

Lipid Profile of Cord Blood in Term Newborns

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Background: Hyperlipidemia is an important risk factor for coronary artery disease. Detection of lipid profile in umbilical cord blood of term newborns could identify neonates with a higher risk of coronary artery disease.

Objectives: The aim of the present study was to improve the existing information about cord blood lipid profile of Iranian term newborns.

Patients and Methods: This cross-sectional study was conducted on healthy term neonates born from healthy mothers between August and October 2009 in Zanjan, Iran. Ten milliliters of cord blood was collected from the placental end of umbilical vein immediately after the cord clamping. Total cholesterol (TC) and triglyceride (TG) were measured by enzymatic GOD-PAP method with Pars Azmoon kits. High-density lipoprotein-cholesterol (HDL-C) was measured after precipitation of Apo lipoproteins with phosphotungstic acid (PTA). Low-density lipoprotein-cholesterol (LDL-C) was calculated by Friedewald's formula. Statistical Analysis was performed by the SPSS statistical package version 16.0 for windows.

Results: Of the 174 neonates, 97 were female. Vaginal delivery was recorded in 79.8%. There were no significant differences regarding demographic findings between male and female neonates. The mean values of TC, LDL-C, HDL-C and TG were 73.1 ± 26.5 , 28.7 ± 11.1 , 27.6 ± 10 , and 81.4 ± 37.1 mg/dL respectively, with no difference between the two sexes.

Conclusions: We found a relatively high value of TC and TG in our study. Considering the relationship between high levels of lipids in the neonatal period and coronary artery disease in the adult population, we recommend future cohort studies for this statistical society.

Keywords: Cord Blood; Lipid; Newborn Infants

1. Background

Coronary artery disease (CAD) is an important leading cause of mortality in the world (1, 2). The prevalence of CAD related mortality has increased (3, 4); this increase was more dramatic in developing countries with the age of onset of disease being reduced during the recent years (5-7). The process of this disease begins early in life and gradually progresses throughout the following years (8). Hyperlipidemia is an important risk factor for cardiovascular disease (9). A strong independent relationship between childhood and adulthood serum lipids has been reported (10). There are evidences of such associations originating at birth (10-12). There are many reports of hyperlipidemia at young ages (13-15), in recent years there are some reports of high cord blood triglyceride level from Iran (16-19). The high triglyceride level may be due to the relatively high frequency of vitamin D deficiency in Iranian newborns (20). Some reports have indicated that the serum level of vitamin D has an inverse relationship with blood triglyceride level (21, 22). Prevention of CAD must be initiated at younger ages, because there is an opportunity to begin preventive interventions for cardio-vascular risk factors (23), furthermore the study of CAD risk factors is greatly recommended during this

period. There are many researches about cord blood lipid profiles in the literature with some controversies (24-36). Detection of these markers in umbilical cord blood of term newborns could identify neonates at higher risk of coronary heart disease (29, 30).

2. Objectives

The aim of this study was to gather more information for analyzing the cord blood lipid profile of term newborn infants and compare the findings with other reports.

3. Patients and Methods

This cross sectional study was conducted from August to October 2009 in Zanjan city at a public general hospital affiliated with Zanjan University of Medical Sciences, Iran (Zanjan is located in the northwest of Iran). This research was approved by the ethical committee and financially supported by the deputy of research of Zanjan University of Medical Sciences. The aim of the study was explained to all the candidate's mothers before obtaining a written informed consent. The study group was selected from healthy term neonates born to healthy mothers with no history of diabetes, eclampsia and preeclampsia,

