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Maternal Lipid Profile and Adverse Pregnancy Outcome: A Cohort Study

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Abstract

Aim: The aim of this study is to investigate the relationship between maternal lipid profile alterations and the development of adverse pregnancy outcomes.

Materials and methods: This prospective cohort study included 50 pregnant women divided into two groups: 25 women with deranged lipid profiles (study group) and 25 with normal lipid profiles (control group). Inclusion criteria were singleton pregnancies beyond 28 weeks conceived naturally, while exclusions included multiple pregnancies, pre-existing diabetes, thyroid or metabolic disorders, coronary artery disease, and chronic obstructive pulmonary disease. Data analysis was done using SSPS software.

Results: In the study group, women who developed preeclampsia had significantly higher total cholesterol levels (335.45 ± 20.24 mg/dL) compared to those who did not develop preeclampsia (193.33 ± 35.14 mg/dL), with a p-value <0.02. Triglyceride levels were slightly lower in women with preeclampsia (253.22 ± 32.43 mg/dL) compared to those without preeclampsia (262.23 ± 4.21 mg/dL), also with a p-value <0.02. High-density lipoprotein (HDL) levels were lower in women with preeclampsia (39.35 ± 7.22 mg/dL) than in those without preeclampsia (53.75 ± 5.70 mg/dL), but this difference was not statistically significant (p >0.03). Low-density lipoprotein (LDL) and very-low-density lipoprotein (VLDL) levels were higher in women with preeclampsia (121.76 ± 7.12 mg/dL and 58.33 ± 2.17 mg/dL, respectively) compared to those without preeclampsia (139.62 ± 20.50 mg/dL and 45.12 ± 10.43 mg/dL), but these differences were also not statistically significant (p >0.03).

Conclusion: Third trimester maternal dyslipidemia is linked to several maternal and fetal complications, including gestational diabetes mellitus, preeclampsia, and preterm labor.

Keywords: Trimester, Preeclampsia, Pregnancy

Introduction

Maternal lipid profile plays a crucial role in determining pregnancy outcomes, as alterations in lipid levels during gestation are associated with various maternal and fetal

complications. During pregnancy, normal physiological changes lead to increased levels of lipids, including triglycerides, cholesterol, and lipoproteins, to support fetal development. However, dyslipidemia, characterized by elevated or imbalanced lipid levels, can contribute to adverse outcomes such as gestational diabetes mellitus (GDM), preeclampsia, preterm labor, small or large for gestational age infants, and other pregnancy complications. The association between maternal lipid profiles and these outcomes highlights the importance of monitoring lipid levels during pregnancy, as early detection and management of dyslipidemia may help reduce the risk of these complications and improve both maternal and fetal health.[1,2,3]

Adverse pregnancy outcomes, such as preterm delivery, being born small for gestational age (SGA) or large for gestational age (LGA), and pregnancy-induced hypertension (PIH), carry significant short-term consequences, including increased perinatal morbidity and mortality, and long-term risks like type 2 diabetes, cardiovascular diseases, and hypertension in adulthood.[4] Despite advancements in obstetric care, these complications remain prevalent, highlighting the clinical and economic need to identify and address causal factors. Maternal atherogenic lipid profiles, including elevated levels of triglycerides (TG) and total cholesterol (TC), have been implicated as potential contributors to adverse outcomes.

While lipids play a crucial role in fetal development by being metabolized and transported via the placenta, abnormal lipid levels are associated with complications such as preterm birth (PTB), preeclampsia, and LGA.[5] Conversely, low TC levels have been linked to PTB and SGA. However, inconsistent findings across studies may result from varying research designs, small sample sizes, incomplete confounder adjustments, or differences in study populations. Furthermore, most research has focused on lipid profiles during the second and third trimesters, potentially confounding interpretations of cause and effect. In this context, this study investigates the relationship between first-trimester maternal TC and TG levels and key adverse pregnancy outcomes, including PIH, preeclampsia, PTB, SGA, LGA, and child loss, in a large cohort of pregnant women.[6]

The aim of this study is to investigate the relationship between maternal lipid profile alterations and the development of adverse pregnancy outcomes.

Materials and methods

This prospective cohort study included 50 pregnant women divided into two groups: 25 women with deranged lipid profiles (study group) and 25 with normal lipid profiles (control group). Inclusion criteria were singleton pregnancies beyond 28 weeks conceived naturally, while exclusions included multiple pregnancies, pre-existing diabetes, thyroid or metabolic disorders, coronary artery disease, and chronic obstructive pulmonary disease. After informed consent, participants underwent routine investigations, lipid profiling, and glucose screening (GST) using DIPSI criteria (GDM defined as blood glucose >140 mg/dL 2 hours after 75 g of glucose). Lipid profile parameters were classified as normal based on specific thresholds for total cholesterol, TG, HDL, LDL, and VLDL.

