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Assessment of Gestational Diabetes Mellitus Among Primigravidas

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ABSTRACT

Introduction: Gestational diabetes mellitus (GDM) is a notable metabolic disease among pregnant women which can have negative consequences on both the mother and baby. Understanding the GDM prevalence, as well as its complications, is vital for timely treatment and better health outcomes during and after birth. The present study seeks to determine the frequency of GDM and its association with different feto-maternal complications. **Methodology:** A descriptive case series study was performed on 121 pregnant women, classifying them by age, body mass index (BMI), gestational week, family history, socio-economic status, and any existing GDM. The prevalence of feto-maternal complications was documented, and their association to GDM was analyzed using statistical methods considering the level of significance at $p<0.05$. **Results:** GDM was present in 24.0% of cases. It showed significant associations with pre-eclampsia ($p=0.001$), preterm labor ($p=0.001$), macrosomia ($p=0.001$), intrauterine fetal death ($p=0.047$), respiratory distress ($p=0.001$), and NICU admission ($p=0.015$). No significant associations were found with age, gestational age, family history, or socio-economic status. **Conclusion:** Gestational diabetes mellitus (GDM) is strongly linked to adverse feto-maternal outcomes, highlighting the need for improved management and prevention. This study emphasizes proactive measures to reduce risks such as pre-eclampsia, preterm labor, macrosomia, and neonatal complications, ensuring better maternal and infant health through early intervention and optimized care strategies.

INTRODUCTION

Gestational diabetes mellitus (GDM) was first defined by O'Sullivan as a "carbohydrate intolerance of varying severity with onset or first recognition during pregnancy". The prevalence of GDM varies depending on the diagnostic criteria used and the ethnic background of the population studied. Certain ethnic groups, particularly women from South Asia (India, Pakistan, and Bangladesh), are at significantly higher risk, with a relative risk of 7.6 to 11 times that of white women. Black Caribbean women also have an increased risk, with a relative risk of 3.1. Overall, the prevalence of GDM is estimated to be between 1% and 5%.[1-2]

GDM is one of the most common complications encountered during pregnancy. According to the latest estimates from the International Diabetes Federation (IDF), approximately 14.0% of pregnancies worldwide are affected by GDM, equating to approximately 20 million births annually. More than 90% of cases of hyperglycemia in pregnancy occur in low- and middle-income countries. In Pakistan, the prevalence of GDM has been reported as 19%.[3-4]

GDM is linked with numerous feto-maternal complications such as pre-eclampsia, fetal macrosomia, polyhydramnios, metabolic syndrome, and even cardiovascular diseases. Women with GDM are more likely to give birth to infants who are large-for-gestational-age (LGA). Furthermore, GDM patients are also more susceptible to undergoing cesarean sections; conversely, their newborns are at risks of shoulder dystocia and birth injuries. GDM is also associated with the increased odds of premature births, hypoxia and hypoglycemia in neonates, respiratory complications in the newborn, and admission to the Neonatal Intensive Care Unit (NICU).[5-6]

Research indicates a rise in the occurrence of gestational diabetes mellitus (GDM) in primigravidas over the years. Nonetheless, there is an extraordinary deficiency of studies concerning the evaluation of the frequency and prevalence of feto-maternal complications of GDM, especially in regard to primigravidas in almost all regions of the globe. Considering the possible mid- and long-term consequences of GDM, it is inevitable to further examine its impacts, risk factors, and preventive

measures among first-time mothers. Such studies are fundamental to reduce the onset of the disease or its related complications through precise diagnosis, interventions, and management strategies which are based on evidence.

MATERIALS AND METHODS

Following the approval from Ethics Review Committee and participants fulfilling the inclusion and exclusion criteria, study was conducted at the Department of Obstetrics & Gynaecology, University of Lahore Teaching Hospital (UOLTH), Lahore. The study was conducted in six months, from August 16, 2024 to February 15, 2025. The study population included all primigravidae visiting the antenatal clinic at ULTH for the study period and were between 24 to 28 weeks of gestation. A non-probability consecutive sampling method was used to recruit participants.

