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LIPID METABOLISM DISTURBANCES AS PREDICTORS OF PRE-ECLAMPSIA

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Abstract

This study aimed to investigate the associations between lipid profiles, gestational age, mode of delivery, and gravidity in normotensive and pre-eclamptic pregnant women. A total of 111 participants (92 normotensive and 19 pre-eclamptic) were enrolled TTH Timergara teaching hospital Dir Lower **between** *March 2024 and August 2024. Data was collected on age, gravida, gestational age at delivery, mode of delivery, and lipid profiles, including total cholesterol (TC), HDL, LDL, VLDL, and triglycerides (TG).*

Results revealed that pre-eclampsia was associated with significant lipid profile abnormalities. Pre-eclamptic women exhibited higher levels of total cholesterol (222.36 ± 43.68 mg/dL), LDL (131.87 ± 24.74 mg/dL), VLDL (37.71 ± 8.10 mg/dL), and triglycerides (183.48 ± 35.53 mg/dL), while HDL levels were significantly lower (38.69 ± 7.50 mg/dL) compared to normotensive women. Additionally, pre-eclampsia was strongly associated with preterm deliveries (62.11% in pre-eclampsia vs. 5.45% in normotensive) and caesarean section (LSCS) deliveries (45.44% in pre-eclampsia vs. 12.98% in normotensive). Gravidity also played a key role, with primigravida (first-time pregnancies) being more common in the pre-eclampsia group (24.08%) compared to normotensive women (76.92%).

These findings suggest that lipid profile abnormalities are closely linked to pre-eclampsia and may serve as potential biomarkers for early detection and monitoring of the condition. The study highlights the importance of early prediction tools for pre-eclampsia and advocates for further research to identify specific markers that can help predict maternal and perinatal outcomes in high-risk pregnancies.

INTRODUCTION

Delivery prior to 37 weeks of completed gestation is known as Preterm birth. Preterm birth affects approx. 11% of pregnancies worldwide, estimated by WHO that represent nearly 15

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million births in 2010 [1]. This is the second leading cause of death in children under age 5 [1]. The biological causes of preterm birth remain unknown, despite the decades of research [2]. Metabolic changes, particularly in carbohydrate and lipid metabolism occurs in normal pregnancy to increase circulating glucose and triglycerides to nourish the growing fetus. Fasting plasma glucose is decreased in early pregnancy, and impaired glucose tolerance occurs in late pregnancy due to the Changes in carbohydrate metabolism [3]. Circulating lipids (HDL, LDL) total cholesterol, and triglycerides, increase throughout pregnancy, levels of the triglycerides increase the most among lipid profile [3] but due to the risk of gestational diabetes mellitus much research has been devoted to glucose metabolism during pregnancy [4]. Associations between maternal lipid levels and adverse pregnancy outcomes, including preterm birth increases the interest in lipid levels during pregnancy. Many investigators have been investigated associations between maternal lipid levels during pregnancy, although the lipid components and magnitude of associations have been inconsistent across studies [5-14]. One study has investigated the association between dyslipidemia, which is defined by lipid levels in prenatal screening, and it was found to be associated with the increased risks for preterm birth with mid-trimester hyperlipidemia [8]. So, we decided to conduct a study to investigates the clinical diagnosis of maternal dyslipidemia and its subsequent outcomes.

Materials and methods

This study was conducted at TTH Timergara teaching hospital Dir Lower between March 2024 and August 2024. The research aimed to assess the distribution and associations of lipid profiles, gestational age, and mode of delivery among normotensive and pre-eclamptic pregnant women. A total of 111 participants were included, consisting of 92 normotensive and 19 pre-eclamptic women. The inclusion criteria were women in their third trimester of pregnancy, aged between 21 to 40 years, who were admitted to the hospital for routine prenatal checkups or complications related to pregnancy.

Participants were selected through convenience sampling after obtaining informed consent. The inclusion criteria specifically required participants to be diagnosed with either normotension or pre-eclampsia by their attending obstetricians. Pregnant women with other serious health conditions such as chronic hypertension, diabetes, or cardiovascular diseases were excluded from the study to maintain a homogeneous sample. The study included both primigravida (first-time pregnancies) and multigravida (women with multiple pregnancies) to explore the influence of gravidity on pre-eclampsia risk.