Pregnancy-induced hypertension (PIH) was diagnosed with BP readings ≥140/90 mmHg on two occasions, while preterm labor was identified by uterine contractions and cervical changes before 37 weeks. Data analysis was done using SSPS software.

Results

Table 1: Comparison of lipid profile of women with GDM versus women without GDM in study group

GDM			
Lipid Profile	Yes	No	P value
Total cholesterol	301.85 ± 20.24	198.22±32.74	<0.02
Triglyceride	282.12 ± 16.23	260.23±42.42	<0.02
HDL	37.23 ± 5.32	54.35± 5.35	>0.03
LDL	121.76 ± 7.12	143.63± 24.53	<0.04
VLDL	53.23 ± 2.42	42.32± 12.64	<0.04

In the study group, women with gestational diabetes mellitus (GDM) exhibited significantly higher levels of total cholesterol (301.85 ± 20.24 mg/dL) and triglycerides (282.12 ± 16.23 mg/dL) compared to women without GDM (198.22 ± 32.74 mg/dL and 260.23 ± 42.42 mg/dL, respectively), with p-values <0.02. High-density lipoprotein (HDL) levels were lower in women with GDM (37.23 ± 5.32 mg/dL) than in those without GDM (54.35 ± 5.35 mg/dL), though this difference was not statistically significant (p >0.03). Low-density lipoprotein (LDL) and very-low-density lipoprotein (VLDL) levels were higher in women with GDM (121.76 ± 7.12 mg/dL and 53.23 ± 2.42 mg/dL, respectively) compared to those without GDM (143.63 ± 24.53 mg/dL and 42.32 ± 12.64 mg/dL), with p-values <0.04.

Table 2: Comparison of lipid profile of women who developed preeclampsia vs who did not develop preeclampsia in the study group

Preeclampsia			
Lipid Profile	Yes	No	P value
Total cholesterol	335.45 ± 20.24	193.33±35.14	<0.02
Triglyceride	253.22 ± 32.43	262.23±4.21	<0.02
HDL	39.35 ± 7.22	53.75± 5.70	>0.03
LDL	121.76 ± 7.12	139.62± 20.50	>0.03
VLDL	58.33 ± 2.17	45.12± 10.43	>0.03

In the study group, women who developed preeclampsia had significantly higher total cholesterol levels (335.45 ± 20.24 mg/dL) compared to those who did not develop preeclampsia (193.33 ± 35.14 mg/dL), with a p-value <0.02. Triglyceride levels were slightly lower in women with preeclampsia (253.22 ± 32.43 mg/dL) compared to those without preeclampsia (262.23 ± 4.21 mg/dL), also with a p-value <0.02. High-density lipoprotein (HDL) levels were lower in women with preeclampsia (39.35 ± 7.22 mg/dL) than in those without preeclampsia (53.75 ± 5.70 mg/dL), but this difference was not statistically significant (p >0.03). Low-density lipoprotein (LDL) and very-low-density lipoprotein (VLDL) levels were higher in women with preeclampsia (121.76 ± 7.12 mg/dL and 58.33 ± 2.17 mg/dL, respectively) compared to those without preeclampsia (139.62 ± 20.50 mg/dL and 45.12 ± 10.43 mg/dL), but these differences were also not statistically significant (p >0.03).

Table 3: Comparison of lipid profile of women who developed preterm labor vs who did not develop preterm labor in study group

	Preterm Labor		
Lipid Profile	Yes	No	P value
Total cholesterol	310.15 ± 22.43	233.53±45.24	<0.01
Triglyceride	252.25 ± 12.31	202.21±32.11	<0.01
HDL	42.51 ± 5.20	40.15± 5.10	>0.02
LDL	125.66 ± 8.22	13.22± 20.52	<0.01
VLDL	52.33 ± 3.71	52.25± 10.76	<0.01

In the study group, women who experienced preterm labor had significantly higher total cholesterol levels (310.15 ± 22.43 mg/dL) compared to those who did not (233.53 ± 45.24 mg/dL), with a p-value <0.01. Triglyceride levels were also elevated in women with preterm labor (252.25 ± 12.31 mg/dL) compared to those without (202.21 ± 32.11 mg/dL), with a p-value <0.01. High-density lipoprotein (HDL) levels were slightly higher in women with preterm labor (42.51 ± 5.20 mg/dL) than in those without (40.15 ± 5.10 mg/dL), but this difference was not statistically significant (p >0.02). Low-density lipoprotein (LDL) levels were markedly higher in women with preterm labor (125.66 ± 8.22 mg/dL) compared to those without (13.22 ± 20.52 mg/dL), with a p-value <0.01. Very-low-density lipoprotein (VLDL) levels were similar between the two groups, although slightly higher in those with preterm labor (52.33 ± 3.71 mg/dL vs. 52.25 ± 10.76 mg/dL), with a p-value <0.01.

