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Original Article

Cord Blood Lipid Profile in Premature, Near-Term and Term Newborn Infants

Raid M. R. Umran Tohmaz [1]*

[1] Assistant Professor, Pediatrician and Neonatologist , Al- Zahraa Teaching Hospital, Department of Pediatrics, College of Medicine, University of Kufa, Kufa, Iraq

ABSTRACT

Introduction: The fetus needs a considerable amount of cholesterol for the development of tissues and organs. Studies have suggested that genetic and environmental factors influence the composition of cord blood lipoproteins. In this study, we aim to assess the effect of gestational age, sex and birth weight on the cord blood lipoproteins.

Methods: We collected umbilical cord blood samples from 91 newborn infants, delivered normally, or by caesarean section. According to their gestational age, the samples were divided into 3 groups: the premature (≤ 34 weeks of gestational age), the near-term (35 – 37 weeks of gestational age), and the term group (≥ 38 weeks of gestational age). Serum was used to measure cholesterol, triglycerides and high-density lipoprotein (HDL) by the enzymatic auto-analyzer. SPSS 17 software was used for ANOVA test, Student t-test and Spearman correlation test. P-value less than 0.05 was regarded as significant.

Results: The results of this study indicate that gender has no effect on the level of lipid in the samples; it doesn't affect the subgroups, either. The serum level of cholesterol is inversely correlated with neonatal gestational age, and the neonatal body weight ($P < 0.05$). Only in the term subgroup, high positive correlation is observed between the triglyceride level and gestational age ($P < 0.05$). All other subgroups show no significant correlation between the lipids and age or weight.

Conclusion: The cord blood cholesterol, triglyceride and HDL are not affected by the gender of the newborns. Cholesterol level is inversely correlated with the gestational age and birth weight, and this could be regarded as a risk factor for atherogenic lipoprotein metabolism, later on in life.

Keywords: Cord blood, Lipid profile, Lipoprotein, Near-term, Newborn, Premature, Term

Introduction

The fetus needs a considerable amount of cholesterol for the development of tissues and organs. After birth, human lipid transportation system changes from containing low levels of very-low-density lipoprotein (VLDL), and low-density lipoprotein (LDL), to the adult pattern, which continues to increase with age (1).

LDL is the major cholesterol-carrying particle in the plasma. HDL is responsible for transporting cholesterol back from the tissues to the liver. Race and gender differences in lipoproteins levels have repeatedly been demonstrated in adults (2, 3). These differences have also been noted in children, supporting the concept that the variance is due to genetic influences, rather than environmental factors (4).

The cord blood cholesterol level in infants is lower than the adults (5). Small for gestational age (SGA) Infants has higher levels of triglyceride, rich VLDL, and intermediate low-density lipoprotein (LDL), in comparison with the AGA (appropriate for gestational age) infants. These findings suggest a link between higher triglyceride, rich VLDL subclasses in SGA infants, and future coronary artery disease (6).

Materials and Methods

A total number of 91 newborn infants were prospectively enrolled in this study. They were delivered normally, or by caesarean section, and their gestational age was included. The infants with congenital anomalies or those whose mothers had medical problems, were excluded from the study. The gestational age was determined according to the date of the last menstrual period, or the early ultrasound in 20 weeks of gestation. All the information related to the newborns and their mothers were recorded in

* *Corresponding author:* Raid M. R. Umran Tohmaz, Al- Zahraa Teaching Hospital, Department of Pediatrics, College of Medicine, University of Kufa , Kufa, Iraq; Tel: +964 7801421961; E-mail: raidumran@yahoo.com

Table 1. Descriptive Statistics of all study populations

	N	Min	Max	Mean	Sd
Gestational Age (wk)	91	26	41	36.31	3.47
Newborn weight (gm)	91	1000	4000	2490.11	699.14
Cholesterol (mg/dl)	91	38	271	85.64	35.55
Triglyceride (mg/dl)	91	13	105	50.44	21.93
HDL (mg/dl)	91	16	133	34.67	18.46

Table 2. Comparison between the means of the study groups

	Premature (22)	Late preterm (27)	Term (42)	*P*
	Mean ±SD	Mean ±SD	Mean ±SD	
Age (wk)	31± 2.4	36 ±0.74	39 ±0.92	0.00*
Weight (gm)	1648 ±364	2404 ±360	2987± 533	0.00*
Cholesterol (mg/dl)	90 ±30.1	99 ±50	74.8 ±20.7	0.16
Triglyceride (mg/dl)	52± 23.2	51.2 ±23	49.1± 20.97	0.86
HDL (mg/dl)	33.1 ±8	34.1 ±10.4	35.83± 25.4	0.85

* One way ANOVA test, significant *P* value < 0.05

the prepared forms. Following the delivery, blood samples were taken from the umbilical cord immediately, and were separated after clotting, for at least 45 min at room temperature. Serum was stored at 4°C for a maximum of 24 hr, prior to the analysis. Total cholesterol, triglycerides and HDL were measured by enzymatic auto-analyzer (bt 35i) of Ringelsan company.

