	2 [10%]	55[64.7%]	

Table 3 and fig 1 shows the significant associatatioin of hypocalcaemia and hypomagnesaemia in infant of GDM, in infants of early onset gestational diabetic mother hypocalcaemia was presenting 60%(12) compared to infant of late onset GDM 44%(25) with significant p value of 0.010 and hypomagnesaemia in early GDM infants was 90% (18) to that late onset GDM 35.29% which is also with p value of 0.001 significant

Fig 1



DISCUSSION

In Our study we compared the status of serum magnesium and calcium between infants born to mothers with gestational diabetes mellitus (GDM) early onset and late onset in a tertiary care care center. The study included 105 infants, of which 81% were from late onset GDM mothers and 19% were from early onset GDM mothers. The findings of this study align with similar studies done (9-12)(aniquatasnim

et al)(18) which also showed significant association of hypocalcaemia 12.1% and hypomagnesaemia 24.1% but in that study showed prevalence is more in infant of pregestational diabetic mothers with significant association , our study showed the association and prevalence in infant of early onset GDM to that of late onset GDM and its complication .especially concerning the serum magnesium levels and other associated biochemical markers in infants of diabetic mothers (IDMs) . (15,16,18)

This result is consistent with earlier studies that also reported lower serum magnesium levels in infants born to diabetic mothers, particularly those with PGDM. Fetal magnesium deficiency results from maternal glycosuria caused by poor glycemic control and urinary Mg2+ loss (15). That indicates the higher rate of hypomagnesaemia in the infant of early GDM group may be attributed to the long-standing diabetes in mothers (19), which can affect placental function and fetal nutrient transfer. Other studies have shown that pregestational diabetes leads to a more pronounced disruption in mineral metabolism than gestational diabetes, likely due to the longer duration of maternal hyperglycemia.

Our findings on serum calcium levels further showed that hypocalcaemia was more prevalent in the infant of early onset GDM group (60%) compared to the late onset GDM group (43.1%). The lower serum calcium in GDM infants could be due to chronic fetal hypoxia and alterations in insulin & parathyroid hormone regulation, which are more obvious in long-standing diabetes.

CONCLUSION

This study demonstrates that early-onset gestational diabetes mellitus leads to significantly higher rates of electrolyte disturbances—specifically hypomagnesaemia (90.0\%, p = 0.001) and hypocalcaemia (60.0\%, p = 0.010)—as well as elevated neonatal mortality (16.7\%, p = 0.003) compared to late-onset GDM. Early identification, close monitoring of serum electrolytes in the NICU, and targeted insulin therapy during pregnancy are crucial to minimizing neonatal complications.

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