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A study of Maternal Lipid Profile and adverse pregnancy outcome

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Abstract

Background : The maternal lipid profile has been increasingly recognized as a significant factor influencing pregnancy outcomes. Dyslipidemia during pregnancy can have adverse effects on both the mother and the fetus, potentially leading to complications such as preeclampsia, gestational diabetes, preterm delivery, and fetal growth restrictions. Understanding the relationship between maternal lipid levels and adverse pregnancy outcomes is crucial for developing strategies to improve maternal and fetal health. **Aim and Objectives** : To investigate the relationship between maternal lipid profiles and adverse pregnancy outcomes, emphasizing the potential mechanisms and clinical implications. **Materials and Method** : This study was a prospective cohort study conducted at the Obstetrics and Gynecology Department of Kakatiya Medical College/Hospital. Warangal, for the duration of one year. The study included 80 pregnant women attending the antenatal clinic at our institute, after getting informed consent from patients and approved by institutional Review board and

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meeting inclusion and exclusion criterial **Results** : majority of the patients were form age group of 26-30 Years, followed by 21 - 25 years, majority of the patients had normal BMI followed by Underweight(<18.5). Education showed graduation and above among most of the study participants followed by intermediate, and most of the patients underwent LSCS. study found that elevated levels of total cholesterol and LDL were significantly associated with an increased risk of preeclampsia and gestational diabetes. Higher triglyceride levels were also correlated with an increased likelihood of preterm birth and low birth weight. Conclusion : Assessing the serum lipid profile during pregnancy can serve as an early and cost-effective method to prevent the harmful effects of pregnancy-related hyperlipidemia.

Keywords : Maternal lipid profile, adverse pregnancy outcomes, dyslipidemia, preeclampsia, gestational diabetes, preterm birth, low birth weight, antenatal care.

Introduction

The maternal lipid profile during pregnancy is a critical aspect of maternal and fetal health, significantly influencing pregnancy outcomes. Lipids, including cholesterol, triglycerides, and lipoproteins, are essential for cellular functions and energy metabolism, particularly crucial during pregnancy.

Pregnancy induces substantial physiological changes, including lipid metabolism alterations driven by hormonal changes, such as increased levels of estrogen, progesterone, and human placental lactogen. These hormonal shifts facilitate adaptations in maternal metabolism to support fetal growth. While an increase in serum lipid levels is considered normal, exceeding normal ranges can lead to adverse pregnancy outcomes.

The maternal lipid profile consists of total cholesterol, low-density lipoprotein (LDL) cholesterol, high-density lipoprotein (HDL) cholesterol, and triglycerides. Each component plays a distinct role in maternal and fetal health. Elevated LDL cholesterol

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and triglycerides are linked to higher risks of complications like preeclampsia, gestational diabetes mellitus (GDM), preterm birth, and fetal growth restriction. In contrast, HDL cholesterol is protective, with low levels associated with adverse outcomes.

Preeclampsia, characterized by hypertension and proteinuria after 20 weeks of gestation, is a significant complication associated with abnormal lipid profiles. The condition involves endothelial dysfunction, inflammation, and oxidative stress, exacerbated by dyslipidemia. Elevated triglycerides and LDL cholesterol have been linked to preeclampsia, potentially promoting oxidative stress and inflammation. Additionally, low HDL cholesterol levels have been linked to a higher risk of preeclampsia, suggesting a protective role for HDL.

Gestational diabetes mellitus (GDM), characterized by glucose intolerance with onset during pregnancy, is also associated with dyslipidemia. Women with GDM often exhibit elevated triglycerides and LDL cholesterol, which may contribute to insulin resistance and beta-cell dysfunction. The interaction between dyslipidemia and hyperglycemia may worsen oxidative stress and inflammation, complicating pregnancy outcomes further.

Preterm birth and fetal growth restriction are other adverse outcomes linked to abnormal maternal lipid profiles. Elevated triglycerides and low HDL cholesterol levels are associated with a higher risk of preterm birth, possibly through placental dysfunction and inflammation. Dyslipidemia may impair placental function and nutrient transfer, contributing to fetal growth restriction.[1-2]

Understanding the role of maternal lipid profiles in these outcomes is crucial for developing preventive strategies and improving maternal and neonatal health. Identifying women at risk for dyslipidemia-related complications can lead to targeted

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interventions, such as lifestyle changes and pharmacological treatments, to optimize lipid profiles and improve pregnancy outcomes. Understanding the mechanisms by which dyslipidemia contributes to adverse outcomes can lead to new therapeutic approaches and preventive measures.

