Original Research Article

A comparative study to assess the umbilical cord blood lipid profile between normal and low birth weight babies in a tertiary care hospital

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Abstract

Background: Lipid profile is a marker of an underlying cardiovascular status. Lipid profile includes measurement of cholesterol and its derivatives and various atherogenic indices. Studies have shown that SGA babies had abnormal lipid profile compared to AGA babies. There are many studies showing the direct relationship between the abnormalities in lipid profile among the SGA babies and occurrence of cardiovascular diseases. The present study was undertaken for early detection of abnormalities in the lipid profile at the earliest. **Objective:** To estimate and compare cord lipid profile (total cholesterol [TC], triglyceride [TG], high density lipoprotein [HDL], low density lipoprotein [LDL], (VLDL) (very low-density lipoprotein) in normal and low birth weight neonates. **Materials and Methods:** The present Cross-sectional study was conducted by the department of Pediatrics Rajiv Gandhi Med ical College and hospital from June 2019 to May 2020. A total of 100 study subjects were enrolled in the study and 50 subjects in each group weighing more than 2.5 kg and 50 subjects weighing less than 2.5 kg. **Results:** Cord blood Lipid profile values for TG, and VLDL were significantly higher in low-birth-weight babies compared to normal birth weight babies. Cord blood lipid profile values for TC, HDL and LDL were not significantly higher in low-birth-weight babies. **Conclusion:** A fetus receiving inadequate nutrition has to make adaptations in order to survive and may be prone to hyperlipidemia. Thus, strategy to prevent coronary heart disease must include measures to improve fetal growth and early detection of hyperlipidemia with dietary intervention during infancy and later childhood.

Keywords: Lipid profile, Neonate, Cord Blood, Low Birth Weight, Lipoprotein

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INTRODUCTION

There are a number of maternal as well as fetal high risk factors, which adversely affect the fetal-placental unit, thus compromising its functions. Some of the well-recognized maternal as well as fetal factors are pregnancy induced hypertension, chronic maternal diseases like diabetes mellitus hypertension etc., ante-partum hemorrhage, prolonged labor, premature rupture of membranes (more than 12 hours), fetal distress due various causes, cord compression and low Apgar score, low birth weight and prematurity.[1,2] Lipids constitute a very important group of organic substances in animal tissues. The term LIPID was suggested by BLOOR and recommended by international union of Pure and Applied Chemistry. Plasma lipids consist of triacylglycerol's (16%), phospholipids (30%), cholesterol (14%), and cholesteryl esters (36%) and a much smaller fraction of unesterified long- chain fatty acids (free fatty acids) (4%). This latter fraction, the free fatty acids (FFA), is metabolically the most active of the plasma lipids.[3] The Low-Birth-Weight Infants are born with intrauterine malnutrition. Such circumstances favor fetal adipose tissue breakdown liberating free fatty acids. That portion of free fatty acids that escapes oxidation for energy is synthesized in liver into triglycerides which

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cause elevated levels of triglycerides in low birth weight as compared to normal full-term infants. Intrauterine malnutrition resembling marasmus and starvation in other children could be the result of placental insufficiency. The normal full-term ones on the contrary are in receipt of a ready placental supply of nutrients, and so there is very little need for lipolysis in utero.[4] Higher free fatty acids and triglyceride levels in the cord blood of SGA neonates may be due to release of free fatty acids from fat stores for energy metabolism in presence of intrauterine malnutrition. In the intermediate postnatal period lower level of free fatty acids in these newborn compared to control may be result of relative depletion of fat stores by the intrauterine release. The high levels of triglycerides in the fasting state may be as a result of very high triglyceride levels in the cord blood. The lesser rise in the free fatty acids levels in preterm AGA of 28- 32weeks gestation may be as a result of insufficient lipid stores and lipolysis in them.[5,6] Although blood cholesterol and lipid profile have been extensively studied in adults, limited studies are available in pediatric population, more so in our country. There is scanty data on serum lipid levels in preterm and term newborns. This study was undertaken to find out the influence of prematurity on cord lipid levels and to compare the cord blood lipid levels in term and preterm newborns. Lipid profile is a marker of an underlying cardiovascular status. Lipid profile includes measurement of cholesterol and its derivatives and various atherogenic indices.[7] The present study was undertaken for early detection of abnormalities in the lipid profile at the earliest (at birth), especially in the Preterm and SGA babies, so that these high risk babies can be under vigilant monitoring in future

Objective: To estimate and compare cord lipid profile (total cholesterol [TC], triglyceride [TG], high density lipoprotein [HDL], low density lipoprotein [LDL], (VLDL) (very low-density lipoprotein) in normal and low birth weight neonates.

