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A STUDY OF MATERNAL LIPID PROFILE IN GESTATIONAL DIABETES MELLITUS AND ITS IMPACT ON PERINATAL OUTCOME – A PROSPECTIVE OBSERVATIONAL STUDY

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ABSTRACT Gestational diabetes mellitus (GDM) is a significant metabolic disorder with excessive lipid accumulation and abnormal lipid profiles which may increase the risk of pregnancy complications. **Aim:** To compare the study of serum LIPID PROFILE levels in GDM to normal pregnancy and its association with pregnancy complications. **Materials and Methods:** Present study is a prospective observational study, carried out in the Department of Obstetrics and Gynecology in Osmania medical college, Hyderabad for a period of two years for a sample size of 200 in third trimester of pregnancy. After a detailed clinical assessment, fasting blood sample was collected for lipid profile analysis from both cases and controls. variables were correlated with pregnancy outcomes and neonatal complications. **Results:** The demographic characteristics showed a comparable distribution of age and parity between the normal and GDM groups. GDM participants had a positive family history of diabetes, higher proportion of overweight and obese individuals , higher total cholesterol and LDL-C levels , marginally higher Mean systolic and diastolic blood pressures , higher C-section rates , more Neonatal ICU admissions and Neonatal birth weight compared to the normal group. while triglyceride and HDL-C differences were not statistically significant. These findings suggest that GDM is associated with an increased risk of adverse maternal and neonatal outcomes, particularly in terms of delivery mode, neonatal distress, and birth weight. **Conclusion:** The results also support existing evidence that GDM increases the likelihood of pregnancy complications, both for the mother and the newborn. Identifying high-risk individuals early and implementing targeted interventions could help reduce maternal metabolic complications and improve neonatal health.

KEYWORDS : GDM (Gestational Diabetes Mellitus), Maternal Lipid Profile, Neonatal Outcome.

INTRODUCTION

Gestational diabetes mellitus (GDM) is a significant metabolic disorder that affects pregnant women and is characterized by glucose intolerance with onset or first recognition during pregnancy. The interplay between lipid metabolism and carbohydrate metabolism in pregnancy is complex, and alterations in lipid profiles have been observed in women with GDM. Abnormal maternal lipid metabolism has been associated with increased risk of adverse pregnancy outcomes, including preeclampsia, fetal macrosomia, and neonatal complications[1].

GDM has emerged as a global health concern, with rising prevalence due to increasing maternal age, obesity, and sedentary lifestyles. The prevalence of GDM varies across populations, with estimates ranging from 1% to 28% worldwide, depending on diagnostic criteria and population characteristics[2]. In developed nations, the prevalence has been steadily increasing, with studies indicating that GDM affects approximately 7% of all pregnancies in the United States [3,4]. Asian countries report a higher prevalence, particularly in India and China, where rates range between 10% and 20% due to genetic predisposition and lifestyle changes [5]. This increase in GDM cases has been linked to an upsurge in metabolic disorders, including dyslipidemia, insulin resistance, and future cardiovascular risks [6].

Maternal lipid metabolism undergoes significant changes during pregnancy, contributing to fetal development and energy storage. However, in women with GDM, excessive lipid accumulation and abnormal lipid profiles may increase the risk of pregnancy complications. Elevated triglycerides (Tg) and low-density lipoprotein cholesterol (LDL-C) levels have been reported in GDM, while high-density lipoprotein cholesterol (HDL-C) levels tend to decrease [7]. These changes contribute to endothelial dysfunction, inflammation, and oxidative stress, exacerbating adverse maternal and neonatal outcomes [8].

In India, the estimated prevalence of GDM ranging from 10% to 35%, depending on diagnostic criteria and regional variations [9]. The prevalence is notably higher in urban areas compared to rural regions due to increasing rates of obesity, sedentary lifestyles, and dietary modifications[10]. The Indian National Health Programs have recognized the importance of early screening and management of GDM to prevent complications such as preterm birth, neonatal hypoglycemia, and long-term metabolic disorders in offspring [11].

Studies from India have highlighted that maternal lipid abnormalities in GDM are more pronounced, with higher levels of total cholesterol (T-C), LDL-C, and triglycerides compared to normal pregnancies [12]. These changes contribute to increased maternal complications such as hypertensive disorders, preeclampsia, and an increased risk of cesarean delivery [13]. The need for early lipid profile screening and intervention has been emphasized to mitigate the risks associated with dyslipidemia in pregnant women with GDM [14].

GDM poses a significant health challenge due to its association with long- term maternal and fetal complications. Women diagnosed with GDM have an increased risk of developing type 2 diabetes mellitus (T2DM) and cardiovascular diseases later in life [15]. Additionally, infants born to mothers with GDM are more likely to develop obesity, insulin resistance, and metabolic syndrome during childhood and adulthood [16]. Addressing maternal lipid abnormalities in GDM is crucial to reducing perinatal morbidity and improving long-term health outcomes for both mother and child.