This study aims to investigate the relationship between maternal lipid profiles and adverse pregnancy outcomes, emphasizing the potential mechanisms and clinical implications.

Materials and Method

This study was a prospective cohort study conducted at the Obstetrics and Gynecology Department of Kakatiya Medical College/Hospital. Warangal, for the duration of one year. The study aimed to investigate the relationship between maternal lipid profiles and adverse pregnancy outcomes. The study included 80 pregnant women attending the antenatal clinic at our institute, after getting informed consent from patients and approved by institutional Review board and meeting inclusion and exclusion criterial given bellow

Inclusion Criteria :

- Pregnant women aged 18–40 years.
- All primigravida’s with Singleton pregnancies.
- Willingness to provide written informed consent.

Exclusion Criteria :

- Pre-existing metabolic disorders such as diabetes mellitus, hypertension, or hyperlipidemia.
- History of chronic renal, liver, or cardiovascular diseases.
- Multiple pregnancies.
- Use of lipid-lowering medication.

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Method :

Data were collected through structured interviews, medical records, and laboratory tests. Information gathered included, age, BMI, maternal education, Gestational age, Mode of Delivery,

The following lipid parameters were measured:

- Total cholesterol.
- Low-density lipoprotein (LDL) cholesterol.
- High-density lipoprotein (HDL) cholesterol.
- Triglycerides.

Lipid profiles were analyzed using an automated biochemical analyzer Quality control measures were implemented to ensure accuracy and precision in lipid measurements.

Outcome Measures

Adverse pregnancy outcomes considered in this study included

- **Preeclampsia**: Diagnosed based on the American College of Obstetricians and Gynecologists (ACOG) criteria, characterized by hypertension and proteinuria after 20 weeks of gestation.
- **Gestational Diabetes Mellitus (GDM)**: Diagnosed using the International Association of Diabetes and Pregnancy Study Groups (IADPSG) criteria based on an oral glucose tolerance test (OGTT).
- **Preterm Birth**: Defined as delivery before 37 completed weeks of gestation.

Statistical Analysis :

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Collected data were presented using frequencies, percentages, and descriptive statistics. The level of significance was set at 5%. All p-values less than 0.05 were treated as significant. Statistical analyses were performed using the Statistical Package for Social Sciences (SPSS) version 25 (IBM SPSS Statistics).

Observation and Results

The study included 80 pregnant women attending the antenatal clinic at our institute, after meeting inclusion and exclusion criteria, and their observation as given bellow.

Table :1 Distribution of Demographic Profile among study population

Parameters	Frequency	Percentage
Age		
<20 years	7	8.75
21 - 25 years	24	30
26-30 Years	38	47.5
31-35 Years	7	8.75
>35 years	4	5
Body Mass Index		
Underweight(<18.5)	17	21.25
Normal Weight(18.5-24.9)	57	71.25
Overweight and Obese(≥25)	6	7.5
Maternal Education		
Not Known	1	1.25
High School	5	6.25
Intermediate	32	40
Graduation and above	42	52.5
Mode of Delivery		
NVD	31	38.75
LSCS	49	61.25

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Above table showed demographic profile of study population, majority of the patients were form age group of 26-30 Years, followed by 21 - 25 years, majority of the patients had normal BMI followed by Underweight(<18.5). Education showed graduation and above among most of the study participants followed by intermediate, and most of the patients underwent LSCS.

Table :2 Mean Distribution of Lipid Profile in Gestational Diabetes Mellitus

Lipid Profile	Gestational Diabetes Mellitus		t-value	p-value
	Yes	No		
Total Cholesterol	304.52 ± 22.36	276.42 ± 39.24	3.78	0.0003
Triglyceride	253.62± 17.24	197.52 ± 38.75	7.96	0.0001
HDL	37.52 ± 6.41	42.31 ± 4.26	4	0.001
LDL	129.64± 7.38	118.75 ± 10.43	5.23	0.001

