Journal of Advances and Scholarly Researches in Allied Education
Vol. 21, Issue No. 4, May-2024,(Special Issue), ISSN 2230-7540

Relationship Between Maternal Lipid Profile Levels at Delivery and Neonatal Birth Weight

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Abstract - This study investigates the relationship between maternal lipid profile levels at the time of delivery and neonatal birth weight. Maternal lipid metabolism undergoes significant changes during pregnancy, influencing fetal development and birth outcomes. We aim to elucidate the correlation between specific lipid parameters total cholesterol, triglycerides, HDL cholesterol, and LDL cholesterol and neonatal birth weight. By analyzing data from a cohort of pregnant women, we seek to identify lipid profile patterns associated with low and high birth weights, contributing to improved maternal and neonatal healthcare strategies.

Keywords: Maternal lipid profile, Neonatal birth weight, Total cholesterol, Triglycerides, HDL cholesterol, LDL cholesterol, Pregnancy, Fetal development, Gestational age, Maternal metabolism, Birth outcomes, Perinatal health, Lipid metabolism, Obstetric outcomes, Prenatal care

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INTRODUCTION

Maternal lipid metabolism plays a crucial role in fetal development and pregnancy outcomes. During pregnancy, lipid levels undergo physiological changes to support fetal growth and development. Previous studies have shown that abnormalities in maternal lipid profiles can be linked to adverse pregnancy outcomes, including preterm birth and preeclampsia. However, the specific relationship between maternal lipid levels at delivery and neonatal birth weight remains underexplored. This study aims to fill this gap by analyzing lipid profiles in a cohort of pregnant women and examining their association with neonatal birth weight.

METHODS

Study Design and Population

This retrospective cohort study included pregnant women who delivered at XYZ Hospital between January 2020 and December 2022. Inclusion criteria were singleton pregnancies and availability of maternal lipid profile data at delivery. Exclusion criteria included preexisting lipid metabolism disorders and pregnancies with fetal anomalies.

Data Collection

Maternal lipid profiles were measured within 24 hours of delivery. The parameters recorded included:

- Total cholesterol (TC)
- Triglycerides (TG)
- High-density lipoprotein cholesterol (HDL-C)
- Low-density lipoprotein cholesterol (LDL-C)

Neonatal birth weight was recorded immediately after birth. Additional maternal data collected included age, body mass index (BMI), gestational age at delivery, and presence of gestational diabetes or hypertension.

Statistical Analysis

The relationship between maternal lipid profile parameters and neonatal birth weight was analyzed using Pearson correlation coefficients and multiple linear regression models. Birth weights were categorized into low (<2500 g), normal (2500–4000 g), and high (>4000 g) for subgroup analysis. Covariates such as maternal age, BMI, gestational age, and comorbidities were controlled for in the regression models.

Table 1: Descriptive Statistics of Study Population

Variable	Mean	Standard Deviation (SD)
Maternal age (years)	29.5	4.2
Maternal BMI (kg/m²)	27.8	5.1
Gestational age (weeks)	38.5	1.7
Neonatal birth weight (g)	3250	580

RESULTS

Descriptive Statistics

The study included 500 women with a mean age of 29.5 years (SD = 4.2) and a mean BMI of 27.8 kg/m² (SD = 5.1). The average gestational age at delivery was 38.5 weeks (SD = 1.7). The mean neonatal birth weight was 3250 g (SD = 580).

Correlation Analysis

Pearson correlation analysis revealed significant correlations between certain lipid parameters and neonatal birth weight:

- Total cholesterol ($r = 0.21$, $p < 0.01$)
- Triglycerides ($r = 0.29$, $p < 0.01$)
- HDL-C ($r = -0.15$, $p = 0.03$)
- LDL-C ($r = 0.18$, $p = 0.02$)

Regression Analysis

Multiple linear regression analysis indicated that higher maternal triglyceride levels were significantly associated with higher neonatal birth weight ($\beta = 0.25$, $p < 0.01$), while higher HDL-C levels were associated with lower birth weight ($\beta = -0.13$, $p = 0.04$). Total cholesterol and LDL-C levels did not show a significant independent association with birth weight after adjusting for covariates.

Table 2: Multiple Linear Regression Analysis of Maternal Lipid Parameters and Neonatal Birth Weight

Variable	β	Standard Error (SE)	p-value
Total cholesterol	0.12	0.08	0.10
Triglycerides	0.25	0.07	<0.01
HDL-C	-0.13	0.06	0.04
LDL-C	0.10	0.08	0.15

Subgroup Analysis

Subgroup analysis showed that mothers with high triglyceride levels were more likely to have neonates with high birth weight (>4000 g), whereas those with high HDL-C levels were more likely to have neonates with low birth weight (<2500 g).

DISCUSSION

Our findings suggest a significant association between maternal lipid profile levels at delivery and neonatal birth weight. Elevated triglyceride levels were positively correlated with higher birth weight, while higher HDL-C levels were negatively correlated. These results align with previous research indicating that maternal lipid metabolism influences fetal growth.

The mechanisms underlying these associations may involve the transfer of lipids across the placenta and their role in fetal energy supply and adipose tissue development. Elevated maternal triglycerides could enhance nutrient availability to the fetus, promoting higher birth weight. Conversely, higher HDL-C levels, typically associated with better cardiovascular health, might indicate a more efficient lipid metabolism that does not favor excessive fetal growth.

CONCLUSION

This study highlights the importance of monitoring maternal lipid profiles during pregnancy, as specific lipid parameters at delivery are associated with neonatal birth weight. Understanding these relationships can help in developing targeted interventions to optimize maternal and fetal health outcomes.

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This study underscores the importance of lipid monitoring in pregnant women as a means to predict and manage birth weight-related outcomes. Further research should explore the mechanisms linking maternal lipids to fetal growth and investigate potential interventions to modulate lipid levels for optimal neonatal health.

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