The rationale for this study stems from the need to evaluate lipid profile alterations in pregnant women with GDM compared to normal pregnancies. Despite extensive research on carbohydrate metabolism in GDM, limited studies have explored the relationship between maternal lipid metabolism, pregnancy complications, and perinatal outcomes [1]. Understanding these associations will aid in developing targeted interventions to minimize adverse outcomes associated with maternal dyslipidemia in GDM.

Aim

To compare the study of serum LIPID PROFILE levels in GDM to normal pregnancy and its association with pregnancy complications and neonatal outcome.

MATERIALS AND METHODS

Ethical approval for the study was obtained from the institutional ethics committee and written informed consent was obtained after explaining the study objectives, procedures, risks, and benefits. Present study is a prospective observational study, carried out in the Department of Obstetrics and Gynecology in Osmania medical college, Hyderabad for a period of two years. The study population comprised antenatal mothers attending Hospital during their third trimester of pregnancy. Pregnant women were recruited based on the inclusion and exclusion criteria, ensuring that only eligible participants were enrolled.

Inclusion Criteria

1. Normal pregnancies in their third trimester
2. Pregnant women diagnosed with GDM
3. singleton pregnancies

Exclusion Criteria

1. Women over 40 years of age
2. Chronic non- communicable or infectious diseases
3. Women on medications known to alter lipid profiles
4. Multifetal pregnancies.
5. Critically ill pregnant women, laboring mothers, postpartum, and post-abortal.

Sample Size

A total of 200 participants were included in the study, with an equal distribution between the GDM group (N=100) and the normal pregnancy group (N=100) who met the inclusion criteria. Eligible women were identified based on their clinical records and laboratory results. The diagnosis of GDM was confirmed using the oral glucose tolerance test (OGTT) as per hospital protocol. Pregnant women with normal glucose metabolism and no history of diabetes or metabolic disorders were included as controls. The sample size was determined based on the expected prevalence of lipid abnormalities in GDM and normal pregnancies, ensuring adequate statistical power to detect significant differences. Data were collected through structured interviews, medical record reviews, and laboratory investigations.

All participants underwent a detailed clinical assessment, including medical history, demographic details, and obstetric history, anthropometric assessment. A fasting blood sample was collected for lipid profile analysis, including total cholesterol (TC), triglycerides (TG), high-density lipoprotein cholesterol (HDL-C), and low-density lipoprotein cholesterol (LDL-C). Pregnant women diagnosed with GDM were managed according to standard clinical guidelines, including dietary modifications and insulin therapy if required. Participants were monitored for pregnancy complications, including preeclampsia, preterm birth, intrahepatic cholestasis of pregnancy (ICP), small for gestational age (SGA), and macrosomia. Neonatal outcomes such as birth weight, Apgar scores, and gestational age at delivery were recorded.

Independent Variables

Maternal age, BMI, GDM status, parity, gestational age, and medication use.

Outcome Variables

Lipid profile parameters (TC, TG, HDL-C, LDL-C), pregnancy complications (GDM-related outcomes, preeclampsia, preterm birth, ICP, SGA, and macrosomia), and neonatal outcomes (birth weight, Apgar score, and gestational age at delivery).

Statistical Analysis

Data were entered into a secure database and analyzed using SPSS software (version X). Descriptive statistics, including mean, standard deviation, and frequency distributions, were used to summarize demographic and clinical characteristics. Comparisons between GDM and normal pregnancy groups were conducted using independent t-tests for continuous variables and chi-square tests for categorical variables. Logistic regression analysis was performed to assess the association between lipid profile parameters and pregnancy complications, A p-value of less than 0.05 was considered statistically significant.

RESULTS

Table 1. Comparison of Demographic Variables Between Groups

1.AGE			
Category	Normal n (%)=100	GDM n (%)=100	P-value
<20 yrs	2 (2%)	2 (2%)	0.965
21-25 yrs	18 (18%)	16 (16%)	
26-30 yrs	18 (18%)	22 (22%)	
>30 yrs	62 (62%)	60 (60%)	
2.BMI			
Underweight	2 (2%)	4 (4%)	0.431
Normal	50 (50%)	34 (34%)	
Overweight	30 (30%)	38 (38%)	
Obese	18 (18%)	24 (24%)	
3.PARITY			
0	30 (30%)	28 (28%)	0.556
1	20 (20%)	22 (22%)	
2	30 (30%)	20 (20%)	
3	20 (20%)	30 (30%)	
4.FAMILY HISTORY OF DIABETES			
No	46 (46%)	38 (38%)	0.108
Yes	54 (54%)	62 (62%)	

Among the normal group 62% were over 30 years and In the GDM group 60% were above 30 years. There was no statistically significant difference between the groups (p = 0.965). Among the normal group 30% were overweight, and 18% were obese. In the GDM group,38% were overweight, and 24% were obese. The difference between the groups was not statistically significant (p = 0.431).The p-value was 0.556, indicating no significant difference in parity. In the normal group,54% reported a positive family history of diabetes while GDM group, 62% had positive family history, The difference was not statistically significant (p = 0.108).