Discussion

This cohort study investigates the relationship between maternal lipid profiles and adverse pregnancy outcomes, including gestational diabetes mellitus (GDM), preeclampsia, and preterm labor. By analyzing lipid parameters such as total cholesterol, triglycerides, high-density lipoprotein (HDL), low-density lipoprotein (LDL), and very-low-density lipoprotein (VLDL), the study aims to determine their role as potential predictors of complications. Pregnant women beyond 28 weeks of gestation were grouped based on their lipid profile status and monitored for the development of these conditions.[7] The findings provide insights into how lipid metabolism impacts maternal and fetal health, emphasizing the importance of lipid screening in pregnancy care.

In our study women with gestational diabetes mellitus (GDM) exhibited significantly higher levels of total cholesterol (301.85 ± 20.24 mg/dL) and triglycerides (282.12 ± 16.23 mg/dL) compared to women without GDM (198.22 ± 32.74 mg/dL and 260.23 ± 42.42 mg/dL, respectively), with p-values <0.02. High-density lipoprotein (HDL) levels were lower in women with GDM (37.23 ± 5.32 mg/dL) than in those without GDM (54.35 ± 5.35 mg/dL), though this difference was not statistically significant (p >0.03). Low-density lipoprotein (LDL) and very-low-density lipoprotein (VLDL) levels were higher in women with GDM (121.76 ± 7.12 mg/dL and 53.23 ± 2.42 mg/dL, respectively) compared to those without GDM (143.63 ± 24.53 mg/dL and 42.32 ± 12.64 mg/dL), with p-values <0.04.

In the study by Vrijkotte TG et al.,[8] data from the Amsterdam Born Children and Their Development

(ABCD) cohort were used to investigate the association between nonfasting maternal total cholesterol and triglyceride levels during early pregnancy (median 13 weeks) and six major adverse pregnancy outcomes. The study included 4008 nondiabetic women with singleton deliveries, with specific analyses for pregnancy-induced hypertension (PIH) and preeclampsia conducted in 2037 nulliparous women. Results indicated that elevated triglyceride levels were significantly associated with increased risks of PIH, preeclampsia, large for gestational age (LGA), and induced preterm delivery, with odds ratios ranging from 1.48 to 1.69. However, no associations were found for small for gestational age (SGA) or child loss, and total cholesterol levels were not linked to any outcomes. These findings highlight the potential for lifestyle interventions, such as improved diet, weight management, and physical activity, to reduce triglyceride levels and mitigate the risks of hypertensive complications and adverse birth outcomes in pregnancy.

In the study by Tripathi U et al.[9], a cohort study conducted at a tertiary care hospital in Central India aimed to evaluate the association between altered lipid levels and the development of adverse maternal and fetal outcomes. The study included women attending outpatient, antenatal care, and inpatient departments during the study period. The results showed that women who developed gestational diabetes mellitus (GDM) and preeclampsia had significantly higher levels of total cholesterol, triglycerides (TG), low-density lipoprotein (LDL), and very-low-density lipoprotein (VLDL) compared to those who did not experience these conditions. Similarly, women who developed preterm labor (PTL) had significantly higher lipid levels. Additionally, women with small for gestational age (SGA) infants had elevated lipid levels, while no significant difference was found in lipid levels between women with and without macrosomia. The study concluded that third-trimester maternal dyslipidemia is associated with various maternal and fetal complications, including GDM, preeclampsia, preterm labor, and SGA babies.

In the study by Zhu SM et al.[10], the aim was to investigate the association between maternal lipid profiles during early pregnancy and birth weight, considering stratified pre-pregnancy body mass index (BMI). This retrospective cohort study included 57,516 women with singleton live births from two maternity centers in Shanghai, China, between January 2018 and October 2020. The study found that higher maternal concentrations of total cholesterol (TC), triglycerides (TG), and low-density lipoprotein cholesterol (LDL-c) in early pregnancy were linked to increased birth weight. Elevated TG levels, particularly above the 75th percentile, were positively associated with large for gestational age (LGA) and macrosomia, while negatively associated with small for gestational age (SGA). Additionally, the study identified significant combined effects of pre-pregnancy BMI and lipid profiles on LGA and macrosomia. The findings suggest that early pregnancy lipid profiles and pre-pregnancy BMI could be used as screening tools to identify high-risk women for adverse birth outcomes.

Maternal lipid profiles during early pregnancy play a significant role in predicting adverse pregnancy outcomes, including gestational complications and fetal growth abnormalities. Monitoring lipid levels, along with pre-pregnancy BMI, could serve as valuable screening tools for identifying high-risk pregnancies. Early detection and appropriate management of lipid

imbalances may help mitigate the risks of conditions such as macrosomia, LGA, and SGA, ultimately improving maternal and fetal health outcomes. Further research is needed to explore the long-term benefits of lipid management during pregnancy for both mothers and children.

Conclusion

Third trimester maternal dyslipidemia is linked to several maternal and fetal complications, including gestational diabetes mellitus, preeclampsia, and preterm labor.

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