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COMPARISON OF UMBILICAL CORD BLOOD LIPID PROFILE IN TERM AND PRETERM NEONATES: A CROSS-SECTIONAL STUDY AT A TERTIARY CARE HOSPITAL IN CENTRAL INDIA

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ABSTRACT

Background: Changes in foetal lipid profiles have been connected to an increased risk of cardiovascular disease in later life. Lipid metabolism starts in utero. Lipid transport and metabolism may be impacted by preterm delivery. The purpose of this study is to compare the lipid profiles of the umbilical cord blood in term and preterm newborns.

Objectives: Estimating and contrasting the cord blood lipid profiles of term and preterm infants.

Methods: From March 2022 to January 2023, a tertiary care hospital conducted a comparative cross-sectional study. 200 newborns (109 term, 91 preterm) had cord blood samples taken, and an autoanalyzer was used to measure the levels of total cholesterol, triglycerides, LDL, HDL, and VLDL. Version 20 of SPSS was used for statistical analysis.

Results: The mean total cholesterol was 103.63 ± 21.09 mg/dL in preterm neonates and 72.44 ± 21.27 mg/dL in term neonates ($p<0.001$). Additionally, preterm newborns had higher triglycerides (76.43 ± 23.31 mg/dL vs. 46.83 ± 32.80 mg/dL, $p<0.001$). Compared to 40.01 ± 17.83 mg/dL, preterm infants had higher LDL values (64.34 ± 15.21 mg/dL, $p<0.001$). There was no discernible difference between VLDL and HDL ($p>0.05$).

Conclusion: Preterm neonates had much higher levels of LDL, triglycerides, and total cholesterol, suggesting early changes in lipid metabolism that may make them more susceptible to cardiovascular hazards in the future.

Keywords: Cord blood, Lipid profile, Term neonates, Preterm neonates, Neonatal dyslipidemia

INTRODUCTION

Lipids are essential biological substances that serve as sources of energy, cellular membrane structural elements, and signalling molecule precursors. Lipid metabolism plays a crucial part in a number of processes throughout foetal development, such as immunological response, cell differentiation, pulmonary maturation, and neurodevelopment. Because of improved maternal-fetal lipid transfer, the foetus exhibits increased lipid deposition throughout the third trimester in particular (1,2).

Lipids including lipoproteins, triglycerides, and cholesterol are selectively transferred from the mother to the foetus by the placenta. However, disorders such as maternal metabolic syndromes, intrauterine growth restriction, and preterm may interfere with this process (3). Compared to term neonates, preterm neonates frequently have different lipid characteristics at birth because they do not get the essential third-trimester intrauterine lipid enrichment (4).

According to the "Developmental Origins of Health and Disease" (DOHaD) hypothesis, the idea of foetal programming highlights how changes in metabolism and endocrine function during pregnancy can make people more susceptible to chronic illnesses in later life (5). Adult obesity, insulin resistance, and cardiovascular disease have all been associated with neonatal dyslipidaemia (6).

Numerous investigations into the lipid levels in neonatal cord blood have produced conflicting results, especially when it comes to the impact of gestational age on the lipid profile. While some studies have found no significant differences or lower values, others have found increased levels of triglycerides and cholesterol in preterm newborns (7–9). Additionally, there is a dearth of literature from the Indian subcontinent, and the majority of data are from Western nations.

In order to find early variations in lipid metabolism and possible cardiovascular risk factors, this study compared the umbilical cord blood lipid profiles of term and preterm neonates in an Indian tertiary care setting.

MATERIALS AND METHODS

Study Design and Setting:

The pediatric department of a tertiary teaching hospital in central India served as the site for this cross-sectional comparative study. The study period ran from March 2022 to January 2023, a total of eleven months.

Ethical Approval:

Prior to the start of data collection, the Institutional Ethics Committee approved the study protocol. Following an explanation of the study's goals and methods, the mothers of every newborn included in the trial provided written informed consent.