The inclusion criteria was all primigravidae attending the antenatal clinic within 24 to 28 weeks of gestation. However, primigravidae with previously diagnosed type 1 or 2 diabetes mellitus were not part of the study. Each participant provided informed consent with the understanding that their medical records would remain confidential. Demographic information along with gestational age, and a thorough clinical examination which consisted of family and sociodemographic details, past medical history, body mass index (BMI), blood pressure, and socio-economic status were collected.

All enrolled primigravidae women who did not have a prior diagnosis of diabetes were screened using a 75g oral glucose tolerance test (OGTT) between the 24th and 28th week of their gestation. The screening was classified as abnormal if the fasting blood glucose (FBG) levels were equal to or greater than 100 mg/dL (5.6 mmol/L) and/or 2-hour post 75g glucose load levels were equal to or greater than 140 mg/dL (7.8 mmol/L). Further assessment of feto-maternal complications was conducted in participants diagnosed with gestational diabetes mellitus (GDM) due to more precocious feto-maternal conditions.

Antenatal diagnosis surveillance was done through the basic laboratory examination which included urine complete examination, blood sugar level test, OGTT, detailed anomaly scan, fetal echocardiogram, and ultrasound for fetal growth and amniotic fluid index (AFI) levels. This was done to assess the impact of GDM on the maternal and fetal outcomes.

The collected data was analyzed statistically using SPSS version 25. Quantitative variables such as age, gestational age, and body mass index (BMI) were presented as mean ± standard deviation (S.D.). Qualitative variables were expressed in the form of frequency and percentage. The outcome variables included the percentage of GDM cases and associated feto-maternal complications, such as pre-eclampsia, polyhydramnios, preterm labor, infections, cesarean section, macrosomia, intrauterine demise (IUD), and prematurity. To control the effect of potential confounding variables, the data was stratified based on age, socio-economic status and family history. After stratification, a chi-square test was applied to assess statistical significance, with a p-value ≤ 0.05 considered statistically significant.

RESULTS

The age distribution shows 52.9% aged 18-30 years and 47.1% aged 31-40 years, with a mean age of 29.60±6.52 years. The mean BMI is 26.84±4.92 kg/m², and gestational age averages 25.93±1.48 weeks, with most participants falling between 24-26 weeks (65.3%). 50.4% have a positive family history. Participants are divided into low (28.9%), middle (48.8%), and high (22.3%) socio-economic categories. Gestational diabetes mellitus prevalence is 24.0%. Fasting blood sugar is 118.17±17.29 mg/dl, one-hour postprandial is 145.26±30.68 mg/dl, and two-hour postprandial is 138.28±23.79 mg/dl.

The second table shows feto-maternal complication frequencies. Notably, pre-eclampsia is in 12.4% of cases, polyhydramnios in 8.3%, preterm labor in 11.6%, infections like UTIs or vaginal infections in 7.4%, cesarean section in 11.6%, anomalies in 9.1%, macrosomia in 14.0%, intrauterine fetal death in 13.2%, prematurity in 17.4%, shoulder dystocia in 12.4%, newborn respiratory distress in 14.0%, and NICU admission in 19.0%.

The third table shows strong associations between feto-maternal complications and gestational diabetes mellitus. Pre-eclampsia (86.7% affected, p=0.001), polyhydramnios (60.0%, p=0.005), preterm labor (85.7%, p=0.001), urinary tract/vaginal infections (55.6%, p=0.021), Cesarean section (85.7%, p=0.001), congenital anomalies (54.5%, p=0.013), macrosomia (76.5%, p=0.001), intrauterine fetal death (p=0.047), prematurity (66.7%, p=0.001), respiratory distress (76.5%, p=0.001), NICU admission (43.5%, p=0.015) are significantly linked to gestational diabetes. Shoulder dystocia does not show a significant association (p=0.120).

