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Research Article

COMPARISON OF LIPID PARAMETERS IN MATERNAL SERUM AND NEWBORN CORD BLOOD

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ABSTRACT

Objective: One of the leading causes of morbidity and mortality in the modern period is coronary heart disease. The fetal origin concept has shown that the origins of this epidemic can be found as early as fetal life. A few research have compared the lipid profiles of cord blood from pre-term and term newborns, opening the door to early chronic disease prevention.

Aim: The aim of the study was to compare lipid parameters in pre-term and term maternal serum and neonatal cord blood.

Methods: In 300 newborns cord blood and 300 maternal serum samples, a cross-sectional research was performed. The placental side of the umbilical cord was used to collect cord blood samples, which were then examined for their lipid profiles, which included measurements of serum cholesterol, triglycerides, low density lipoprotein (LDL), high density lipoprotein (HDL), and apolipoproteins including ApoA and ApoB.

Results: When lipid parameters from maternal serum and neonatal cord blood were compared, maternal serum had statistically significant higher values for the apolipoproteins, atherogenic index (AI), and lipid profile. Lipid parameters (TC, TG, LDL, very low density lipoprotein, Apolipoprotein B, and AI) were higher in mothers of pre-term babies and also in cord blood of pre-term neonates. Comparison of lipid parameters of pre-term and term mothers and neonatal cord blood was highly significant.

Conclusion: There was a significant association of cord blood and maternal lipid parameters; hence, change in maternal lipid levels might influences the lipid levels in the cord blood of neonates.

Keywords: Cord blood, Maternal serum, Neonates, Lipid profile, Atherogenic index.

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INTRODUCTION

Nature's greatest gift to women is motherhood. For all women, having a baby is a joyful experience. However, occasionally this talent comes with consequences that could put her life in risk. The uterus, cardiovascular system, and renal system are the areas of the mother's tissues that undergo the most significant morphological, physiological, and metabolic changes during pregnancy. Numerous fetomaternal problems might be brought on by poor nutrition. A peek into adult life may be provided by fetal nutrition. An important tool for predicting the health of newborns is cord blood.

All human beings strive to achieve and maintain health, which is defined by the WHO as a state of total physical, social, and mental well-being rather than merely the absence of disease or infirmity. However, it is encouraging to note that our ancient medical scriptures have defined health more comprehensively and appropriately, stating that it is a composite blend of bodily as well as mental health. There is undeniable proof that nutrition is essential for maintaining optimal health, and more crucially, that it extends its influence to the future generations by nourishing fetuses in utero. Women of reproductive age frequently experience macro and micronutrient deficits in most underdeveloped nations [1].

Quoting by Barker (1993) hypothesis, adverse environment like under nutrition during fetal development can leads to impaired intrauterine growth program and later coronary artery disease in adult life. The incidence of CAD depends in general on the prevalence of genetic and environmental risk factors. Recent experiment in animals and human studies has shown that the risk factors for CVD are the influence of the intrauterine environment like poor nutrition that affects development during a critical period of life. It may permanently change structure and physiology of organ and tissue [2].

Cord blood sera have been demonstrated to contain all well-characterized adult lipoproteins and apolipoproteins [3]. Fetal growth restriction is associated with a chronic pattern of atherogenic lipoprotein metabolism. The relative amount of apolipoprotein A-1 and apolipoprotein B (ApoA1, ApoB) is important. Atherogenic index (AI) is the ratio of ApoB/apoA1 is found to track closely during the 1st year of life. Abnormal lipoprotein profile in childhood persist into adult life and elevated ApoB levels in young adult have been linked to atherosclerosis in adult life [4]. According to Jain and Sogani (2015) study, lipid metabolism differs across tribal and non-tribal populations as well as male and female newborns due to genetic diversity [5,6].