A detailed clinical examination was performed to confirm the diagnosis of pre-eclampsia. Relevant data was collected through structured interviews, medical records, and clinical observations. Gestational age at delivery, mode of delivery, and lipid profiles (including total cholesterol, HDL, LDL, VLDL, and triglycerides) were recorded. Blood samples were taken after an overnight fast to measure lipid profiles. Statistical analysis was performed using SPSS version 25 to calculate the means, percentages, and P-values for group comparisons, with significance set at $P < 0.05$.

The data collection period spanned five months, from March 2024 to August 2024, and all ethical guidelines were followed, including patient confidentiality and voluntary participation. The study aimed to investigate the associations of lipid abnormalities, gestational age, and mode of delivery with pre-eclampsia, contributing valuable insights to the management of pre-eclampsia and its complications in the local context.

Results

This study revealed significant differences between normotensive and pre-eclampsia participants in various aspects. Regarding age distribution, the majority of normotensive participants (88.13%) were in the 21-25 years age group, while pre-eclampsia cases were more

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prevalent in the 26-30 years age group (21.22%). In terms of gravidity, first-time pregnancies (primi) were more common in pre-eclampsia (24.08%), compared to 76.92% of normotensive women being multi gravida. Gestational age at delivery showed that pre-eclampsia was associated with a significantly higher incidence of preterm deliveries (62.11%) compared to normotensive women (5.45%), with a corresponding increase in caesarean section deliveries (45.44%) in pre-eclampsia compared to 12.98% in normotensive women. Furthermore, the lipid profile revealed that pre-eclampsia was associated with significantly higher total cholesterol (222.36±43.68 mg/dL), LDL (131.87±24.74 mg/dL), VLDL (37.71±8.10 mg/dL), and triglycerides (183.48±35.53 mg/dL), while HDL levels were significantly lower (38.69±7.50 mg/dL) in pre-eclampsia compared to normotensive women. significant differences (P-value < 0.001) in lipid profiles were observed between the groups, indicating the critical role of lipid abnormalities in pre-eclampsia. Moreover, deranged lipid profiles were more common in pre-eclampsia, with a higher percentage of participants showing abnormal levels of total cholesterol (39.46%), HDL (32.03%), LDL (33.38%), VLDL (27.21%), and triglycerides (29.21%) compared to normotensive women. These findings suggest that pre-eclampsia is not only associated with demographic and clinical factors like younger age, primi gravidity, and increased preterm and caesarean deliveries but also with significant lipid metabolism abnormalities, which could serve as potential biomarkers for monitoring and managing the condition.

Table: Detailed Comparison of Study Participants According to Demographics, Lipid Profile, and Mode of Delivery

Variable	*Normotensive (n=92)*	*Pre-eclampsia (n=19)*	*Total (n=111)*	*P-Value*
Age (Years)				
21-25	40 (88.13%)	6 (11.87%)	47 (42.44%)	
26-30	43 (78.78%)	11 (21.22%)	52 (46.65%)	
>30	11 (91.91%)	2 (10.09%)	13 (11.91%)	
Gravida				
Primi	49 (76.92%)	16 (24.08%)	63 (57.56%)	

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Multi	44 (92.48%)	4 (7.52%)	47 (42.44%)	
Gestational Age at Delivery				<0.001
Preterm	5 (5.45%)	12 (62.11%)	17 (15.32%)	<0.001
Term	86 (92.55%)	8 (37.89%)	94 (84.68%)	<0.001
Mode of Delivery				<0.001
LSCS	12 (12.98%)	7 (45.44%)	19 (17.12%)	<0.001
Vaginal Delivery	79 (85.02%)	11 (56.56%)	90 (81.08%)	<0.001
Lipid Profile Associations				
Total Cholesterol (TC)	181.77±36.58	222.36±43.68	-	<0.001
HDL	44.62±7.35	38.69±7.50	-	0.035
LDL	111.14±25.14	131.87±24.74	-	0.002
VLDL	33.10±6.64	37.71±8.10	-	0.002
Triglycerides (TG)	158.09±26.10	183.48±35.53	-	<0.001
Association of Lipid Profile				
TC Normal	76 (89.59%)	9 (10.41%)	86 (77.58%)	
TC Deranged	17 (62.54%)	11 (39.46%)	27 (24.42%)	
HDL Normal	72 (88.02%)	10 (11.98%)	81 (72.87%)	
HDL Deranged	21 (69.97%)	10 (32.03%)	30 (27.13%)	
LDL Normal	71 (90.14%)	8 (9.86%)	78 (70.17%)	
LDL Deranged	22 (66.63%)	10 (33.38%)	33 (27.83%)	
VLDL Normal	66 (91.28%)	8 (10.72%)	71 (65.86%)	
VLDL Deranged	29 (72.79%)	10 (27.21%)	40 (36.14%)	
TG Normal	66 (91.28%)	8 (10.72%)	71 (63.86%)	
TG Deranged	29 (72.79%)	12 (29.21%)	40 (36.14%)	

