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# CORD BLOOD LIPID PROFILE IN PRETERM AND TERM NEWBORNS: A HOSPITAL BASED COMPARATIVE STUDY FROM NORTH KANARA REGION OF INDIA

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**ABSTRACT**

**Introduction: Background:** Cardiovascular diseases are common cause of moertality in developed countries and also are rising trend in developing countries. It has its roots in adverse fetal environment; which lead to adult diseases like Coronary artery diseases in later life. **Aim:** The objective of this study was to compare & contrast the lipid profiles in term and preterm neonates. **Materials and Methods:** a case-control study was conducted in departments of Pediatrics & Obstetrics of Karwar Institute of Medical Sciences, Karwar, Karnataka of India over a period of 10 months. 500 deliveries were recruited randomly which met the inclusion criteria after informed written consent; babies were divided into Comparison group 1 (Preterm gestation of <37weeks gestational age)& comparison group 2 (term gestation of >37 weeks gestational age). Cord blood lipd-profiles of these babies were compared & studied. **Results:** Out of 500 babies studied, there were 197 preterm (<37weeks gestational age) & 409 term babies (>37 weeks gestational age) babies. The Mean gestational age was 39.55±1.11 weeks for term babies & 34.50 ± 2.77 weeks for preterm babies. The mean TC level (73.76±27.98 mg/dL) was higher in comparison group 1(preterms) compared to comparison group 2(term)babies(62.60 ± 34.20mg/dL) and this difference was statistically very significant(P=0.003). The mean low density lipoprotein(LDL) level (35.54 ± 20.96mg/dL) was more higher in comparison group 1(preterms) compared to comparison group 2(term)babies (27.89 ± 15.62 mg/dL) and this difference was statistically very significant(P=0.001). The mean very low density lipoprotein(VLDL) level (11.12 ± 5.13mg/dL) was more higher in comparison group 1(preterms) compared to comparison group 2(term)babies (8.68 ± 7.55 mg/dL) and this difference was statistically very significant(P=0.003).The mean Triglycerides(TGs) levels of comparison group 1(preterms) & comparison group 2(term)babies were comparable with no statistical significance(42.63 ± 25.80mg/dL of preterm babies ; 42.43 ± 28.10mg/dL of term babies; P=0.948). The mean High density lipoprotein(HDL) levels of comparison group 1(preterms comparison) & comparison group 2(term)babies were comparable with low statistical significance(26.37 ± 13.65mg/dLof reterm babies ; 24.78 ± 10.76mg/dL of term babies;P=0.218). **Conclusion:** Levels of most lipid components were observed to be higher in preterm babies compared to term babies.

## INTRODUCTION:

It is a well known fact that hyperlipidemia can lead to complications like stroke, coronary artery disease (CAD), atherosclerosis, renal failure[1]. Also, it is found that prematurity and fetal malnutrition influence the lipids in cord blood[2,3].

It is debated that high triglyceride(TG) levels & apolipoprotein-B in lower maturity; and increased apolipoprotein-C1 rich in high density lipoprotein(HDL) in low birth weight babies are potentially risky to develop heart diseases in later life[4,5,6]. It is postulated that fetal malnutrition results in neuroendocrine, pancreatic & adipose tissue dysfunction; ultimately increases food-intake and decreases energy utilization.

Insulin resistance & Adiposity increase and finally the forementioned adult diseases in later life[3]. It is also observed that increased rate of coronary heart diseases is found in people having prematurity, low birth weights or low-normal birth weight, thin or short at birth or with too small placental size[1,7,8]. This study makes an effort to find the relation between lipid profiles of preterm & term babies, which is one of the steps in correlating the hyperlipidemia of fetal malnutrition and future metabolic diseases as proposed in famous FOAD hypothesis[3]. This process of disease is hypothesized to initiate early in fetal-life and progresses silently over many decades to manifest in adult life. This hypothesis still needs sufficient evidence to explain. Hence, our study was planned & conducted to compare & contrast the umbilical cord-blood lipid profile between preterm and term neonates.