The goal of the present study was to identify anomalies in newborns' lipid profiles as soon as possible (at birth), to monitor these at-risk infants closely in the future. As early diagnosis, followed by sensible nutritional supplementation and pharmacological therapy, may offer a chance for the improvement of risk factors that lead to the development of cardiovascular illnesses in adults in these high-risk neonates. Thus, this study was carried out to examine the lipid profile of cord blood in newborns. The study's goal was to ascertain whether there was any relationship between the lipid profile of the mother and the neonates' cord blood according to gestational age (Pre-term ≤37 weeks, term=37–42 weeks).

METHODS

The present study was carried out in the Department of Obstetrics and Gynecology at tertiary care hospital, Udaipur. It is hospital based cross-sectional study carried out on 109 preterm infants who were

delivered during the study period and met the inclusion and exclusion requirements made up the study group.

During prenatal admission in the third trimester, moms who met the inclusion criteria had their informed consent obtained (when the mother was not in labor pains). The mother's case sheet and the obstetrician involved in her care were then used to gather the demographic profile and pertinent data, including fasting blood glucose, thyroid profile, and medication history.

Inclusion standards

Each and every mother who gave birth to a child at the Pacific Institute of medical Sciences, Udaipur (including mothers who deliver twins or multiple children) was included in the study.

Near term refers to all newborns whose gestational ages were 37 weeks or less, whereas term refers to those whose gestational ages were between 37 and 42 weeks.

Exclusion standards

Newborns with congenital defects, those whose congenital heart conditions were discovered during pregnancy, and those who were born with breathing difficulties were excluded from the study.

According to ADA rules, a woman who has a maternal ailment like diabetes, including insulin-dependent diabetes mellitus, or a mother who has gestational diabetes with FBS >126 mg/dl, will be deemed to have diabetes (HbA1c testing would not be done for research purposes).

Mothers suffer from thyroid, cardiac, or hypertensive disorders (The primary investigator will conduct a history and clinical examination to rule out heart illnesses in the mother, such as a structural cardiac lesion).

Immediately after the cord was clamped and centrifuged to extract the serum, 5 ml of umbilical venous blood were taken from the placental side of the cord during delivery. Roche used reagent to measure the levels of total cholesterol, high density lipoprotein (HDL)-C, and triglyceride [7]. The Friedewald formula was used to analyze the low density lipoprotein (LDL) values [8] Animmunoturbidimetric technique was used to assess apolipoprotein levels [9]. In addition, the assay was carried out using a fully automatic analyzer. Triglycerides, Apo A1, Apo B, total cholesterol, HDL, and LDL were all measured in the serum of mothers and cord blood of neonates. The ratio of Apo B to Apo A1 was used to calculate the AI.

The statistical analysis was carried out Excel 2013. Data were shown as mean plus standard deviation. The Student's t-test was used to compare the mean values. Significant was defined as p=0.05.

RESULTS

The results are depicted in Table 1 and Fig. 1 showed that lipid profile and apolipoproteins parameters were lower in neonates cord blood than maternal serum sample.

Preterm neonates in the current study had higher levels of total cholesterol, triglycerides, HDL, LDL, very low density lipoprotein (VLDL), and lipoproteins A and B than term neonates. The mean lipid profile of term and pre-term neonates differs statistically highly significant, and mothers of term neonates exhibited significantly different mean lipid profiles from mothers of preterm neonates, with term neonatal mothers having greater total, HDL, LDL cholesterol (LDL-C) triglycerides, lipoproteins, and AI.

