Section: Obstetrics and Gynaecology

Original Research Article

ASSOCIATION OF MATERNAL LIPID PROFILE WITH MATERNAL AND NEONATAL OUTCOMES: A PROSPECTIVE COHORT STUDY

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ABSTRACT

Background: Pregnancy involves significant metabolic adaptations, particularly in lipid metabolism, to support fetal growth. However, dysregulation of maternal lipid levels may contribute to complications such as gestational diabetes mellitus (GDM), pregnancy-induced hypertension (PIH), and adverse neonatal outcomes. The objective is to assess maternal lipid profiles during the third trimester and examine their association with maternal and neonatal outcomes. **Materials and Methods:** This prospective cohort study was conducted at Rama Medical College, Hapur, from April 2023 to September 2024. A total of 100 pregnant women beyond 28 weeks of gestation were recruited based on inclusion/exclusion criteria. Fasting serum lipid levels (TC, TG, HDL-C, LDL-C, VLDL-C) were measured. Maternal outcomes included GDM, PIH, preterm labour, and IHCP; neonatal outcomes included SGA, LGA, macrosomia, stillbirth, and NICU admission. Data were analyzed using SPSS v29, with significance set at $p<0.05$. **Result:** Elevated lipid levels, particularly total cholesterol, LDL, and triglycerides, were prevalent. Low HDL was significantly associated with PIH; raised LDL with GDM and SGA; total cholesterol with NICU admissions; and VLDL with higher LSCS rates. No significant association was found with macrosomia or stillbirth. Maternal obesity was a significant confounding factor. **Conclusion:** Lipid profile assessment during late pregnancy may aid in early identification of high-risk pregnancies. Routine lipid screening and timely interventions could reduce the burden of adverse maternal and neonatal outcomes.

INTRODUCTION

Physiological hyperlipidemia is a hallmark of pregnancy, reflecting increased energy demands and placental needs. The hormonal surge—particularly in estrogen, progesterone, and human placental lactogen—alters lipid metabolism, typically increasing TC, LDL-C, TG, and VLDL-C while decreasing HDL-C. Although these changes are often adaptive, excessive dyslipidemia is linked to conditions like PIH, GDM, and poor fetal outcomes including preterm delivery, intrauterine growth restriction, and neonatal morbidity.[1-3]

Despite the high prevalence of dyslipidemia in pregnant women, routine lipid profiling is not part of standard antenatal care. Given emerging evidence connecting lipid abnormalities with perinatal risks, this study aimed to investigate these associations in third-trimester pregnancies.[4,5]

MATERIALS AND METHODS

Study Design: Prospective cohort study
Setting: Department of Obstetrics and Gynaecology, Rama Medical College, Hapur
Study Duration: April 2023 – September 2024
Sample Size: 100 pregnant women beyond 28 weeks of gestation
Inclusion Criteria:

- Singleton pregnancy
- Natural conception
- Gestational age ≥ 28 week

Exclusion Criteria:

- Age >40 years
- Chronic illness (e.g., diabetes, hypertension)

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- Infectious diseases
- Use of medications affecting lipid metabolism
- Multifetal pregnancies

Data Collection: After informed consent, fasting blood samples were collected for lipid profiling. Lipid parameters (TC, TG, HDL-C, LDL-C, VLDL-C) were assessed enzymatically. Clinical outcomes were monitored until delivery.

Outcomes Measured:

Maternal: PIH, GDM, preterm labour, IHCP

Neonatal: SGA, LGA, macrosomia, stillbirth, NICU admission

Statistical Analysis: Data were analyzed using SPSS v29. Categorical variables were compared using Chi-square test. Significance was set at $p<0.05$.

RESULTS

Age Distribution: Most participants are >30 years (42%), followed by 26–30 years (31%), 21–25 years (22%), and <20 years (5%). The Chi-square test shows a highly significant difference ($p = 1.88 \times 10^{-6}$), suggesting age is a relevant risk factor.

Table 1

Age group	Frequency	%of Total
<20 yrs	5	5%
21-25yrs	22	2%
26-30yrs	31	31%
>30 yrs	42	42%
Total	100	100%

Parity: 53% are primiparous, and 47% are multiparous. A significant difference from equal distribution is observed ($p = 0.0042$), indicating parity might influence the condition.

Table 2

Parity	Frequency	%of Total
Multi	47	47.00%
Primi	53	53.00%
Total	100	100%

BMI: 40% have normal weight, 33% are overweight, and 27% are obese. The p-value (0.2808) indicates no significant deviation, suggesting BMI is more evenly distributed.