Participants:

A total of 200 neonates delivered at the hospital were recruited. Based on gestational age at birth, participants were divided into two groups:

- Term neonates: Gestational age ≥ 37 completed weeks (n = 109)
- Preterm neonates: Gestational age < 37 completed weeks (n = 91)

Inclusion Criteria:

- Neonates born within the hospital (inborn)
- Deliveries conducted through vaginal, cesarean, or instrumental methods
- Absence of congenital anomalies or major perinatal complications

Exclusion Criteria:

- Neonates delivered outside the hospital (outborn)
- Infants born to mothers diagnosed with chronic conditions such as gestational diabetes, hypertensive disorders of pregnancy, thyroid dysfunction, tuberculosis, or hepatic/renal diseases

- Neonates whose mothers were taking long-term medications that could influence lipid metabolism (e.g., steroids or antiepileptic drugs)

Data Collection Procedure:
Demographic and clinical information was gathered using a predesigned proforma. This included maternal age, obstetric history, delivery type, and any antenatal complications. Neonatal details such as gender, birth weight, and gestational age (calculated using the Modified Ballard Scoring System) were recorded.

Cord Blood Sampling and Processing:
Five millilitres of cord blood were extracted aseptically from the placental end as soon as the baby was delivered and the umbilical cord was clamped. To separate the serum, the samples were placed in sterile plain vacutainers and centrifuged for 15 minutes at 3000 revolutions per minute. Before being examined further, the serum was kept at -20°C.

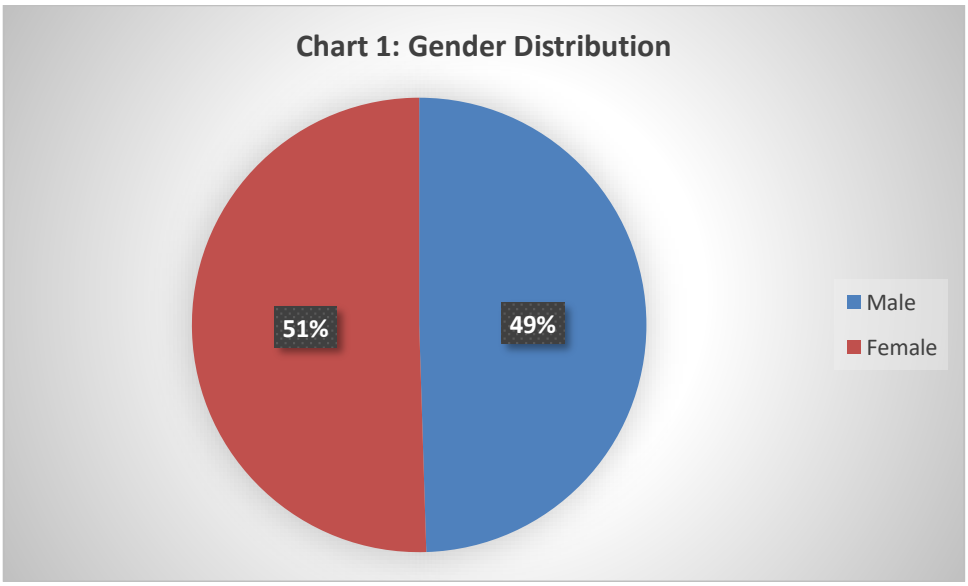
Biochemical Analysis:
The central diagnostic laboratory's automated chemistry analyser was used to evaluate the lipid profile. Measurements were made of the following parameters: Low-Density Lipoprotein (LDL), High-Density Lipoprotein (HDL), Very Low-Density Lipoprotein (VLDL), Total Cholesterol (TC), and Triglycerides (TG)

Statistical Methods:
IBM SPSS software, version 20.0, was used to analyse the data. The standard deviation (SD) and mean were used to summarise continuous variables. The independent sample t-test was used to examine differences in mean values between term and preterm newborns. P-values below 0.05 were regarded as statistically significant.