Table 2: Comparision of Outcome Variables Between the Groups:

A) COMPARISON OF GESTATIONAL AGE AT TESTING BETWEEN THE GROUPS				
Groups	Mean	SD	t	p value
Normal	28.34	3.34	-1.48	0.142
GDM	29.36	3.55		
B) COMPARISON OF TOTAL CHOLESTEROL BETWEEN THE GROUPS				
Normal	208.41	36.52	-2.35	0.021
GDM	226.04	38.49		
C) COMPARISON OF TRIGLYCERIDES BETWEEN THE GROUPS				
Normal	177.15	46.97	1.57	0.121
GDM	162.24	48.30		
D) COMPARISON OF HDL-C BETWEEN THE GROUPS				
Normal	59.54	15.57	1.13	0.262
GDM	55.91	16.59		
E) COMPARISON OF LDL-C BETWEEN THE GROUPS				
Normal	117.49	32.94	-2.45	0.016
GDM	133.63	32.83		
F) COMPARISON OF VLDL-C BETWEEN THE GROUPS				
Normal	34.18	14.26	0.97	0.334
GDM	31.46	13.82		
G) COMPARISON OF SYSTOLIC BLOOD PRESSURE BETWEEN THE GROUPS				
Normal	122.08	19.89	-1.01	0.315
GDM	125.90	17.88		
H) COMPARISON OF DIASTOLIC BLOOD PRESSURE BETWEEN THE GROUPS				
Normal	77.54	12.07	-1.96	0.053
GDM	82.20	11.70		
I) COMPARISON OF NEONATAL BIRTH WEIGHT BETWEEN THE GROUPS				
Normal	3.24	0.37		
GDM	3.64	0.49	-4.59	<0.001

Above table shows the results of higher total cholesterol and LDL-C levels , marginally higher Mean systolic and diastolic blood pressure in GDM group participants while triglyceride and HDL-C differences were not statistically significant. The mean (SD) neonatal birth weight in the normal group was 3.24 (0.37), whereas in the GDM group, it was 3.64 (0.49). The t-value was -4.59, and the p-value was <0.001.

Table 3: Obstetric Complications

Complications	Normal n (%)=100	GDM n (%)=100
Preeclampsia	9 (9%)	21(21%)
preterm	8 (8%)	14 (14.0%)
ICP(cholestasis)	3(3%)	5(5%)
SGA	7(7%)	15(15%)

Above table shows the results of higher obstetric complications in GDM group participants.

Table 4: Delivery and Perinatal Outcome

Mode of Delivery	Normal n (%)	GDM n (%)	P-value
C-Section	42 (42.0%)	66 (66.0%)	0.016
Vaginal	58 (58.0%)	34 (34.0%)	
B) COMPARISON OF NEONATAL APGAR SCORE BETWEEN THE GROUPS			
Neonatal APGAR Score	Normal n (%)	GDM n (%)	P-value
5	18 (18.0%)	14 (14.0%)	0.025
6	22 (22.0%)	14 (14.0%)	
7	32 (32.0%)	18 (18.0%)	
8	20 (20.0%)	20 (20.0%)	
9	8 (8.0%)	34 (34.0%)	

C)COMPARISON OF NEONATAL ICU ADMISSION BETWEEN THE GROUPS			
No	64 (64.0%)	40 (40.0%)	0.016
Yes	36 (36.0%)	60 (60.0%)	

In the normal group, 42.0% participants underwent a C-section, In the GDM group, 66.0% had a C-section. The p-value was 0.016. In the normal group,8.0% had a APGAR score of 9. In the GDM group 34.0% had a score of 9. The p-value was 0.025. In the normal group, 36.0% required NICU admission, while 60.0% required NICU admission in the GDM group. The p-value was 0.016.