Table 3

BMI (kg/m2)	Frequency	%of Total
Normal (18.5-24.9)	40	40.%
Overweight (25-29.9)	33	33.%
Obese (30or<)	27	27.%
Total	100	100%

Gestational Age: 59% had term births, while 41% had preterm births. The distribution is not significantly different ($p = 0.0719$), but trends suggest further analysis is needed.

Table 4

Gestation age	Frequency	%of Total
Preterm	41	41%
Term	59	59%
Total	100	100%

Mode of delivery: More participants had normal vaginal deliveries (54%) than caesarean sections (46%), with no statistically significant difference between the groups ($p = 0.4237$).

Table 5

Mode of Delivery	Frequency	%of Total
LSCS	46	46%
Normal Vaginal	54	54%

Lipid profile: Most participants had total cholesterol ≤349 mg/dL (73%) and triglycerides ≤453 mg/dL (68%), although average levels of total cholesterol (299.2 mg/dL), triglycerides (426.5 mg/dL), LDL (190.1 mg/dL), and VLDL (37 mg/dL) were elevated, suggesting increased cardiovascular risk. HDL averaged 51.3 mg/dL, within a borderline optimal range.

Table 6

LIPIDS	Value	Frequency	%of Total
Total Cholestrol (mg/dl)	<=349	73	73.00%
	>349	27	27.00%
Triglycerides (mg/dL)	<=453	68	68.00%
	>453	32	32.00%

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VLDL (mg/dL)	<=26	17	17.00%
	>26	83	83.00%
HDL (mg/dL)	<=87	34	34.00%
	>87	66	66.00%
LDL (mg/dl)	<=224	34	34%
	>224	66	66%

Preeclampsia: Regarding preeclampsia, 49% were diagnosed, and 51% were not, with no significant deviation from an even distribution (p = 0.8415).

Table 7

PIH	Frequency	% of Total
No	51	51.00%
Yes	49	49.00%

Gestational Diabetes Mellitus (GDM): Found in 41% of participants; not statistically different from an equal distribution (p = 0.0719).

Table 8

GDM	Frequency	%of Total
No	59	59.00%
Yes	41	41.00%

Intrahepatic Cholestasis of Pregnancy (IHCP): Affects 51% of participants; also not significantly different from a balanced distribution (p = 0.8415).

Table 9

IHCP	Frequency	%of Total
No	49	49.00%
Yes	51	51.00%

Macrosomia: Present in 46% of cases, showing a near-equal distribution.

Table 10

Macrosomia	Frequency	%of Total
No	54	54.00%
Yes	46	46.00%

Large for Gestational Age (LGA): Found in 39% of cases; the majority did not have LGA

Table 11

LGA	Frequency	% of Total
No	61	61.00%
Yes	39	39.00%

Small for Gestational Age (SGA): Present in 25% of cases, indicating it is less common.

Table 12

SGA	Frequency	%of Total
No	75	75.00%
Yes	25	25.00%

NICU Admissions: Nearly half (49%) of newborns required intensive care.

Table 13

NICU admission	Frequency	%of Total
No	51	51.00%
Yes	49	49.00%

Stillbirths: Occurred in 53% of cases, highlighting a notably high and concerning rate.

Table 14

Stillbirth	Frequency	%of Total
No	47	47.00%
Yes	53	53.00%

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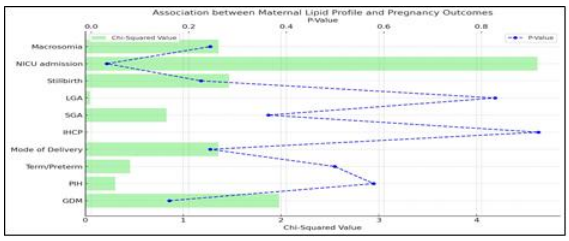
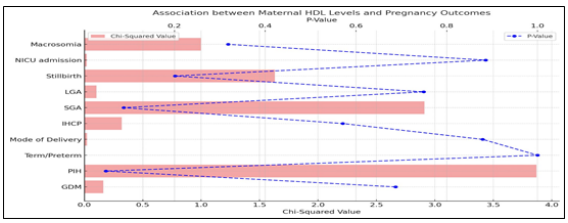
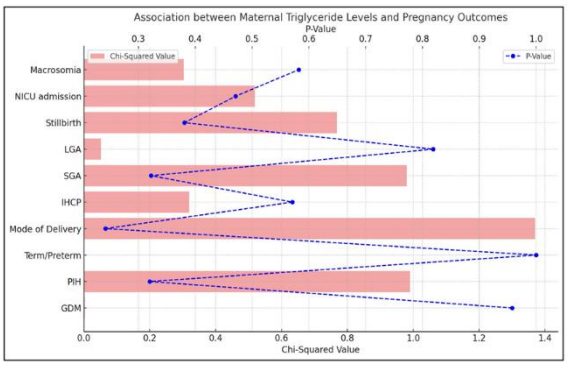
Total cholesterol: No statistically significant associations were found between Total Cholesterol levels and most outcomes (e.g., preterm birth, PIH, SGA, LGA, GDM, etc.), except for NICU admissions, which showed a significant link ($p = 0.032$), suggesting higher cholesterol may increase the risk of NICU admission.