## MATERIALS AND METHODS:

### Aims and Objectives:

1. To compare & contrast the cord blood lipid parameters of preterm (<37weeks gestational age) & term (>37weeks gestational age) babies.
2. To compare lipid profiles of preterm & term babies with Mothers' lipid profiles

This case control study was conducted in the department of Paediatrics and department of OBG of Karwar Institute of Medical sciences, Karwar, Karnataka, India over a period of 10 months (December 2020 to september 2021).

### Study procedure:

After Institutional ethical committee approval, the mothers in labour, admitted in hospital were approached (using consecutive sampling method). The study was explained in their vernacular language & informed written consent was taken by each mother once she met the inclusion criteria. After the delivery, babies if stable were enrolled for the study. Umbilical cord blood (4ml) from maternal end before placental delivery was collected at delivery and sent for lipid profile estimation [total cholesterol(TC), triglycerides(TGL), high density lipoproteins (HDL) and low density lipoproteins (LDL)]. Mother's venous blood is sent for similar lipid profile studies at the beginning of the labor. Mothers weight documents were listed incuding weight gain during pregnancy documented at the time of labor. BMI was calculated for mother.

Anthropometric measures were taken to all enrolled newborns: birth weight using a calibrated digital weighing

scale, birth length using a standard infantometer, head circumference(HC) using a nonstretchable measurement tape, abdominal circumference(AC).

Baby's maturity was assessed using modified new Ballard Score. Fenton charts[10] were plotted so that we define: the maturity as Preterm whose gestation is less than 37 completed weeks & terms whose gestation was more than 37 weeks and less than 42 completed weeks.

Two study groups were created using consecutive sampling method; comparison group 1of preterm babies whose gestation was <37completed weeks and comparison group 2 of term babies whose gestation was > 37 weeks and less than 42 completed weeks.

**Inclusion criteria**:
The newborns with antenatal uneventful course, born (<24 hours post delivery) to the mothers admitted in department of OBG, KRIMS, Karwar, whose mothers were willing to participate in the study and gave informed written consent.

**Exclusion criteria**:
Newborns with birth asphyxia, congenital heart diseases, malformations or respiratory distress. And infants of mother diagnosed with diabetes mellitus or hypertension or cardiac diseases or thyroid diseases were excluded from the study.

**Statistical analysis**
The data was coded and entered into MS-Excel 2019. The data was analyzed using statistical software SPSS version 16.0. The results were documented using descriptive and inferential statistics. The descriptive statistics included mean, standard deviation and range. The association between two continuous variables were done by using students't-test and p-value<0.05 was interpreted as statistically-significant.

**RESULTS:**
Out of 500 babies studied, there were 97 preterm (<37weels gestational age) & 403 term babies (>37 weeks gestational age) babies.

The Mean gestational age was 39.55±1.11 weeks for term babies & 32.50 ± 2.77 weeks for preterm babies.

**The mean TC level**(73.76±27.98 mg/dL) was higher in comparison group 1(preterms) compared to comparison group 2(term)babies(62.60 ± 34.20mg/dL) and this difference was statistically very significant(P=0.003). [table/Figure 1]

**The mean low density lipoprotein(LDL) level** (35.54 ± 20.96mg/dL) was found to be higher in comparison group 1(preterms) compared to comparison group 2(term)babies (27.89 ± 15.62 mg/dL) and this difference was statistically very significant(P=0.001).

**The mean very low density lipoprotein(VLDL) level** (11.12 ± 5.13mg/dL) was more higher in comparison group 1(preterms) compared to comparison group 2(term)babies (8.68 ± 7.55 mg/dL) and this difference was statistically very significant(P=0.003).

**The mean Triglycerides(TGs) levels** of comparison group 1(preterms) & comparison group 2(term)babies were comparable with no statistical significance(42.63 ± 25.80mg/dLof preterm babies ; 42.43 ± 28.10mg/dL of term babies;P=0.948).

