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Lipid profiles of umbilical cord blood: A comparative study in pre-term and full-term Newborns

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ABSTRACT

The foremost causes of death in developed and developing countries both are cardiovascular disorders. Higher concentration of lipids in pre term neonates may increase their future risk of cardiovascular diseases. Early diagnosis and dietary modifications and proper management may rectify the risk factors and prevent future risk of cardiovascular disease. Our study aims to compare lipid profiles and atherogenic index in the cord blood of pre-term and full-term neonates. It is a retrospective and observational study conducted for a period of one year from December 2018 to November 2019 in the Departments of Biochemistry and Gynecology of Santosh Medical College and Hospitals, Ghaziabad and K D Medical College Hospital and Research center. Among 60 neonates including 30 (50%) term and 30 (50%) preterm, TC, TG, LDL, VLDL, were raised in preterm when compared to term babies while HDL level was significantly increased (<0.05) in a term as compared to preterm babies. This study supports inverse relation between gestational age and lipid profile and this deranged lipid profile preterm group could be a threat or among factors for the future development of Atherosclerotic and cardiovascular diseases in their former part of life.

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INTRODUCTION

Serum lipid profile characterizes the pattern of concentration of key compounds of lipid metabolism, mainly triglycerides (TG), total cholesterol (TC) and its sub-types, high-density lipoproteins cholesterol (HDL-C) and the low-density lipoproteins cholesterol (LDL-C) (Kliegman *et al.*, 2016). The wellness of a new-bornderives from the nutritional status of the foetal life determines the quality of future adult life. Foetus is known to be the reference source for the establishment of normal concentrations of nutrients in the blood & tissue (Kliegman *et al.*, 2016). The carbohydrate, protein and lipid nutritional status to the foetus can nicely be traced out in the cord serum. Concentrations of lipoproteins in the cord blood are subjective to the maturity level of full term/preterm in newborns. Raised cholesterol and triglycerides in the blood are very well known risk factors in coronary heart disease (Kleinman *et al.*, 2008; Gale *et al.*, 2002; Godfrey and Barker, 2000). It is not yet known whether lowering the level of elevated blood lipids will prevent or retard the onset of coronary heart disease, but if such treatment is really of worth, should possibly be started at the earliest right from the start. Early diagnosis of hyperlipidemia is very important to cop up with the clinical condition. In India follow up neonatal risk factors

of lipid disorder, cardiac ischemia, hypertension, obesity and diabetes in adult stage (Vobecky *et al.*, 1982; Epstein and Ostrander, 1971). One investigational report given by researchers showed that that gender wise there is no variation in cord blood profile (Kannel *et al.*, 1971; Carlson and Bottiger, 1972). Decreased HDL with high LDL and low birth weight are potential risk factors for cardiovascular disease in future.

A study in Spain reported that the cord blood HDL-C level was lower in premature than in term newborns, but levels of very-low-density lipoprotein (VLDL) were more in preterm than in term newborns. In a study in Japan, cord blood samples of preterm newborns had higher concentrations of VLDL, LDL-C, and HDL-C subclasses compared with their term counterparts (Goldstein *et al.*, 1973; Morillas *et al.*, 1992).

This unbalanced lipid profile can continue into adult life, it is wise to recognize such children at risk in the antenatal and postnatal period itself and give special attention to them in terms of lifestyle modification to prevent the development of future complications particularly cardiovascular complications. Such screening can be done through determination of Umbilical cord blood lipid profile.

This study tries to compare and determine all lipid parameters in Umbilical cord blood and correlate levels of pre-term and full term newborn. Weight of birth and fetal gender whether influence lipid profile in neonates.

Aims and Objectives

To estimate the biochemical parameters such as serum lipid profile total cholesterol, triglycerides, HDL, LDL, in Umbilical cord blood in preterm and full term neonates.

MATERIALS AND METHODS

This study, on Human Umbilical cord blood serum, is a retrospective hospital based comparative study, carried out in Biochemistry and Gynecology of Santosh Medical College and Hospitals, Ghaziabad and K D Medical College Hospital and Research center. The small study was conducted in a sample size of 60, of which a control group and experimental groups were divided.

Total of 60 neonates was involved and enrolled in this study. Two groups of neonates were formed. Group A- included, 30 preterm neonates (32 weeks to 36 weeks) and group B- included, 30 full term neonates (from 37 weeks to 41 weeks). Birth weight was estimated by digital electronic weighing scale.

Inclusion criteria

Neonatal infants between 32 to 41 weeks of gestation period.

Exclusion criteria

1. Congenital abnormalities and syndromes
2. Less than 7 APGAR score at 5 minutes
3. Neonates on treatment
4. Chronic pancreatitis, thyroid disorders, Cushing's disease and primary hypercholesterolemia in mother
5. Intake of drugs by mother affecting neonatal lipid levels

Inclusion criteria consisted of all healthy neonates just delivered to healthy mothers. Newborns babies who were born by normal vaginal delivery in tertiary care hospital were enrolled. All cases were involved after obtaining written informed consent of parents. 5 ml of blood from the umbilical cord was immediately collected after delivery. Sample was allowed to clot and serum was separated to store at -20°C until the analysis is done in aliquots. Lipid profile of each sample was done using automatic analyzer by regular protocols. Tg was measured by GPO-PAP method, TC was estimated by CHOD-PAP method. HDL was estimated by clearance method. LDL and VLDL values were calculated by Fried-wield formula.