RESULTS

Table 1: Gender Distribution

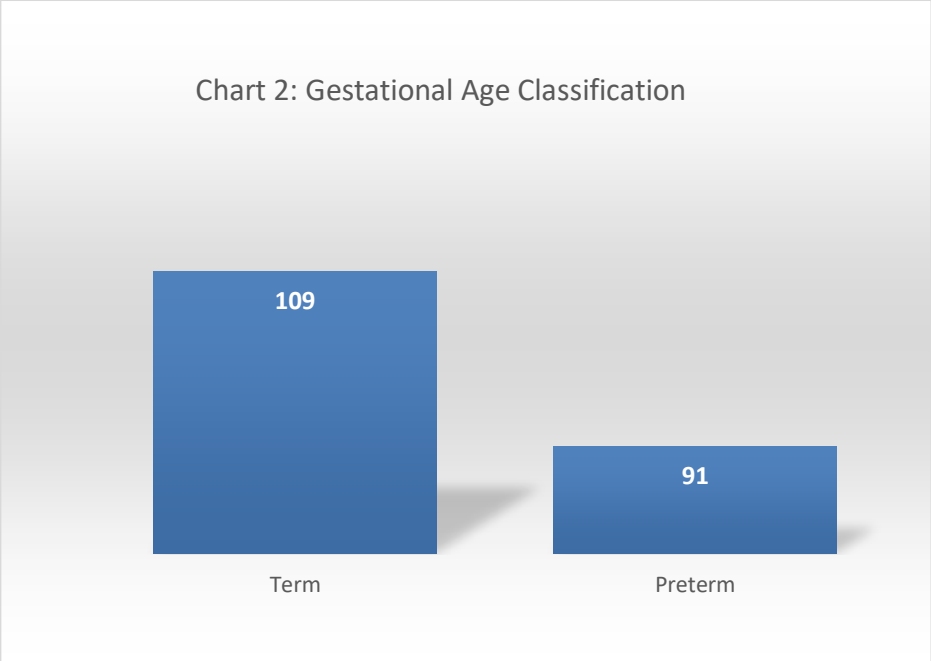
Gender	Number	Percentage
Male	99	49.50%
Female	101	50.50%



The gender distribution in the study population was nearly equal, with a slight predominance of females (50.5%) over males (49.5%).

Table 2: Gestational Age Classification

Classification	Number	Percentage
Term	109	54.50%
Preterm	91	45.50%



Of the total 200 neonates included in the study, 54.5% were term and 45.5% were preterm.

Table 3: Cord Blood Lipid Profile

Parameter	Mean ± SD	Median (IQR)	Range
Total Cholesterol	86.46 ± 26.25	86 (68–103.25)	30–181 mg/dL
Triglycerides	60.3 ± 32.38	61 (32.75–82)	10–293 mg/dL
LDL	51.06 ± 20.66	50.74 (36–66.1)	2–128.6 mg/dL
VLDL	9.95 ± 7.26	8.1 (5.75–12.05)	2–58.6 mg/dL
HDL	25.73 ± 7.19	25 (22–29)	2.5–76.6 mg/dL

The overall lipid profile across all neonates demonstrated wide ranges, particularly in triglycerides and total cholesterol, suggesting individual variability. The mean total cholesterol level was within the expected neonatal range.

Table 4: Cord Blood Lipid Profile Comparison: Term vs. Preterm Neonates

Lipid Parameter	Term (n=109) Mean ± SD	Preterm (n=91) Mean ± SD	p-value
Total Cholesterol	72.44 ± 21.27	103.63 ± 21.09	<0.001
Triglycerides	46.83 ± 32.80	76.43 ± 23.31	<0.001
LDL	40.01 ± 17.83	64.34 ± 15.21	<0.001
VLDL	8.46 ± 6.47	10.09 ± 5.65	0.1
HDL	28.28 ± 7.95	26.85 ± 5.17	0.14

The main result of the study is shown in this table: compared to term newborns, preterm neonates had considerably higher levels of total cholesterol, triglycerides, and LDL ($p<0.001$ for each). Since these lipids are known to contribute to early atherogenic alterations, it is possible that a disturbed lipid regulation mechanism, possibly brought on by immature hepatic function and missed third-trimester lipid transfer, is linked to premature birth.

Preterm neonates had lower HDL and higher VLDL values, respectively, although these differences were not statistically significant (p=0.14 and p=0.10, respectively). This suggests that while preterm has a considerable impact on core atherogenic lipids (cholesterol, TG, and LDL), additional factors like maternal lipid profile, foetal nutrition, or genetic susceptibility may have an impact on HDL and VLDL.

DISCUSSION

The present study offers strong proof that the lipid profiles of preterm neonates differ markedly from those of term neonates. In particular, triglycerides, low-density lipoprotein (LDL), and total cholesterol—all known indicators of atherogenic potential—were substantially elevated in premature infants. Studies by Mishra et al. (2), Obaji et al. (3), and Yashodha et al. (4) have also revealed higher lipid markers in preterm or small-for-gestational-age (SGA) infants, which is consistent with these findings.