**The mean High density lipoprotein(HDL) levels** of comparison group 1(preterms comparison) & comparison group 2(term)babies were comparable with low statistical significance(26.37 ± 13.65mg/dLof preterm babies ; 24.78 ± 10.76mg/dL of term babies;P=0.218).

When compared to Mothers' lipid profile and compared with those of preterm & term babies, the VLDL levels of Mothers of comparison group 1(preterms) [40.24 ± 26.49mg/dL] was higher than of comparison group 2(term)babies [33.91 ± 14.65mg/dL] with good statistical significance.(p=0.025)

Whereas other lipids were higher in blood of mothers of comparison group 1 i.e., Preterm babies than those of comparison group 2 of term babies but with no statistical significance. [table/ figure 2]

Also it is observed that, Pre pregnancy weight of mothers (47.04 ± 10.56kg for mothers of Group 1; 50.43 ± 10.12kg for moters of Group 2; p=0.003) and weight gain during pregnancy, documented at delivery (9.93 ± 1.86kg for Mothers of Group 1; 10.46 ± 1.69kg for mothers of Group 2; p= 0.008)were significantly less in mothers giving birth to comparison group1 of preterms compared to comparison group 2 of term neonates & it was a significant finding statistically.

Body mass index(MBI) were less for mothers of Preterm babies (20.75 ± 4.26kg/m2 for mothers of Goup1; 21.77 ± 4.06kg/m2 for mothers of Group 2; p=0.028) than term babies & was statistically significant.

These indicate that, the poor nutritional state and poor weight gain of mothers resulted in babies with less maturity and vice versa.

**DISCUSSION:**
Pardo et al. [11] did similar research in early term (35-37 weeks) and term babies. Their findings demonstrated that LDL and Total cholesterol also atherogenic indices were significantly higher in near-term babies compared to full term neoates, indicating a trend of an unusually bad lipid status in near term babies of Brazil. Their study documented lower apolipoproteinA-1values in preterm babies indicating inverse cholesterol transport.

A study by Irving et al. [12] in low birth weight neonates showed that preterm babies were found to be predisposed to similar risks as adults, whether or not having fetal growth retardation.

The fatty streak formation in preterm neonates due to long term effects of hypercholesterolemia environment is still debated.

Napoli et al. [13] described aortic adipose-band conformation in fetuses of humans, utmost presumably enhanced by mothers' & presumably fetal hyper cholesterolemia. Another new study done by the same experimenters [10] showed that the substantiation of lipid-accumulation in the extracranial arteries of fetuses and preterm babies, indicating the atherogenic response to a terrain of hypercholesterolemia.

Ijzerman RG et al. [14] suggested that genetic factors are responsible for the association of prematurity, low birth weight with high total cholesterol, LDL-cholesterol and apolipoprotein B levels.

A recent study showed correlation of prematurity with abnormal retinal-vascularization and hypertension in adult women[15]. Chandrika et al reported that abnormal intrauterine environment created by maternal changes during pregnancy may `have a profound impact on newborn's lipid metabolism, which may be responsible for their abnormalities and differences in lipid values and anthropometry at birth [16].

Our findings demonstrate that TC, LDL-cholesterol & VLDL cholesterols were significantly higher in preterm babies

when compared with term babies, showing a trend towards a bad lipid profile status in preterm newborns. Future studies are recommended to study if this atherogenic profile in preterm babies can influence body metabolism and to what extent it affects and increases the risk for a cardiovascular diseases in adult life.

**CONCLUSION :**

All lipids were found to be higher in preterm babies than full term babies. This difference was statisticaly significant for TC, LDL and VLDL. Mothers of preterm babies were nutritionally poor and showed poor weight gain during pregnancy. It may be interesting to follow up and see whether these neonates with abnormally high lipid values do remain at an increased risk for developing cardiovascular diseases in adult life.

