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# Correlation between umbilical cord blood lipid profile and neonatal birth weight

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ABSTRACT

**Introduction and aim:** The aim of this study was to investigate the relation between birth weight and neonatal umbilical cord serum lipid levels. **Patients and methods:** Two hundred and three healthy newborns were studied in an educational hospital in the southwest of Iran from April 2009 to April 2010. The newborns' birth weights were measured and their neonatal ponderal indices (NPI) were calculated. Newborns were divided into 3 groups according to their birth weight: low birth weight (<2500 g; group 1), normal birth weight (2500–4000 g; group 2), and high birth weight (>4000 g; group 3). The newborns' umbilical cord serum was analyzed for its lipid profile, including total cholesterol (TC), triglycerides (TG), high density lipoprotein (HDL), very low density lipoprotein (VLDL), and low density lipoprotein (LDL). The atherogenic index of plasma (AIP) also was calculated. **Results:** The mean serum lipid levels (TG, TC, LDL, and VLDL) were higher in groups 1 and 3 than in group 2, but the HDL levels were not significantly different. TG, TC, HDL, LDL, VLDL, and atherogenic index had no significant differences between genders ($P > 0.05$). TG, TC, LDL, and VLDL levels in low birth weight (LBW) and high birth weight newborns were significantly higher than in normal weight newborns ($P < 0.05$). TC and LDL were significantly lower in neonates whose mother's age $\leq$ 30 years compared to older mothers ($P < 0.05$). TC and LDL were significantly higher in group whose mother's BMI $\leq$ 25 compared to >25. **Conclusion:** TG, TC, LDL, and VLDL levels in LBW and high birth weight newborns were significantly higher than in normal weight newborns. TC and LDL were significantly lower in neonates whose mother's age $\leq$ 30 years compared to older mothers. TC and LDL were significantly higher in group whose mother 's BMI $\leq$ 25 compared to >25. Another prospective study with more sample size is recommended to finding correlation between neonatal birth weight and cord blood lipid profile.



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## Introduction

Cardiovascular disease (CVD) is the most common cause of disability and death in adults worldwide [1]. Besides genetic tendency, an increased risk of CVD is associated with lifestyle and various medical conditions, such as hypercholesterolemia, hypertension, smoking, obesity, and inadequate physical activity. All of these cause CVD by developing atherosclerosis [2]. In addition, other factors such as childhood or adolescent obesity and post-natal catch-up growth can lead to CVD [3, 4]. Recently, the prevalence of risk factors for CVD, especially obesity and hyperlipidemia, has been increasing among children and adolescents [5, 6]. The effect of intrauterine factors on the emergence of these risk factors also has been suggested [7]. Moreover, several maternal and fetal factors, such as hypertension, diabetes, obesity, and low or high birth weight, can influence fetal plasma lipids [8–11].

Low birth weight (LBW) is associated with increased incidence of CVD, hypertension, and type II diabetes [12]. Changes in blood lipids in LBW newborns with relative insulin intolerance can increase the risk of CVD in adulthood. LBW is a risk of later atherosclerotic diseases that is equal to smoking or hypertension at puberty [13–15]. Therefore, it seems that a relation exists between birth weight and mortality from CVD in adulthood [13]. On the other hand, high birth weight is associated with increased insulin-like growth factor-1 (IGF-1) that could change lipoprotein composition and concentration at birth, and could increase the risk of CVD [17]. This study examined the possible relation between neonatal umbilical cord lipids and the risk of atherosclerosis at puberty by determining umbilical cord serum lipid profiles in healthy newborns with normal, low, or high birth weight.

## Methods

This epidemiological study was conducted from April 2009 to April 2010 on 203 healthy newborns in an educational hospital in south-western Iran. The study was approved by the Ethics Committee of Ahvaz Jundishapur University of Medical Sciences, and written informed consent was obtained from all of the parents. The inclusion criteria were gestational age between 28 and 42 weeks singleton pregnancy, no congenital anomalies, 5 minute Apgar score greater than 7, and vaginal delivery. The exclusion criteria were infants with intrauterine growth retardation (IUGR), history of maternal hypertension either before or during pregnancy, preeclampsia or eclampsia, history of paternal or maternal hyperlipidemia, maternal CVD, pre-gestational or gestational diabetes, any history of maternal drug use during or before pregnancy (except for vitamins, folic acid, and iron), or a history of smoking.

The birth weight was measured with an electronic scale (Seca Medical Scales and Measurement Systems, Birmingham, United Kingdom). The neonatal ponderal index (NPI) was calculated according to the formula:

$$\mathrm{NPI} = 100 \times \left[\frac{\text{birth weight(g)}}{\text{length(cm)}^3}\right].$$

Newborns were divided into 3 groups according to their birth weight: low birth weight (<2500 g; group 1), normal birth weight (2500–4000 g; group 2), and high birth weight (>4000 g; group 3). The newborns also were divided into 2 groups according to their mother's BMI (BMI $\leq$ 25 kg/m$^2$or BMI > 25 kg/m$^2$) and age (<30 years and $\geq$30 years). Five milliliters of cord blood were collected from the placental end of the umbilical vein, and then the serum was separated by centrifugation. Serum lipid and lipoprotein levels were measured using an enzymatic method in an autoanalyser (Hitachi, Tokyo, Japan), and further analyzed on the same day to determine the lipid profile, including total cholesterol (TC), triglycerides (TG), high density lipoprotein (HDL), very low density lipoprotein (VLDL), and low density lipoprotein (LDL), using formulas which were described previously [18]. The atherogenic indices of plasma (AIP) were calculated as the LDL/HDL ratio and TC/HDL ratio.

Statistical analysis: Data were analyzed with SPSS 13.0 for Windows (SPSS Inc., Chicago, IL, USA). Results were expressed as mean (SD). The Chi square and Mann–Whitney tests were used to make statistical comparisons. A $P < 0.05$ was considered statistically significant.

## Results

A total of 203 newborns [104 (51.2%) girls and 99 (48.8%) boys] were recruited in to the study. Of them, 54 infants (26.6%) had LBW, 98 (48.3%) infants had normal birth weight, and 51 (25.1%) high birth weight (Tab.I). The mean total serum lipid levels in these infants are compared in Table II. The mean serum levels of TG, TC, LDL, and VLDL in groups 1 and 3 were significantly higher than those in group 2 (Tab.II). However, the mean amount of HDL in groups 1 and 3 was not

**Table I – Weight distribution among study groups**

| Parameter | Groups | | | | | |
|---|---|---|---|---|---|---|
| | Low birth weight | | Normal birth weight | | High birth weight | |
| | Female ($n$ = 29) | Male ($n$ = 25) | Female ($n$ = 50) | Male ($n$ = 48) | Female ($n$ = 25) | Male ($n$ = 26) |
| Mean (SD) | 1794 (473) | 1838 (494) | 3140 (340) | 3255 (307) | 4133 (91) | 4251 (143) |
| Max | 2400 | 2480 | 3900 | 3800 | 4350 | 4550 |
| Min | 870 | 800 | 2550 | 2600 | 4020 | 4000 |

SD, standard deviation; $n$, number.