The physiological immaturity of the hepatic enzymes involved in lipid metabolism is one explanation for these high lipid levels in preterm infants. Preterm newborns have lower levels of lipoprotein lipase (LPL), an enzyme essential for triglyceride clearance, which causes lipid buildup in the bloodstream (5). Furthermore, the third-trimester increase in maternal lipid transfer—specifically, cholesterol and long-chain polyunsaturated fatty acids—that is necessary for the development of the foetal brain and lungs is not available to premature infants (6).

The "Developmental Origins of Health and Disease" (DOHaD) concept, which holds that exposures during pregnancy may have long-term impacts on an adult's health, makes the importance of these findings even more pertinent. It is thought that early-life dyslipidaemia predisposes people to type 2 diabetes, insulin resistance, hypertension, and atherosclerosis later in life (7,8). Therefore, using cord blood lipid profiling to identify at-risk infants may offer a useful chance for early intervention.

It's interesting to note that there were no statistically significant variations in the groups' HDL and VLDL levels. Known for its cardioprotective function, HDL has exhibited mixed tendencies in various research; some have shown no difference, while others have reported higher levels in term neonates (9,10). Our study's lack of significance in HDL levels may have been caused by genetic variability, dietary consumption, and maternal lipid status heterogeneity.

In an Indian tertiary care setting, where regional eating patterns, maternal health, and perinatal procedures may differ significantly from Western populations, this study provides useful data. Studies like ours highlight the significance of early risk assessment, especially in light of the rising prevalence of cardiovascular illnesses in South Asia.

The study does have several drawbacks, though. It was a single-center study with a small sample size, to start. Second, there was no parallel evaluation of maternal lipid profiles, which would have shed light on lipid linkages between the mother and the foetus. Third, it is impossible to draw conclusions about the clinical consequences of changed cholesterol levels in the absence of long-term neonatal follow-up.

In order to assess the relationship between newborn lipid state and subsequent metabolic health, future research should investigate longitudinal tracking of these neonates. Our findings would also be supported by multi-center trials that include maternal biochemical markers and have bigger sample sizes.

CONCLUSION

According to this study, compared to term newborns, preterm neonates have noticeably higher levels of total cholesterol, triglycerides, and LDL in their umbilical cord blood. These results point to early abnormalities in lipid metabolism in preterm infants, which may put them at risk for metabolic and cardiovascular disorders in later life. In order to identify neonates at risk, cord blood lipid profile

may be a helpful non-invasive screening method that directs early interventions and fosters lifetime health.

REFERENCES

1. Barker DJ. The fetal and infant origins of adult disease. BMJ. 1990;301(6761):1111–5.
2. Mishra L, Choudhary P, Yadav K, et al. Cord blood lipid profile in neonates and its relation to gestational age and birth weight. Int J ContempPediatr. 2017;4(4):1305–10.
3. Obaji O, Ezechukwu C, Ikeogu C, et al. Cord blood lipid profile and its relationship with gestational age and birth weight. BMC Pediatr. 2023;23(1):121.
4. Yashodha HT, Jayashree S, Nataraj SM. Lipid profile and atherogenic indices in late preterm and term neonates. Int J Med Res Health Sci. 2018;7(7):85–91.
5. Zetterström R. Lipid metabolism in the fetus and the newborn. Prog Clin Biol Res. 1983;128:181–8.
6. Herrera E, Ortega-Senovilla H. Lipid metabolism during pregnancy and its implications for fetal growth. Curr Pharm Biotechnol. 2014;15(1):24–31.
7. Barker DJP, Osmond C, Kajantie E, et al. Growth and chronic disease: findings in the Helsinki Birth Cohort. Ann Hum Biol. 2009;36(5):445–58.
8. Srinivasan SR, Bao W, Wattigney WA, Berenson GS. Adolescent overweight is associated with adult metabolic syndrome: the Bogalusa Heart Study. Pediatrics. 1996;98(2):280–5.
9. Gupta R, Agarwal A, Meena K. Comparison of cord blood lipid profile in AGA and SGA neonates. Indian J Pediatr. 2021;88(9):840–4.
10. Magon P, Anand S, Jain V. Lipid profile of Indian newborns and the impact of prenatal factors. J Perinatol. 2013;33(5):346–51.
11. Arora S, Patel N, Gajjar M. Cord blood lipid profile in term neonates. J Clin Neonatol. 2017;6(3):128–32.
12. Joshi SJ, Chaudhari S, Jadhav AT. Cord blood lipid levels and neonatal outcomes. J Clin Neonatol. 2022;11(2):89–94.