MATERIALS AND METHODS

The present Cross-sectional study was conducted by the department of Pediatrics Rajiv Gandhi Medical College and hospital from June 2019 to May 2020. A total of 100 study subjects were enrolled in the study and 50 subjects in each group weighing more than 2.5 kg and 50 subjects weighing less than 2.5 kg.

Inclusion Criteria: Term babies weighing more than 2.5 kg into Group A and Babies weighing Less than 2.5 kg in group B

Exclusion Criteria: Neonates with any Congenital malformations. Neonates born to mother with maternal illness like Diabetes mellitus (DM) including Insulin dependent diabetes mellitus (IDDM) and gestational diabetes, Tuberculosis, Asthma, Pregnancy induced hypertension, thyroid disease. Neonates with family history of coronary heart disease / hypercholesterolemia. Any maternal medication, except iron and vitamin supplements. Drug abuse in mother and antenatal medications. Instrumental delivery including extraction. Neonates with one minute Apgar score

Methodology: All the subjects were included after obtaining written informed consent from parents/ guardian. 5 ml of cord blood was collected from the umbilical cord immediately after the delivery from the placental end of the cord just after the delivery of the baby in a plain dry test tube. Cord blood was allowed to clot and then immediately sent to lab where the samples were centrifuged at 400×for 10 minutes, and then serum was separated and stored at -20 0C until analysis. After the delivery, the babies were examined, weight was recorded on electronic weighing scale, length was recorded with the help of infantometer, head circumference, chest circumference and other relevant anthropometric data were recorded using non stretchable measuring tape. Gestational age was calculated from the first day of the last menstrual period and confirmed by clinical assessment using modified New Ballard's score. A thorough clinical examination of the newborn was done and weight of the baby was calculated by electronic weighing scale. Classification of infants was done based on gestational age as term and preterm newborn based on New Ballard's scoring. Lipid profile was done by using Auto analyzer (Erba Mannheim, Transasia bio-medical LTD). TC estimated by using Modified Roeschlau method, TG estimated by using Wako and the modification by McGowan *et al.* and Fossati *et al.* HDL and LDL estimated based on a modified polyvinyl sulfonic acid (PSV) and polyethylene- glycol methyl ether (PEGME) coupled classic precipitation method with the improvements in using optimized quantities of PSV/PEGME and selected detergents. VLDL estimated by TC/5 and Atherogenic index (AI) by TC/HDL. The data was entered in M S Exel and analyzed using SPSS V 21. Results were expressed as mean ± standard deviation for continuous variables and as number and proportion (%) for categorical data. Since all data are known to be normally distributed, the parametric tests were used for statistical analyses. Differences between normal birth weight and low birth weight and SGA, AGA neonates as well as between male and female neonates were determined by Student's t test. Chi square test was applied to test the association between two categorical factors. All the tests of significance were applied at 5% level of significance.

RESULTS

A total of 100 study subjects were enrolled and analyzed. The 50 study subjects were classified into Group A who weighed more than 2.5kg and another 50 study subjects into Group B who weighed less than 2.5kg.

Table 1: Distribution of Gravida and Gender among study subjects

		Frequency	Percentage
Gender	Male	58	58%
	Female	42	42%
Parity	Primi	36	36%
	Multi	64	64%

In the present study among the 100 study subjects in both the groups nearly 58% of them were male and 42% were Female. Nearly 36% of them were born to primiparous women and 64% to Multiparous women.

Table 2: Comparison of Mean Lipid Profile Parameters between both the groups

		Birth Weight Category		P Value
		Normal Birth weight(Group A)	Low Birth Weight (Group B)	
Lipid Profile Parameters	Total Cholesterol (mg/dl)	95.96 ± 3.45	98.64 ± 3.98	0.0005
	Triglycerides (mg/dl)	43.87 ± 3.75	63.74 ± 6.85	<0.0001
	HDL Cholesterol (mg/dl)	23.94 ± 4.95	25.79 ± 5.71	0.086
	LDL Cholesterol (mg/dl)	68.83 ± 5.01	71.42 ± 4.56	0.008
	VLDL Cholesterol (mg/dl)	9.24 ± 1.35	13.51 ± 1.97	<0.0001

In the present study on comparing lipid profile parameters like total cholesterol, Triglycerides, HDL Cholesterol, LDL Cholesterol and VLDL Cholesterol levels were found to be higher among the babies who were low birth weight babies. On analyzing the mean values of lipid profile in both the the groups the p value was found to be statistically significant for all the parameters except HDL Cholesterol.