The fourth table displays how gestational diabetes mellitus is distributed across different variables. Age groups 18-30 and 31-40 make up 21.9% and 26.3% of cases, with no significant difference. Gestational age categories 24-26 weeks and 27-28 weeks account for 24.1% and 23.8%, showing no significant association. Family history (24.6% positive, 23.3% negative) and socioeconomic status (25.7% low, 27.1% middle, 14.8% high) do not significantly correlate with gestational diabetes.

Table 1

Frequency distribution of different variables (n=121)

Variables		Frequency	Percent
Age groups	18-30 years	64	52.9%
	31-40 years	57	47.1%
	Mean age (years)	29.60±6.52	
BMI	Mean BMI (kg/m^2)	26.84±4.92	
Gestational age	24-26 weeks	79	65.3%
	27-28 weeks	42	34.7%
	Mean gestational age (weeks)	25.93±1.48	
Family history	Yes	61	50.4%
	No	60	49.6%
Socio-economic status	Low	35	28.9%
	Middle	59	48.8%
	High	27	22.3%
Gestational diabetes mellitus	Yes	29	24.0%
	No	92	76.0%
	Blood sugar fasting (mg/dl)	118.17±17.29	
	1 hour post-prandial (mg/dl)	145.26±30.68	
	2 hour post-prandial (mg/dl)	138.28±23.79	

Table 2

Frequency distribution of feto-maternal complications (n=121)

Feto-maternal complications		Frequency	Percent
Pre-eclampsia	Yes	15	12.4%
	No	106	87.6%
Polyhydramnios	Yes	10	8.3%
	No	111	91.7%
Preterm labour	Yes	14	11.6%
	No	107	88.4%
Infections (UTI/Vaginal)	Yes	9	7.4%
	No	112	92.6%
Cesarean section	Yes	14	11.6%
	No	107	88.4%
Congenital anomalies	Yes	11	9.1%
	No	110	90.9%
Macrosomia	Yes	17	14.0%
	No	104	86.0%
Intrauterine fetal death	Yes	16	13.2%
	No	105	86.8%
Prematurity	Yes	21	17.4%
	No	100	82.6%
Shoulder dystocia	Yes	15	12.4%
	No	106	87.6%
Respiratory distress	Yes	17	14.0%
	No	104	86.0%
NICU admission	Yes	23	19.0%
	No	98	81.0%