dyslipidemia and other chronic diseases. Neonates with gestational age of less than 37 weeks, congenital anomaly, five minute Apgar score of less than seven, and sick newborns were excluded. Gestational age was recorded based on the last menstruation date and sonographic information. The weight, height and head circumference of the neonates were measured with standard methods and body mass index (BMI) was calculated immediately after delivery. Ten milliliters of cord blood was collected from the placental end of the umbilical vein immediately after cord clamping. Serum was separated by centrifugation and frozen at -70°C. All samples were analyzed for lipid profiles including total cholesterol (TC), triglyceride (TG) and high-density lipoprotein-cholesterol (HDL-C). An auto analyzer (Selectra II, Netherland) was used to determine the lipid profiles. Total cholesterol and TG were measured by GOD PAP enzymatic method using cholesterol esterase, cholesterol oxidase and glycerol phosphate oxidase test with Pars Azmoon kits with a sensitivity of 0.5 mg/dL. High-density lipoprotein-cholesterol was measured after precipitation of Apo lipoproteins with phosphotungstic acid (PTA). Low-density lipoprotein-cholesterol was calculated by Friedewald's formula (31). A lipid standard (CFAS/Boehringer Mannheim, cat. no. 759350) was used to calibrate the selectra 2 auto analyzer. Assay performance was checked after every 20 tests using the lipid control serum perineum (normal range) and percipat (pathologic range), wherever applicable. Inter- and intra-coefficients of variation (CV) for the assay (TC or TG) were 1.1% and 1.6% for the lower limit, 0.9% and 0.6% for the upper limit, respectively (calculated in mg/dL). Statistical Analysis was performed using the SPSS software version 16.0. Continuous data were expressed as mean \pm standard deviation (SD). The Student's t-test and Mann-Whitney test were applied for comparison of mean values wherever appropriate. The relationship between cord blood lipid profile and quantities of birth weight and gestational age was determined by the Mann Whitney regression test. Spearman correlation coefficient was used to find a correlation between these variables. The significance level was set at P value < 0.05.

4. Results

One-hundred and seventy-four neonates including 97 females and 77 males were included in this study. Vaginal delivery was recorded in 139 (79.8%) and unwanted pregnancies in 27 (15.5%) of the subjects; maternal ages were between 14 and 40 years. All newborns were term and near term. Their weight ranged from 2500 to 3970 grams. Height and head circumference were 45-56 cm and 31-37 cm, respectively. Body mass index was calculated as 10.3-16.1. Demographic findings of the study population are demonstrated in Table 1. There were no significant differences regarding demographic findings between male and female neonates. There was no difference between vaginal delivery and cesarean sections regarding cord

blood lipids. Minimum, maximum and total mean level of lipid concentrations in this study have been shown in Table 2. There was no difference between the two sexes regarding the mean value of TC, TG, HDL-C and LDL-C. A significant positive correlation was observed between cord blood TC and TG ($r = 0.42$, $P < 0.01$), as well as between TG and non HDL-C ($r = 0.39$, $P < 0.01$), TG and HDL-C ($r = 0.23$, $P < 0.01$) and TG and LDL level ($r = 0.22$, $P < 0.01$). No significant correlations were detected between lipid concentrations and demographic finding of neonates, yet there was a negative significant correlation between cord blood TG concentration and maternal age ($r = -0.15$, $P = 0.03$).

Table 1. Maternal and Neonatal Demographic Findings of the Study Population ^a

Variable	Total (No. =174)	Male (No. =77)	Female (No. =97)	P Value
Gestational Age, Week	39.1 \pm 0.9			
Maternal Age, y	26.3 \pm 5.9			
Neonatal Weight, gr	3166 \pm 32.9	3218 \pm 292	3124 \pm 352	0.063
Height, cm	50.1 \pm 1.8	50.3 \pm 1.7	49.9 \pm 1.9	0.19
Head Circumference, cm	33.9 \pm 1.4	34.1 \pm 1.4	33.8 \pm 1.3	0.23
BMI, kg/m ²	12.6 \pm 1.1	12.7 \pm 1	12.5 \pm 1.2	0.26

^a Data are presented as Mean \pm SD.

Table 2. Minimum, Maximum and Total Mean Level of Lipid Concentrations ^a

Variables, Level of Lipid	Minimum	Maximum	Total, Mean \pm SD
TC, mg/dL	39	229	73.1 \pm 26.5
TG, mg/dL	31	270	81.4 \pm 37.1
HDL-C, mg/dL	11	78	27.6 \pm 10
LDL-C, mg/dL	15	100	28.7 \pm 11.1

^a Abbreviations: TC, total cholesterol; TG, triglyceride; HDL-C, high-density lipoprotein cholesterol; LDL-C, low-density lipoprotein cholesterol.