The table reveals that total cholesterol, triglyceride, HDLs, LDLs, VLDLs Apolipoproteins A-1, and Apo B all were higher in maternal serum as compared to cord blood. When the comparison was between pre-term and term mothers, the lipid profile apolipoproteins and AI were higher in pre-term mothers. The comparison of cord blood of neonates with gestational age <37 weeks (pre-term) and term having gestational age more than 37 weeks, the lipid parameters were higher in pre-term neonates. In pre-term neonates (<37 weeks) and their mothers had higher levels which were TC (223.02±33.32 mg/dL in maternal and 80.55±15.90 mg/dL in cord blood), TG (154.61±53.00 mg/dL in maternal and 61.06±23.28 mg/dL in cord blood), LDL-C (131.43±42.78 mg/dL in maternal and 39.00±14.22 mg/dL in cord blood), VLDL-C (28.12±10.60 mg/dL in maternal and 20.41±4.65 mg/dL in cord blood), ApoB (70.60±29.61 mg/dL in maternal and 35.33±6.75 in cord blood), and AI ApoB/ApoA-1 was higher in pre-term mothers (0.51±0.24 in maternal serum). Whereas in cord blood, the values were higher in term neonatal cord blood (0.65±0.24) and all were highly significant (<0.005) when compared.

It was interesting to note that HDL cholesterol (58.66±12.38 mg/dL in maternal serum an 29.14±10.42 mg/dL in cord blood) and apolipoprotein A1 (143.11±20.38 mg/dL in maternal and 54.22±8.80 mg/dL in cord

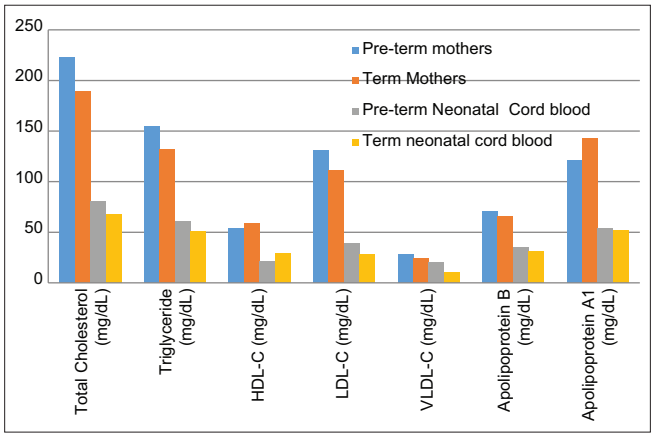

Fig. 1: Lipid parameters in pre-term and term maternal serum and neonatal cord blood

Table 1: Maternal serum and umbilical cord blood levels of Lipids and lipoproteins

S. No.	Parameters	Pre-term (<34 weeks)		Term (37–42 weeks)		p-value preterm and term mothers	p-value preterm and term neonatal cord blood
		Maternal Serum (n=150) Mean±SD	Neonatal Cord blood (n=150) Mean±SD	Maternal Serum (n=150) Mean±SD	NeonatalCordblood (n=150) Mean±SD		
1	Total cholesterol mg/dL	223.02±33.32	80.55±15.90	189.11±39.32	67.95±15.96	<0.0001	<0.004
2	Triglyceride (mg/dL)	154.61±53.00	61.06±23.28	131.61±52.00	51.06±23.28	<0.0001	<0.0002
3	HDL-C (mg/dL)	53.76±10.38	21.14±10.42	58.66±12.38	29.14±10.42	<0.0001	<0.0001
4	LDL-C (mg/dL)	131.43±42.78	39.00±14.22	111.43±32.76	28.40±14.42	<0.0001	<0.0001
5	VLDL-C (mg/dL)	28.12±10.60	20.41±4.65	24.02±11.61	10.41±4.65	<0.0001	<0.0001
6	Apolipoprotein B (mg/dL)	70.60±29.61	35.33±6.75	65.60±25.51	31.03±7.72	0.05	<0.0001
7	Apolipoprotein A1 (mg/dL)	121.12±20.42	54.22±8.80	143.11±20.38	51.61±9.61	<0.0001	0.01
8	AI (ApoB/ApoB)	0.51±0.24	0.58±0.20	0.41±0.21	0.65±0.24	0.0002	0.006

HDL-C: High density lipoprotein-cholesterol, LDL-C: Low density lipoprotein-cholesterol, VLDL-C: Very Low density lipoprotein-cholesterol