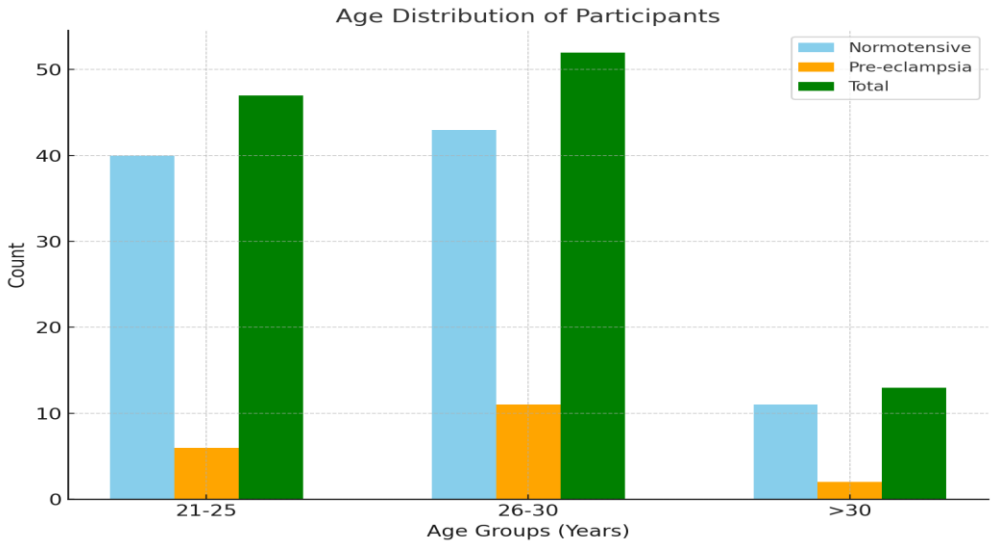

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Fig: Age distribution across normotensive, pre-eclampsia, and total participants

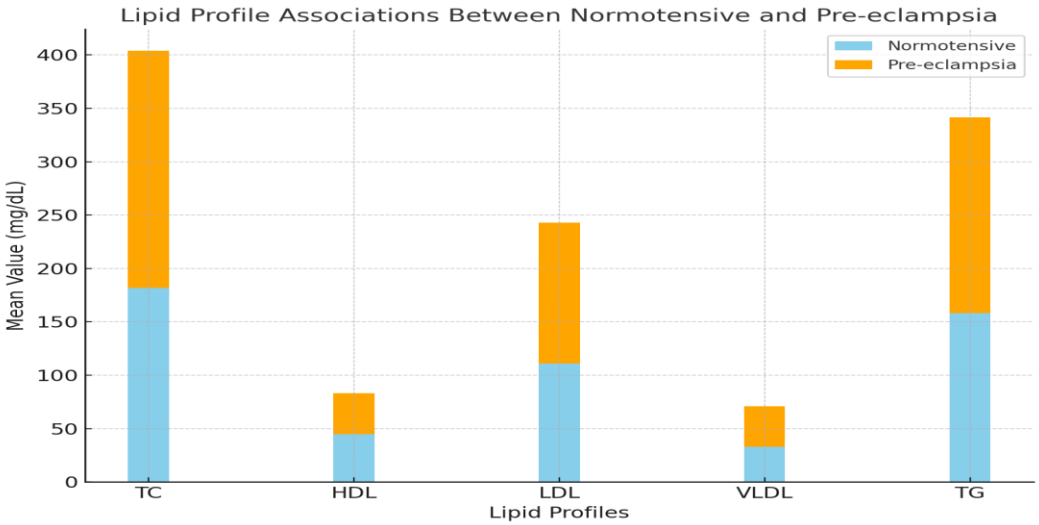

Fig: Gravida distribution between normotensive and pre-eclamptic participants. It shows the number of primigravida (Primi) and multigravida (Multi) participants in both groups.