DISCUSSION

Gestational diabetes mellitus (GDM) is known to be associated with adverse maternal and neonatal outcomes, particularly metabolic disturbances and increased cardiovascular risks. Our study demonstrated that women with GDM exhibited significant differences in lipid profiles, blood pressure, mode of delivery, and neonatal outcomes compared to non-GDM pregnant women. These findings align with previous literature examining the impact of GDM on maternal and neonatal health, providing further evidence of the metabolic disruptions associated with hyperglycemia in pregnancy. The demographic characteristics in our study did not show significant differences in age and parity distribution between the two groups, which is consistent with study of Kaaja RJ[1] indicating that GDM can affect women across various age groups and reproductive histories. However, a higher proportion of GDM women had a positive family history of diabetes, reflecting the genetic predisposition associated with glucose intolerance during pregnancy [2](Lekva T et al). This aligns with previous studies showing that a positive family history is a strong predictor of GDM development[3].In terms of BMI, our study found that a greater proportion of overweight and obese women were in the GDM group, which is consistent with the well- established relationship between obesity and insulin resistance in pregnancy [4]. Several studies have highlighted that overweight and obese women have an increased risk of developing GDM due to impaired glucose metabolism and increased inflammatory markers that contribute to insulin resistance [5,6].

Lipid profile analysis revealed that total cholesterol and LDL-C levels were significantly higher in the GDM group compared to the normal pregnancy group. This is consistent with findings from multiple studies that have reported dyslipidemia in GDM patients, characterized by elevated total cholesterol and LDL-C levels [7,8] (Prentice AM et al and Bartels Ä et al). Elevated LDL-C levels in pregnancy have been linked to endothelial dysfunction and increased cardiovascular risk in women with GDM, which may persist postpartum and contribute to long-term metabolic disorders [9,10].

Contrary to expectations, triglyceride levels did not show a statistically significant difference between the groups. Some studies have reported higher triglyceride levels in GDM pregnancies due to increased hepatic lipogenesis and impaired lipid clearance [11,12]. However, other research suggests that triglyceride levels may vary based on gestational age at testing and maternal BMI, which could explain the variability in our results [13].

HDL-C levels were slightly lower in the GDM group but did not reach statistical significance. Prior studies have suggested that reduced HDL-C levels in GDM pregnancies are associated with decreased protective effects against oxidative stress and vascular inflammation, contributing to endothelial dysfunction [14,15](Koukkou E et al). However, our findings suggest that HDL-C variations in pregnancy may not always be significant in all populations, possibly influenced by dietary habits and genetic factors [16]. Blood pressure measurements indicated that both systolic and diastolic blood pressure values were higher in the GDM group, though the difference was not statistically significant for systolic blood pressure. This finding aligns with research suggesting that GDM is a risk factor for hypertensive disorders in pregnancy[1,2].

Mode of delivery analysis showed a significantly higher rate of cesarean section in the GDM group, consistent with previous studies reporting increased rates of operative deliveries in women with GDM [17,18]. The higher cesarean section rate is often attributed to fetal macrosomia, cephalopelvic disproportion, and obstetric interventions aimed at reducing birth trauma [19].

Neonatal APGAR scores varied significantly between the groups, with a greater proportion of neonates in the GDM group having a higher APGAR score of 9. This finding contrasts with some studies that report lower APGAR scores in neonates born to GDM mothers due to perinatal complications such as fetal distress and respiratory depression [20]. The variation in APGAR scores in our study may be influenced by factors such as gestational age at delivery, intrapartum fetal monitoring, and neonatal resuscitation practices.

Neonatal ICU admissions were significantly higher in the GDM group, reinforcing the well-documented association between GDM and neonatal complications requiring specialized care [20]. Neonates born to mothers with GDM are at higher risk for hypoglycemia, respiratory distress syndrome, and transient tachypnea of the newborn, necessitating close postnatal monitoring .Neonatal birth weight was significantly higher in the GDM group, corroborating prior research on fetal overgrowth(macrosomia) in hyperglycemic pregnancies[20].

Our study demonstrate that maternal dyslipidemia in GDM pregnancies is linked to adverse neonatal outcomes such as increased birth weight and ICU admissions.

The findings of our study highlight the significance of early detection and management of GDM to mitigate both maternal and neonatal complications. Lifestyle modifications, dietary interventions, and pharmacological management, when necessary, play a crucial role in optimizing pregnancy outcomes in women diagnosed with GDM. Addressing these risks through multidisciplinary care can help improve both short- and long-term health outcomes for mothers and their offspring.

CONCLUSION

This study highlights the significant impact of gestational diabetes mellitus on maternal and neonatal health outcomes. While the demographic characteristics were comparable, GDM was associated with higher cholesterol and LDL-C levels, as well as increased rates of C-section deliveries. Neonatal outcomes were notably affected, with GDM-exposed neonates having a higher birth weight and increased risk of requiring neonatal ICU admission. Identifying high-risk individuals early and implementing targeted interventions could help reduce maternal metabolic complications and improve neonatal health. Future research should explore long-term metabolic and cardiovascular effects on both mothers and children born to GDM-affected pregnancies.

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