Table 3: Comparison of Mean Lipid Profile Parameters between Both the Gender

		Birth Weight Category		P Value
		Boys (n=58)	Girls (n=42)	
Lipid Profile Parameters	Total Cholesterol (mg/dl)	94.76 ± 3.25	95.78 ± 2.19	0.066
	Triglycerides (mg/dl)	53.97 ± 6.79	53.81 ± 9.59	0.923
	HDL Cholesterol (mg/dl)	23.92 ± 3.17	25.01 ± 4.77	0.181
	LDL Cholesterol (mg/dl)	68.83 ± 5.81	69.62 ± 4.65	0.457
	VLDL Cholesterol (mg/dl)	9.24 ±3.35	9.59 ±4.97	0.686

The Mea Lipid Profile Parameters between both the genders in the present study was found to be Statistically insignificant for all the parameters.

DISCUSSION

Lipid profile is considered to be an important marker for cardiovascular status of the patients and acts as a direct correlation between the lipid profile abnormalities and occurrence of cardiovascular morbidity and mortality. The level of plasma lipid profile in the cord blood is considered as a reflection of the plasma lipid metabolism in the infant at the time of birth. Most of the lipids are synthesized de novo through the conversion of glucose to various fatty acids which contains compounds and only a part of it derived from placental circulation hence measurement of cord blood lipid profile will act as an accurate marker to the lipid metabolism among the new born. In the present study the lipid profile parameters like triglyceride, high Density lipoprotein, Low density lipoprotein, very low density lipoprotein and total cholesterol was found to be more among the boys when compared with girls, but the association was found to be statistically insignificant for all the parameters in our study. The findings of our study was found to be comparable to the study findings of various studies done by Jagadish Singh *et al.* [8] Whereas in the studies done by Badieez *et al.*[9] and Khalid Mirza *et al.*[10] the female neonates had higher TC and HDL value than boys but the association was found to be statistically insignificant. In the present study on analyzing the Lipid profile it was found that the lipid parameters were very high among the subjects who had low birth weight when compared with subjects who had normal birth weight. among the Low-birth-weight babies had significantly elevated lipid parameters such as Total cholesterol, Triglycerides, LDL, HDL, VLDL but TG and VLDL values were statistically significant. In the study done by Haridas N and Acharya P T *et al.*[11] concluded that Low birth weight neonates have higher TG and TC levels but statistically significant difference was found only in TC. Similar results were also seen in the study done by Mathur

et al.[12] Jane Oba *et al.*[13] in their study concluded that TC, LDL, HDL values were significantly higher in Low-birth-weight neonates ($p<0.0001$). TG value was significantly higher in Low-birth-weight neonates ($p<0.01$)

Pardo *et al.* in their study concluded that TC, LDL, HDL were higher in Low-birth-weight neonates compared to Normal birth weight neonates with statistically significant difference in TC and LDL. But in the study done by Karla AK *et al.*[14] the findings were contrast to our study findings where all cord lipid profile values were lower among the low birth weight neonates when compared to normal birth weight neonates but the significance was found to be statistically insignificant.

CONCLUSION

The prevalent concept is, having bad habits in adult life, such as being sedentary, eating a high fat diet and smoking cause coronary heart disease. The fetal hypothesis does not deny the importance of these adult factors, it simply adds another layer to the complex and multifactorial etiology of the disease, suggesting that in addition to genetic factors and life style factors fetal nutrition needs to be considered a risk factor. There have been studies to show that coronary heart disease has its roots traceably to infancy. Hypolipoproteinemia at birth is one of the risk factors for developing coronary artery disease later in life. a fetus receiving inadequate nutrition has to make adaptations in order to survive and may be prone to hyperlipidemia. Thus, strategy to prevent coronary heart disease must include measures to improve fetal growth and early detection of hyperlipidemia with dietary intervention during infancy and later childhood.

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