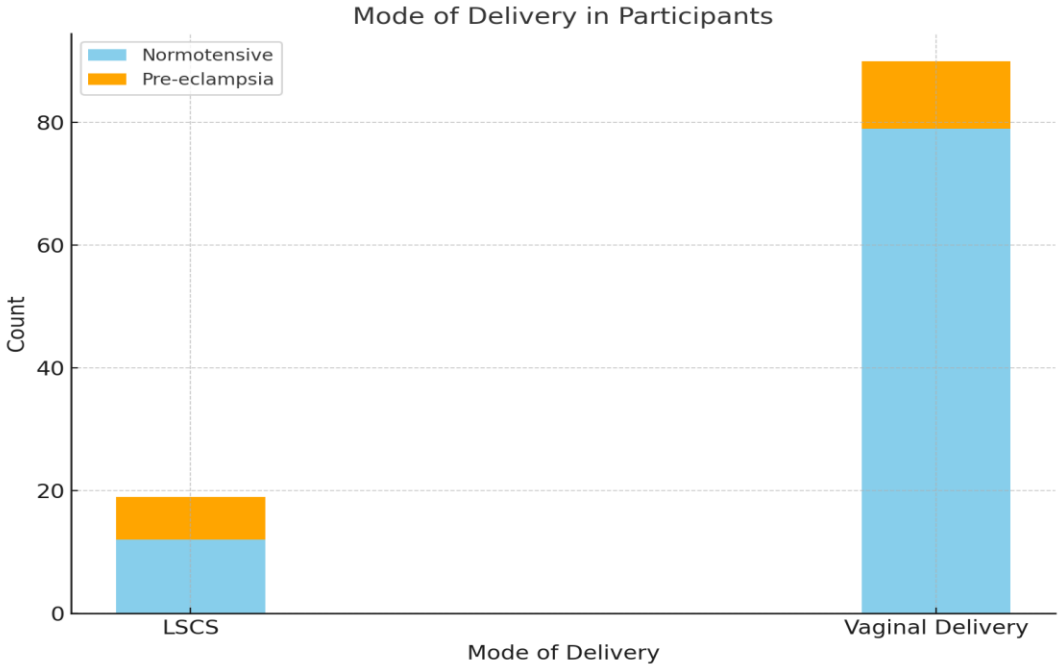

Fig: mode of delivery, comparing the LSCS (Caesarean section) and Vaginal delivery rates between normotensive and pre-eclamptic participants.

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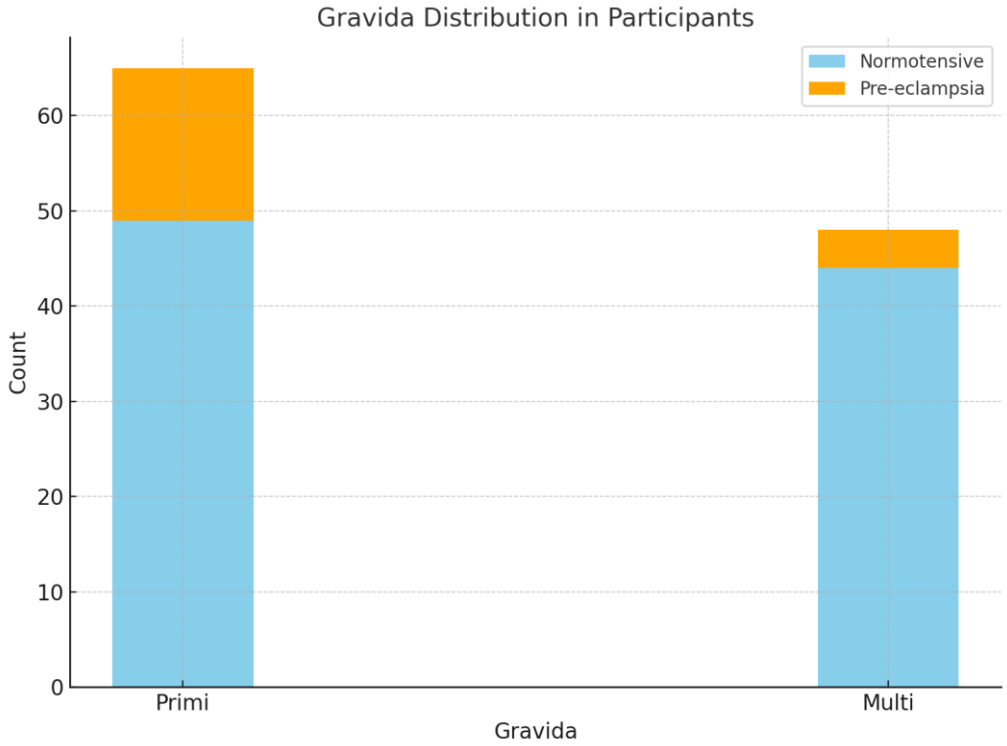

Fig: lipid profile associations (total cholesterol, HDL, LDL, VLDL, and triglycerides) comparing the mean values between normotensive and pre-eclamptic participants.