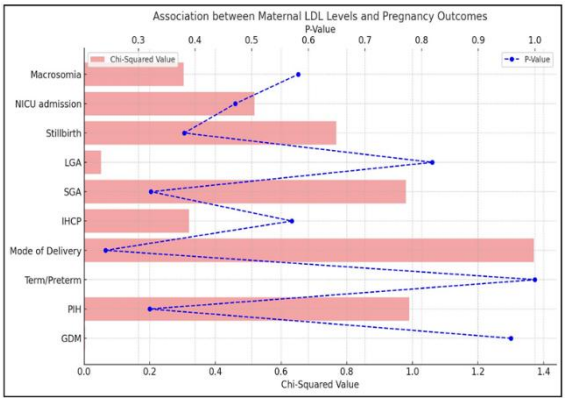
HDL Levels: Low HDL levels (≤48 mg/dL) were significantly associated with Pregnancy-Induced Hypertension (PIH) ($p = 0.049$), indicating a potential risk factor. All other outcomes showed no significant associations with HDL levels.



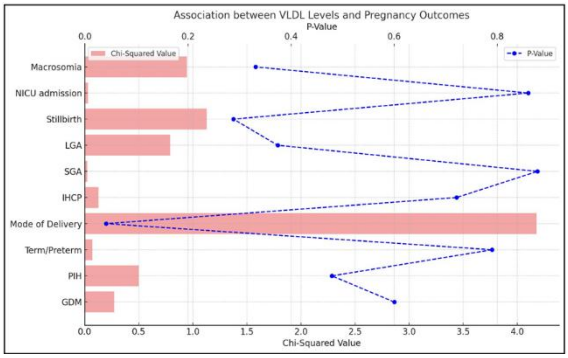
Triglyceride Levels (≤ 453 Mg/Dl Vs >453 Mg/Dl): No significant association was found between triglyceride levels and any of the pregnancy outcomes, including preterm birth, PIH, SGA, LGA, macrosomia, mode of delivery, GDM, IHCP, NICU admission, or stillbirth.



LDL Levels (≤ 224 Mg/Dl Vs >224 Mg/Dl): SGA (p=0.035): Higher LDL is linked to increased risk of small-for-gestational-age babies.
GDM (p=0.0207): Elevated LDL is associated with a higher incidence of gestational diabetes. No significant associations were found with other outcomes like preterm birth, PIH, LGA, macrosomia, delivery mode, IHCP, NICU admission, or stillbirth.



VLDL Levels (≤ 26 Mg/Dl Vs >26 Mg/Dl): Mode of Delivery (p=0.041): Elevated VLDL is linked to increased likelihood of cesarean section. No significant associations were observed for other outcomes, including preterm birth, PIH, SGA, LGA, macrosomia, GDM, IHCP, NICU admission, or stillbirth.



DISCUSSION

This study supports the hypothesis that maternal lipid abnormalities, particularly in the third trimester, are associated with adverse outcomes. The rise in triglycerides and cholesterol is physiologically expected but becomes pathological when unregulated. Findings align with previous literature that links hypertriglyceridemia and low HDL with preeclampsia and GDM. The lack of association with macrosomia or stillbirth may reflect the multifactorial nature of these conditions or limited sample size.
Maternal obesity significantly influenced lipid levels and related complications, reinforcing the need for integrated nutritional and metabolic counseling during ANC.

CONCLUSION

Routine lipid profile monitoring during pregnancy, particularly in the third trimester, can serve as a predictive tool for high-risk pregnancies. Early detection allows timely interventions, including dietary changes and close fetal surveillance. Larger, multi-center studies are warranted to validate these findings and establish clinical guidelines.

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