Figure 1

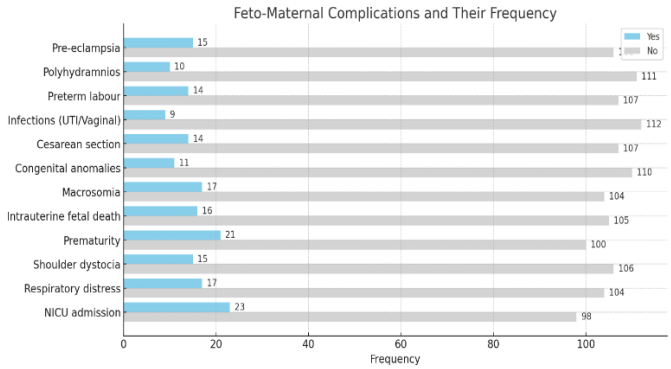

Table 3

Association of feto-maternal complications with gestational diabetes mellitus

Feto-maternal complications		Gestational diabetes mellitus		p-value
		Yes	No	
Pre-eclampsia	Yes	13(86.7%)	2(13.3%)	0.001
	No	16(15.1%)	90(84.9%)	
Polyhydramnios	Yes	6(60.0%)	4(40.0%)	0.005
	No	23(20.7%)	88(79.3%)	
Preterm labour	Yes	12(85.7%)	2(14.3%)	0.001
	No	17(15.9%)	90(84.1%)	
Infections (UTI/Vaginal)	Yes	5(55.6%)	4(44.4%)	0.021
	No	24(21.4%)	88(78.6%)	
Cesarean section	Yes	12(85.7%)	2(14.3%)	0.001
	No	17(15.9%)	90(84.1%)	
Congenital anomalies	Yes	6(54.5%)	5(45.5%)	0.013
	No	23(20.9%)	87(79.1%)	
Macrosomia	Yes	13(76.5%)	4(23.5%)	0.001
	No	16(15.4%)	88(84.6%)	
Intrauterine fetal death	Yes	7(43.8%)	9(56.3%)	0.047
	No	22(21.0%)	83(79.0%)	
Prematurity	Yes	14(66.7%)	7(33.3%)	0.001
	No	15(15.0%)	85(85.0%)	
Shoulder dystocia	Yes	6(40.0%)	9(60.0%)	0.120
	No	23(21.7%)	83(78.3%)	
Respiratory distress	Yes	13(76.5%)	4(23.5%)	0.001
	No	16(15.4%)	88(84.6%)	
NICU admission	Yes	10(43.5%)	13(56.5%)	0.015
	No	19(19.4%)	79(80.6%)	

Figure 2

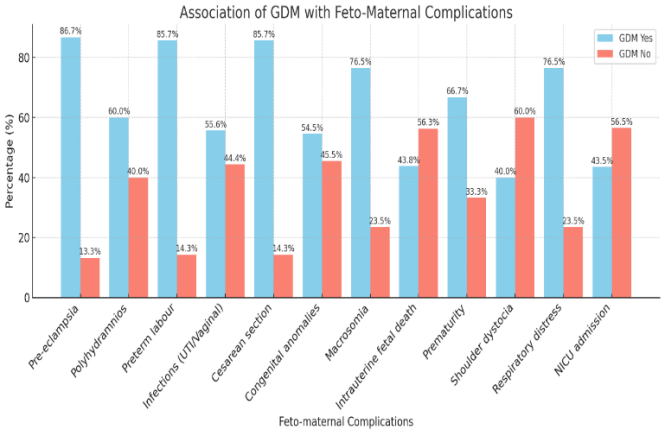

Table 4

Stratification of gestational diabetes mellitus with respect to different variables

Variables		Gestational diabetes mellitus		p-value
		Yes	No	
Age groups	18-30 years	14(21.9%)	50(78.1%)	0.568
	31-40 years	15(26.3%)	42(73.7%)	
Gestational age	24-26 weeks	19(24.1%)	60(75.9%)	0.976
	27-28 weeks	10(23.8%)	32(76.2%)	
Family history	Yes	15(24.6%)	46(75.4%)	0.871
	No	14(23.3%)	46(76.7%)	
Socio-economic status	Low	9(25.7%)	26(74.3%)	0.445
	Middle	16(27.1%)	43(72.9%)	
	High	4(14.8%)	23(85.2%)	

DISCUSSION

Gestational diabetes mellitus (GDM) is a well-recognized complication of pregnancy associated with increased risks of adverse maternal and neonatal outcomes. The prevalence of GDM in this study was 24.0%, which falls within the upper range of reported global prevalence, typically between 10-20%, though variations exist due to differences in diagnostic criteria and population characteristics. A global study reported a prevalence range of 9.8% to 25.5% depending on ethnicity and screening methods.[7-8]

The Hyperglycemia and Adverse Pregnancy Outcomes (HAPO) study found that 17.8% of women had GDM when diagnosed using the International Association of Diabetes and Pregnancy Study Groups (IADPSG) criteria.[9] The slightly higher prevalence in this study may be attributed to genetic predisposition, dietary habits, and lifestyle factors contributing to impaired glucose metabolism.