Table 2: Correlation of mother BMI with lipid parameters

S. No.	Parameters	Correlation with mother's BMI		Correlation with mother's age	
		r-value	p-value	r-value	p-value
1	Total cholesterol mg/dL	0.032	0.58	−0.046	0.42
2	Triglyceride mg/dL	0.022	0.70	−0.135	0.019*
3	HDL-C mg/dL	0.008	0.89	−0.042	0.46
4	LDL-C mg/dL	0.022	0.70	0.021	0.71
5	VLDL-C mg/dL	0.022	0.70	−0.13	0.024*
6	ApolipoproteinB mg/dL	−0.060	0.30	0.024	0.54
7	ApolipoproteinA-1 mg/dL	−0.0769	0.18	0.002	0.12

HDL-C: High density lipoprotein-cholesterol, LDL-C: Low density lipoprotein-cholesterol, VLDL-C: Very Low density lipoprotein-cholesterol

blood) were higher in term neonatal cord blood and also in their mothers compared with pre-term.

The results of correlation with mothers age showed negative correlation with total cholesterol, triglyceride, HDL-cholesterol and positive with low density lipoprotein, Apo A, and Apo B.

DISCUSSION

Lipid profile is an indicator of an underlying cardiovascular status, and there is a direct correlation among the abnormalities in lipid levels and incidence of cardiovascular morbidities and mortality; hence, the present study was done to find the association of maternal lipid levels with the neonates [10]. The study aimed to assess the levels of lipid profile, apolipoproteins and AI in cord blood of neonates according to gestational age showed that the showed total cholesterol, triglyceride, HDL-C, LDL-C, ApoA-1, and Apo B level higher in near term neonates group than term neonates. TC, TG, HDL-C, VLDL-C, and apolipoprotein A-1 were negatively correlated but LDL-C and apolipoprotein B were positively correlated with gestational age [11].

In the study, the cord lipid values were found to be statistically significant in pre-term babies compared to terms babies with higher TC, TG, LDL, and VLDL levels in pre-term. In the study, a statistically association was found between the mother's triglycerides and the triglyceride and LDL levels of babies. When lipid levels were compared between the mothers of babies, it was observed that mothers of pre-term babies had higher lipid level (TC, TG, LDL and VLDL, and Apo B) than mothers of the term neonates, and highly significant differences were present between them.

HDL and apoliporotein A1 were higher in term neonates (37–42v weeks) and their mothers.

The lipid and lipoprotein levels of maternal blood increase during pregnancy [12]., despite of this variations in TC, TG, and lipoprotein levels. Their levels in the cord blood are lower than in adults, and the relative proportion present in HDL-C as opposed to LDL-C is much higher in pre-term neonatal cord blood [13,14].

Table 2 showed negative correlation between maternal age and TC, TG, HDL-C, and positive in AI, VLDL, and LDL and all were non-significant in the cord blood which is in agreement the finding of author who showed the same results like us [15]. During the last 3 decades, there has been an increasing trend toward delayed child bearing among women, and an increased risk of complications in pregnancy as compared to younger ones [16]. Studies of Gunderson *et al.* and others have reported that pregnancy causes adverse effects on the maternal HDL-C level [17]. Moreover, it is known that aging is a significant factor affecting changes in the lipid profile. It seems that higher maternal age might have an independent effect on HDL-C level in cord blood but in our study, it was negative. The reason seems that our study had very less mothers with higher age group mothers (Mother average age was 25.39±3.7 years Table 2).

CONCLUSION

There was a significant association of cord blood and maternal lipid parameters; hence, change in maternal lipid levels might influences the lipid levels in the cord blood of neonates.

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DECLARATIONS

No funding sources are available. No conflict of interest has been reported.

ETHICS CLEARANCE

The Institutional Ethics Committee provided the ethical clearance certificate.

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