Statistical analysis

Data was analyzed using SPSS software. Students' test was used to compare the groups of the study. Significant p value was <0.05.

RESULTS

Total 60 neonates were included in study 30 (50%) were preterm and 30 (50%) term neonates. As depicted in Table 1, the total cholesterol, triglyceride, HDL, LDL and VLDL level were increased in term compared to preterm Neonates.

Cholesterol, triglyceride, LDL and VLDL was increased in preterm babies as compared to term babies. Mean cholesterol in preterm babies was 85.16 ± 22.72 and term babies were 55.79 ± 11.6. Mean of triglyceride in preterm was 51.83.±23.96 and term babies were 48.70±27.97. Mean HDL in preterm was 27.70±1.61 and term babies were 23.61±7.28, which is the only parameter raised among preterm than in term group. Mean LDL in preterm 41.63±14.53 and term babies was 21.27±8.85 and mean VLDL in preterm babies was

Table 1: Comparison of parameters at birth for pre-term and full-term Neonates

Lipid profile	Pre-term Mean ± SD	Full-term Mean ± SD	P. Value
Cholesterol	85.16±22.72	55.79±11.6	.000
TG	51.83±23.96	48.70±27.97	.563
HDL	27.70±1.61	23.61±7.28	.005
Atherogenic index log10 (TG/HDL)	0.341	0.272	0.01
LDL	41.63±14.53	21.27±8.85	.000
VLDL	17.93±13.30	10.41±5.79	.005

17.93±13.30 and term babies were 10.41±5.79. Artherogenic index (log 10(TG/HDL) was calculated for both the groups, it came out to be at increased risk for preterm as compared to term babies however p value is not very significant (0.01).

DISCUSSION

In Umbilical cord blood of humans, lipid profile has been a positive marker of underlying cardiovascular events. Studies have found a direct and strong positive correlation between abnormal lipid profiles and cardiovascular diseases and even mortality (Hossain *et al.*, 2007). Cord blood estimation of lipids and lipoproteins profile serum reflects the prominence of metabolism of lipids and fats in the infant at birth since mostly fetal lipids are synthesized via de novo mechanism of conversion of glucose to various fatty acid compounds. Only a fraction of total fatty acids are synthesized from placental circulation (Lane and McConathy, 1983). Since only one part of fatty acid, is derived from placental circulation, quantifying of cord blood lipid profile will be like measuring fat metabolism through neonatal birth. Among various aspects theorized in the expansion of atherosclerosis and other heart diseases, increased plasma level of TC and Tg are most significant (Misra *et al.*, 1984).

Determination of umbilical cord lipid profile is adapted as a tool of significance to detect babies of higher risk since numerous research scientists are supportive towards the belief that the atherosclerotic lesions owe its origin in early childhood (Haridas and Achrya, 1984). The present study was planned to estimate and compare lipid profiles and artherogenic index in pre-term and full term newborn. Out of a total of 60 subjects 30 pre-term (31 to 36 week) and 30 full-term (37 to 41 week), neonates were involved in the study. The highest amount of cholesterol in cord blood was documented in preterm neonates. In the total study group, a highly significant difference existed in the mean of triglycerides levels. In the development of atherosclerotic symptoms, increased plasma levels of cholesterol and triglycerides are considered crucial factors. Atherosclerosis begins early in life, and the studies done on umbilical cord blood lipid profile had unreliable findings. In this study, we also found artherogenic index from given data, which came out to be at risk in both pre-term and term neonates. Normal artherogenic index should be lower than 0.11, it is intermediate between 0.11 to 0.21 and more than 0.21 value is at higher risks.

Findings of the current study are not consistent with a previous study on cord blood cholesterol, which found higher cholesterol in preterm than in term newborns (Morillas *et al.*, 1992; Nagano *et al.*, 2012; Donegá *et al.*, 2006). In another study, preterm infants had a high level of cholesterol concentrations (Tohmaze, 2014). A research study by Dogra *et al.* reported that preterm neonates had higher levels of TC and TG, but a significant difference was found only in TC ($p<0.001$) levels (Dogra *et al.*, 1988). A study by Kumar A, Gupta A et al., concluded that TG, LDL, HDL were higher in preterm neonates compared to full-term neonates with the significant difference found in TC and LDL levels only. HDL was statistically insignificant. All parametric values were increased in preterm infants as compared to full-terms (Kumar *et al.*, 1989). Other studies by van der Schouw *et al.* discovered that the cord blood lipid profile was lower in preterm neonates when compared to full-term neonates.TC was found statistically significant ($p<0.001$) and HDL and LDL levels were insignificant (van der Schouw *et al.*, 1991). In our study higher status of lipid levels in preterm neonates could be explained by the fact that preterm babies are deficient in hepatic carbohydrate and subcutaneous adipose tissue stores, with the result that circulation fuel is less and may finish (Kumar *et al.*, 2019). The rise in cord blood lipids mirrors the metabolic adaptation of the body to provide suitable energy, especially to vital organs like the brain (Averna *et al.*, 1992).

CONCLUSION

Results of our study demonstrates that TC, LDL-C and HDL were significantly raised in preterm neonates compared with term infants, presenting a drift to a shoddier lipid profile in preterm neonates. Forthcoming studies are certainly needed to answer remaining questions like whether, atherogenic index of preterm/full term neonates could affect body metabolism or not, and also whether it increases the menace for cardiovascular diseases in fully-grown/adult life.

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Conflict of Interest

The authors declare that they have no conflict of interest for this study.

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