This study found a significant association between GDM and pre-eclampsia (p=0.001), which aligns with previous research indicating that insulin resistance and endothelial dysfunction contribute to hypertensive disorders in pregnancy.[10] A meta-analysis demonstrated that women with GDM have a 1.5 to 2 times higher risk of developing pre-eclampsia compared to those without the condition.[11]

Similarly, preterm labor was significantly associated with GDM (p=0.001), consistent with findings that hyperglycemia contributes to inflammation, placental insufficiency, and an increased risk of spontaneous preterm birth. Studies have reported that women with GDM have up to a 1.6 times greater likelihood of delivering prematurely.[12-13]

Polyhydramnios was also significantly associated with GDM in this study (p=0.005), a finding supported by evidence that fetal hyperglycemia leads to increased urine production and excessive amniotic fluid volume.[14]

Cesarean section was significantly more common in GDM cases (p=0.001), consistent with research indicating that GDM increases the risk of operative delivery due to macrosomia, labor dystocia, and fetal distress.[15] A previous study found that early intervention and glycemic control could reduce cesarean section rates in women with GDM.[16]

Congenital anomalies were significantly more frequent in GDM pregnancies (p=0.013), which aligns with studies indicating that uncontrolled hyperglycemia in early pregnancy is teratogenic and increases the risk of neural tube defects and cardiac anomalies.[17]

Macrosomia was significantly associated with GDM (p=0.001), consistent with findings from the HAPO study that maternal glucose levels correlate directly with fetal overgrowth. Another study found that infants of mothers with GDM are at increased risk of being large for gestational age due to excess fetal insulin production, which promotes fat deposition.[18]

Intrauterine fetal death (IUFD) was significantly more frequent in GDM cases (p=0.047), supporting findings that poor glycemic control increases the risk of fetal hypoxia and stillbirth. Prematurity was also significantly associated with GDM (p=0.001), consistent with reports that women with GDM have a 30% higher risk of delivering prematurely.[19-20]

Respiratory distress syndrome (RDS) was more common in neonates born to mothers with GDM (p=0.001), aligning with studies demonstrating that fetal hyperinsulinemia delays lung maturity, increasing the risk of respiratory complications. NICU admission was significantly higher in newborns of GDM mothers (p=0.015), consistent with findings that neonates of GDM mothers require NICU care due to complications such as neonatal hypoglycemia, macrosomia, and respiratory distress.[21-22]

Despite its significant associations with multiple complications, GDM did not show a significant relationship with age (p=0.568), gestational age (p=0.976), family history (p=0.871), or socio-economic status (p=0.445). Some studies have suggested that the prevalence of GDM increases with age and family history of diabetes, though this was not observed in this study. The lack of significant associations with these factors may be attributed to the sample size or population-specific genetic and environmental influences.[23]

The findings of this study reinforce the importance of early screening and management of GDM to mitigate adverse pregnancy outcomes. Tight glycemic control through diet, insulin therapy, and regular monitoring has been shown to reduce complications.[24] Educating pregnant women about the risks of GDM and promoting lifestyle modifications such as physical activity and weight management can also improve maternal and neonatal outcomes.

This research contributes significant knowledge towards understanding the association between GDM and feto-maternal complications. Its limitations, however, are a somewhat small sample size which may not be generalizable and failure to assess long-term neonatal outcomes which could shed further light on the impact of GDM beyond the perinatal period. Further studies with greater sample sizes and longer follow-up periods are necessary to confirm these results.

This study verifies that GDM has a meaningful correlation with unfavorable maternal and neonatal outcomes such as pre-eclampsia, macrosomia, intrauterine fetal death, respiratory distress, preterm labor, and NICU admission. These findings reinforce prior research concerning the urgent need for early intervention along with diagnosis and glycemic control to lower GDM risks.

CONCLUSION

GDM carries a notable correlation with several negative feto-maternal outcomes, suggesting a need for better management and preventative strategies. The study illustrates the necessity of acting proactively in order to mitigate the probable incidences of pre-eclampsia, preterm labor, macrosomia, and other neonatal complications.

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