5. Discussion

There are different reports of cord blood lipid values from various geographical areas (Table 3). In this study we wanted to compare the level of cord blood lipids in our normal term infants of healthy mothers with other articles. In the present study the mean value of TC, LDL-C, HDL-C and TG were 73.1 \pm 26.5, 28.7 \pm 11.1, 27.6 \pm 10, and 81.4 \pm 37.1mg/dL, respectively. These findings are similar to some other studies from Iran (Table 3) yet different from the values reported from certain countries, and this can be related to conditions that affect fetal growth, such as ethnicity and diet.

Table 3. Comparison of Cord Blood Lipid Profiles from Different Iranian Reports and the Nelson Textbook^a

	Iran (This Study)	Badiee (17)	Vaziri (37)	Ghiasi (33)	Nelson Textbook (34)
TC, mg/dL	73.1	76.9	81	52.5	68
LDL-C, mg/dL	28.7	34	48.9	25	29
HDL-C, mg/dL	27.6	30	25	33.5	35
TG, mg/dL	81.4	67.5	42	33	34

^a Abbreviations: TC, total cholesterol; LDL-C, low-density lipoprotein cholesterol; HDL-C, high-density lipoprotein cholesterol; TG, triglyceride.

In comparison to studies conducted in other countries, the mean value of TC in our study was similar to the findings of Kharb et al. with 100 healthy newborn samples in India (27), lower than the report of Juarez et al. with 200 newborns in Mexico (36), and higher than the findings of Mahley et al. with 105 Turkish newborns (32) and Casanueva et al. from Chile with 156 normal newborns (30). Our TC level was lower than studies from other parts of Iran like the study of Badiee et al. from Isfahan (17) and Vaziri Esfarjani et al. from Ahvaz (37), yet higher than the study of Ghiasi et al. from Tehran (33). In the present study the level of LDL-C was lower than studies from Mexico (36), Chile (30) and India (27) and higher than the study from Turkey (32). Compared to other studies from Iran, the level of LDL-C in our study was lower than the study of Badiee et al. from Isfahan (17) and Vaziri Esfarjaniet al. from Ahvaz (37), yet higher than the study of Ghiasi et al. from Tehran (33). The level of HDL-C in our study was similar to that reported by a study from Chile (30) and lower than studies from Mexico (36) and Turkey (32) and higher than a study from India (27). In this study, the mean value of TG in 33% of females and 35% of males was higher than the 95th percentile of triglyceride level reported in the Nelson textbook of Pediatrics, which indicates a high frequency of cord blood hypertriglyceridemia in our subjects (34). There are other reports of high cord blood hypertriglyceridemia in Iran (16, 17, 19, 37), yet the level of cord blood TG in our study was higher than other reports from Iran (17, 33). High triglyceride level may be due to the relatively high frequency of vitamin D deficiency in Iranian newborns (20, 21). In our study there were no significant differences between the two sexes regarding the mean value of TC, LDL-C, HDL-C and TG, which is different from the results of some previous studies (17, 27, 37) and similar to the reports of Ghiasi et al. (33). There was no statistically significant association between lipid levels and anthropometric parameters in our study. In the study of Ghiasi et al. in Tehran (33), there was no statistically significant association between lipid levels and anthropometric parameters in males but there was a significant inverse correlation between TG level and head circumference in female newborns (33). In the present study, there was no difference between vaginal delivery and cesarean section regarding cord blood lipids. In the study of Yoshimitsu N et al. in Japan, TC and non-HDL levels in cord blood showed a correlation with maternal and fetal lipid levels. A correlation coefficient (> 0.3) was noted in the

caesarean section group (35). The first limitation of this study was the lack of mother's serum lipid levels in the data, and the second limitation was the study's cross sectional design. In future studies, by checking the mother's lipid and using longitudinal data, additional valuable information can be provided. We found a relatively high level of TC and TG in our study. Considering the relationship between high levels of lipids in the neonatal period and cardiovascular diseases in the adult population, we recommend future cohort studies to further unveil the involved mechanisms.

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Authors' Contributions

Seyed Alinaghi Kazemi and Mansur Sadeghzadeh prepared the manuscript, designed the project, collected, analyzed and interpreted the data.

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