The study samples were divided into three subgroups, according to their gestational age: The premature (≤ 34 weeks of gestational age), the near-term (35 – 37 weeks of gestational age) and the term group (≥ 38 weeks of gestational age).

The study was approved by the local research center, and the ethics committee in the Al- Zahraa Teaching Hospital and college. Also, the informed consent was obtained from all the mothers.

Statistical analysis was done using SPSS 17 software. The ANOVA test was used to compare the variance between the different categories; Student t-test was used to compare the difference between the two means; and Spearman test was used for the correlation. *P*-value less than 0.05 was regarded as significant.

Results

A total number of 91 newborn babies, recruited in this study, had the mean gestational age of 36± 3.5 weeks; the mean body weight was 2490 ± 699 g. The means of cholesterol, triglyceride and HDL are depicted in Table 1.

Table 4. Correlation of neonatal gestational age and weight with Lipids in all study populations

		Cholesterol	Triglyceride	HDL
Gest Age	Spearman Correlation	-0.253	-0.02	-0.15
	Sig. (2-tailed)	0.015	0.98	0.16
Neon Bwt	Spearman Correlation	-0.24	-0.09	0.14
	Sig. (2-tailed)	0.022	0.43	0.19

Table 5. Correlation of neonatal gestational age and weight with Lipids in term subgroup

		Cholesterol	Triglyceride	HDL
Gest Age	Spearman Correlation	0.107	0.37	-0.19
	Sig. (2-tailed p value)	0.5	0.016	0.24
Neon Bwt	Spearman Correlation	0.130	0.09	0.11
	Sig. (2-tailed p value)	0.4	0.59	0.47

According to the gestational age, the study population was divided into three groups: The premature (age ≤ 34 weeks), the near-term (age 35-37 weeks) and the term group (age ≥ 38 weeks).

The three groups were significantly different, regarding the means of age, weight and cholesterol level, whereas no significant difference was observed concerning the level of triglyceride and HDL, as it is shown in Table 2. Gender has no effect on the level of cholesterol, triglyceride and HDL in the total population and in all subgroups ($P > 0.05$), as it is shown in Table 3.

The serum level of cholesterol is inversely correlated with the neonatal gestational age ($P<0.05$), as it is so with the neonatal body weight ($P< 0.05$); the results are shown in Table 4.

By analysing the correlation between the cholesterol, triglyceride and HDL levels with neonatal gestational age, and neonatal body weight, we find that only in the term subgroup, a highly positive correlation is found between the triglyceride level and gestational age ($P<0.05$), as shown in Table 5. All other subgroups show no significant correlation between the lipids and age or weight.

Discussion

In this study, we have shown that no significant difference exists in the mean of cholesterol, triglyceride and HDL levels, considering the gender in the total study group, and in all subgroups ($P>0.05$). This is in contrast with the previously reported findings on cord blood cholesterol level, which is found to be higher

Table 3. Sex effect on lipids in all study groups and different subgroups

	Study population (91)			Premature (22)			Near term (27)			Term (42)		
	M (60)	F (31)	*P*	M (15)	F (7)	*P*	M (16)	F (11)	*P*	M (29)	F (13)	*P*
Weight	2499	2473	0.87	1656	1628	0.87	2381	2436	0.68	3000	2957	0.84
Cholesterol	86	85	0.87	90	89	0.92	99	99	0.99	77	70	0.28
Triglyceride	50	51	0.91	56	44	0.23	47	58	0.25	49	49	0.92
HDL	36	32	0.20	32	36	0.22	35	33	0.65	39	29	0.10

M= male, F= female, ( ) = no.

in females than in males (9). Similar to other studies, research indicates that gender differences do not affect the cholesterol level (1, 2, 8-10).

Serum cholesterol level is inversely correlated with the gestational age and the infant's body weight, in all study groups (*P*<0.05). These findings were previously noted by other studies (11-13).

It is interesting that fetal growth retardation establishes a lifelong irreversible atherogenic profile, and that the history of low birth weight (14), or pre-term birth (15) in individuals, are associated with apolipoprotein B levels (1). Several studies have also demonstrated that abnormal lipoprotein profiles in childhood persist into adult life. The prevalence and severity of carotid artery atherosclerosis in later years, are linked to lower birth weights. These findings indicate that fetal growth restriction is associated with a chronic pattern of atherogenic lipoprotein metabolism (1).

The present study assumes that the cholesterol level was higher in those with prematurity and pre-term delivery, and is also inversely correlated with the infant's birth weight. Therefore, we believe that monitoring, observation and early-lifestyle modifications may decrease the severity of atherosclerosis in the vessels in adulthood.

Conclusion

Our study has suggested that high cholesterol level is more likely to be observed in pre-term infants, and SGA (small for gestational age). So it seems early prevention and close follow-up would help to prevent the complications of atherosclerosis in these patients. Future prospective studies should aim to identify if early preventive approaches, regardless of age, would delay the cardiovascular events in these patients.

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