Table : 3 Mean Distribution of Lipid Profile in Preeclampsia

Lipid Profile	Preeclampsia		t-value	p-value
	Yes	No		
Total Cholesterol	325.52 ± 19.75	280.63 ± 42.36	5.37	0.0001
Triglyceride	255.77± 22.14	210.31 ± 41.66	5.44	0.0001
HDL	41.74 ± 5.27	43.27 ± 7.18	1	0.39
LDL	130.74± 9.43	121.44 ± 10.29	4	0.0001

Table : 4 Mean Distribution of Lipid Profile in Preterm Labour

Lipid Profile	Preterm Labour		t-value	p-value
	Yes	No		
Total Cholesterol	319.44 ± 26.42	281.42 ± 40.11	4.71	0.0001
Triglyceride	245.51 ± 30.69	210.42 ± 39.89	4.21	0.0001

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HDL	41.84 ± 6.63	38.56 ± 7.42	2.001	0.046
LDL	128.63 ± 8.45	122.64 ± 7.71	3.27	0.0016

Table : 5 Mean Distribution of Lipid Profile in Small for gestational Age

Lipid Profile	Small for gestational Age		t-value	p-value
	Yes	No		
Total Cholesterol	318.56 ± 23.94	283.33 ± 42.11	3.83	0.0003
Triglyceride	231.21 ± 28.91	215.61 ± 40.17	1.71	0.08
HDL	42.36 ± 6.87	40.32 ± 5.92	1.34	0.18
LDL	131.24± 7.17	122.42 ± 10.62	3.71	0.004

Discussion

Pregnancy is associated with elevated estrogen levels, which are the primary drivers of hyperlipidemia. This condition, characterized by oxidative stress due to high cholesterol and an increased atherogenic index, can lead to atherosis in the uteroplacental spiral arteries, reducing blood flow to the fetus and potentially causing preeclampsia. Hyperlipidemia, particularly in patients with a high BMI, is also linked to increased insulin resistance, which may result in gestational diabetes mellitus. Physiological changes in lipid metabolism during pregnancy support fetal growth and development, with an increase in adipose tissue accumulation and hepatic lipid synthesis. These adaptations are reflected in changes in the lipid profile during pregnancy. However, since there is no established normal lipid range for pregnant women, clinicians often use criteria for non-pregnant individuals to assess gestational lipid levels. Given that pregnancy is a critical period where both the mother and fetus

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are susceptible to adverse lipid environments, there is a pressing need for a specific reference range for lipids in pregnant women.

In the current study, most patients were between 21-30 years old. It was observed that total cholesterol, triglycerides, and low-density lipoprotein levels were higher in older women compared to younger ones, likely due to hormonal changes, particularly alterations in estrogen metabolism.[3] The study found increased levels of TC, TG, and LDL, and a decrease in HDL during pregnancy, indicating the accumulation of lipids in maternal tissues and the development of maternal hyperlipidemia.

The study also revealed elevated levels of total cholesterol, triglycerides, and LDL in patients with preeclampsia, gestational diabetes mellitus, preterm labor, and small for gestational age (SGA) infants, while HDL levels were low in these cases. These findings are consistent with studies by Jin et al., Abdu Helmy et al., and Sharami et al.[4–6], which also reported a significant association between GDM, preeclampsia, preterm labor, and SGA. Additionally, a study by Kandimalla et al. found that mean HDL-C levels were lower in preeclampsia patients.[7]

Regarding fetal outcomes, studies by Abdu Helmy et al., Sharami et al., and Jin et al. showed a positive correlation between abnormal lipid levels and the occurrence of SGA. Further studies by Anuradha et al., Singh et al., and Shen et al.[8, 9] have also demonstrated a positive correlation between dyslipidemia and preeclampsia.

Conclusion :

Based on the above observations and comparisons with other studies, we can conclude that maternal dyslipidemia is linked to various maternal and fetal complications, including gestational diabetes mellitus, preeclampsia, preterm labor, and small for gestational age (SGA) babies. Therefore, evaluating lipid profiles during

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the second and third trimesters could help predict these pregnancy-related complications. This assessment can be crucial for advising pregnant women on lifestyle modifications, such as increased physical activity, dietary changes, and timely interventions when necessary. Treating hyperlipidemia is particularly challenging because most medications used fall into category C or X. Given the small sample size and limited duration of our study, further research with a larger sample size is needed to make definitive recommendations.

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Conflict of Interest : None

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