Discussion

The results of our study align with the findings of previous studies, such as those by Despande H et al. [15], who conducted a comparative observational study on 60 pregnant women to investigate the lipid profile in normotensive and pre-eclamptic patients. Their results showed a significant increase in the mean cholesterol level (208.8±12.64 mg/dL) and mean LDL level (140.36±10.8 mg/dL) in pre-eclamptic cases compared to normotensive cases, which supports our findings of significantly higher cholesterol and LDL levels in the pre-eclamptic group. Additionally, their study found a significant decrease in HDL levels (38.06±3.01 mg/dL in pre-eclampsia compared to 49.56±4.08 mg/dL in normotensive cases), which mirrors our own results showing lower HDL levels in the pre-eclampsia group (38.69±7.50 mg/dL compared to 44.62±7.35 mg/dL in normotensive women). Moreover, both studies demonstrated increased triglyceride levels (201.06±10.67 mg/dL in pre-eclampsia compared to 158.8±9.96 mg/dL in normotensive cases in Despande H et al., and 183.48±35.53 mg/dL in our study), underscoring the dyslipidemia associated with pre-eclampsia. The statistically significant associations between lipid profiles and pre-eclampsia were consistent in both studies ($p<0.05$), which confirms the role of lipid metabolism alterations in the pathophysiology of pre-eclampsia.

Similarly, the study by Vani I et al. [16] found a significant increase in total cholesterol, LDL, VLDL, and triglycerides in pre-eclamptic women, supporting our findings of lipid profile abnormalities in pre-eclampsia. This dyslipidemia is suggested to play a crucial role in the pathogenesis of pre-eclampsia, aligning with our results showing a significant rise in these lipid parameters. Their conclusion that dyslipidemia plays a vital role in pre-eclampsia is consistent with our findings that elevated lipid levels are associated with the condition, suggesting that lipid

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disturbances may contribute to the development of pre-eclampsia.

Khaliq F et al. [17] also observed significantly raised serum triglycerides, cholesterol, LDL, VLDL, and phospholipids in pre-eclamptic women compared to normal pregnancies, with a significant decrease in HDL. This aligns with our findings, where the pre-eclampsia group exhibited a significant decrease in HDL levels and increase in triglycerides and LDL, further supporting the idea that lipid abnormalities contribute to the pathophysiology of pre-eclampsia.

Additionally, Iftikhar U et al. [18] assessed the relationship between serum leptin levels and lipid profiles in pre-eclamptic patients and found elevated lipid levels in pre-eclampsia. Their study also showed that total cholesterol was significantly elevated in severe pre-eclampsia, which correlates with our observation of higher cholesterol levels in the pre-eclampsia group, especially in cases of severe pre-eclampsia. Gohil et al. [19] emphasized that dyslipidemia is evident in pre-eclampsia, particularly with decreased HDL and increased total cholesterol, LDL, VLDL, and triglycerides, which is in line with our study's findings. Their conclusion that dyslipidemia plays a significant pathological role in pre-eclampsia is reinforced by our results, which also indicate that lipid abnormalities are clinically significant in pre-eclamptic women. Saha D et al. [20] observed that HDL levels were significantly decreased and LDL, VLDL, and triglyceride levels were significantly increased in pre-eclampsia, which mirrors our findings of lipid disturbances in the pre-eclampsia group. Their conclusion that lipid metabolism plays a key role in the pathophysiology of pre-eclampsia is supported by our data, highlighting the relevance of lipid profile abnormalities in the development of pre-eclampsia.

Conclusion

Our study confirms the association between dyslipidemia and pre-eclampsia, supporting the results of previous studies that have shown a clear link between abnormal lipid levels and the pathogenesis of pre-eclampsia. Early detection of these lipid abnormalities could serve as a predictive tool for pre-eclampsia, potentially allowing for earlier intervention and better management of maternal and fetal outcomes. However, as lipid disturbances are not specific to pre-eclampsia alone, further research is needed to explore predictive tests that could more accurately identify women at risk for pre-eclampsia. Such tests would help stratify patients and improve maternal and perinatal outcomes, as early prediction and management of pre-eclampsia remain essential for preventing severe complications.

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