**Future implications:**

Further more studies on larger scale and follow up till adult-life is required to verify the present study results and to evaluate the effect of high-lipids in LBW-babies on adult lipid-profile and risk of CVD in later part of life.

**Ethics Committee Approval:**

Ethical approval was taken from the Institutional ethical committee with letter number: IEC/KRIMS/O/06/2020-2; 9-2-2020.

**Informed Consent:**

Informed written consents were taken from the participants who volunteered to participate in the study.

**Peer-review**: Internally peer-reviewed.

**Authorship Contributions:**

Concept: V.M, Design: V.M, M.U, Data Collection or Processing: V.M., M.U., Analysis or Interpretation: M.U., And Literature Search: V.M., M.U., Writing: V.M.

**Conflict of Interest:**

No conflict of interest was declared by the authors.

**Financial Disclosure**:

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Table 1: Comparison of neonates' lipid parameters among term and preterm neonates (n=500)

| Parameter of neonates | Comparison group 2 Term (Mean ± SD) n=403 | Comparison group 1 Pre-Term (Mean ± SD) n=97 | t | p-value |
|---|---|---|---|---|
| TC (mg/dl) | 62.60 ± 34.20 | 73.76 ± 27.98 | -2.982 | .003 |
| TGs (mg/dl) | 42.43 ± 28.10 | 42.63 ± 25.80 | -.065 | .948 |
| HDL (mg/dl) | 24.78 ± 10.76 | 26.37 ± 13.65 | -1.233 | .218 |
| LDL (mg/dl) | 27.89 ± 15.62 | 35.54 ± 20.96 | -3.376 | .001 |
| VLDL (mg/dl) | 8.68 ± 7.55 | 11.12 ± 5.13 | -3.019 | .003 |

TC: Total cholesterol, TG: Triglycerides, HDL: High-density lipoprotein, LDL: Low-density lipoprotein, SD: Standard deviation; t- independent t-test

Table 2: Comparison of mothers' lipid parameters among term and preterm neonates (n=500)

| Parameter of mothers' | Term (Mean ± SD) n=403 | Pre-Term (Mean ± SD) n=97 | t | p-value |
|---|---|---|---|---|
| TC (mg/dl) | 207.20 ± 45.51 | 212.88 ± 50.64 | -1.933 | 0.054 |
| TGs (mg/dl) | 158.47 ± 61.46 | 175.59 ± 64.14 | -2.442 | 0.150 |
| HDL (mg/dl) | 56.11 ± 22.12 | 53.76 ± 21.19 | 0.944 | 0.035 |
| LDL (mg/dl) | 114.46 ± 44.61 | 117.51 ± 52.08 | -0.584 | 0.559 |
| VLDL (mg/dl) | 33.91 ± 14.65 | 40.24 ± 26.49 | -2.273 | 0.025 |

TC: Total cholesterol, TG: Triglycerides, HDL: High-density lipoprotein, LDL: Low-density lipoprotein, SD: Standard deviation; t- independent t-test

Table 3: Comparison of mothers' anthropometric parameters among term and preterm neonates (n=500)

| Parameter of mothers' | Term (Mean ± SD) n=403 | Pre-Term (Mean ± SD) n=97 | t | p-value |
|---|---|---|---|---|
| Pre-pregnancy Weight of mother | 50.43 ± 10.12 | 47.04 ± 10.56 | 2.941 | 0.003 |
| Weight of mother at delivery | 60.61 ± 10.25 | 56.17 ± 11.90 | 3.706 | 0.000 |
| Mothers' Weight Gain during Pregnancy | 10.46 ± 1.69 | 9.93 ± 1.86 | 2.684 | 0.008 |
| Mothers' Height | 152.31 ± 5.84 | 150.39 ± 6.45 | 2.847 | 0.005 |
| BMI at delivery | 21.77 ± 4.06 | 20.75 ± 4.26 | 2.208 | 0.028 |

BMI: Body Mass Index, SD: Standard deviation; t independent t-test

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