Lipid Profile of Umbilical Cord Blood of Near Term and Term Neonates

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Abstract:

In this study we compare lipid profile of umbilical cord blood of near term neonates and term neonates. A total of 300 newborns were included in the study, which were divided into 150 term and 150 near term neonates. The groups of a term neonate were subdivided according to weight into AGA and SGA, and according to gender (male and female). Similarly, the groups of near term neonates were subdivided according to weight into AGA and SGA and according to gender.

It is evident that the total cholesterol and LDL cholesterol in near term group is higher than term, triglyceride and VLDL is higher in term neonates as compared to near term neonates. Low HDL-cholesterol in term neonates as compared to near term neonates but the value is not statistically significant.

This study showed the lipid profile in term male and female infants were not significantly different from each other; however, the mean levels of all lipid indicators for newborn girls were higher than those for boys except triglyceride and VLDL. The lipid profile in term SGA and AGA neonates were not significantly different from each other. Similarly, lipid profile in near term SGA and AGA neonates were not significantly different from each other.

Keywords: Neonates, Lipid profile, Small Gestation Age etc.

Introduction:

Atherosclerosis, a major cause of cardiovascular disease (CVD), is a process that begins early in life and progresses silently for decades, several investigators believe that the atherosclerotic lesion may have its genesis during childhood [1-4]. According to fetal origin's hypothesis or 'Barker hypothesis', adverse environment, e.g. under nutrition during fetal development, which leads to impaired intrauterine growth, programs later coronary artery disease (CAD) in adult life [5]. The incidence of CAD depends, in general, on the prevalence of genetic and environmental risk factors. Recent experiments in animals and human studies have 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, may permanently change structure and physiology of organ and tissue [6]. The arterial hypertension of adults causes changes in plasma levels of fibrinogen, dyslipidemia, impaired glucose tolerance or type 2 diabetes which start during fetal life, thus the overall nature of the progress of the atherosclerosis is age dependent, which begins in childhood and progresses with advancing age [7,8].

The primary prevention of hypertension may depend on strategies that promote fetal growth [9]. It is known that premature newborns have lost the chance to complete their energy deposits in later part of pregnancy. Thus, many times these growth restricted neonates need to use these endogenous reserves, thereby activating lipid metabolism that generates energy and promotes gluconeogenesis [10]. Low birth-weight neonates are more prone to CVD, hypertension and type 2 diabetes mellitus later in life [6]. This was in synchronization with 'fetal origin' hypothesis and reflects the phenomenon 'programming' whereby a stimulation or insult during a sensitive or critical period of intrauterine life could result in alteration of physiology and metabolism during adult life [6,11].

CVD is a worldwide disease with 7.2 million deaths and 12.2 % of total death. CAD is assuming a
serious dimension in developing countries. It is expected to be the single most important cause of death in India by the year 2015. There is a considerable increase in prevalence of CVD in urban area in India in last decade [12]. Nearly 1/3rd of neonates born in India are low birth weight, weight less than 2500 grams at birth, 2/3rd of the low birth-weight neonates born in India are IUGR (Intra uterine growth retardation) [13]. Although both the terms IUGR and small for gestational age (SGA) are used interchangeably, and both denote malnutrition, there is a minor difference in the terminology. SGA is a statistical definition used for neonates whose birth weight is less than 10th percentile for the particular gestational age. IUGR is a clinical definition and includes neonates with clinical evidence of malnutrition [14].

Blood cholesterol and lipid profile have been extensively been studied in adults whereas data in pediatric population are very scanty, more so in our country. Up till now two studies [15,16] were conducted in India, but the sample size was small. In one study [15] comparison of lipid profile was made between preterm AGA (appropriate for gestational age) and term AGA and between preterm SGA and term SGA. Ours is the first study, to compare lipid profile between near term AGA and near term SGA along with to compare lipid profile between term AGA and term SGA. We have not only compared lipid profile in term male and female newborns but also between near term males and females, thus differ from previous study [16].

Study of umbilical cord blood lipid profile immediately after birth can shed new light on lipid metabolism in term and near term as well as in AGA and SGA newborns. This study has tried to find out the influence of prematurity on cord blood lipid levels in term and preterm newborns and low birth weight neonates with special reference to SGA.

The aim of the present study was to compare the levels of lipids between term and near term newborn neonate. Primordial prevention of chronic disease is of clinical and public health importance. Considering the fetal onset of atherosclerosis, we aimed to determine the cord blood level of lipid profile in near term and term neonates.

The objectives of the study were:

- To compare lipid profile of umbilical cord blood of near term neonates and term neonates.
- To compare lipid profile between small for gestational age and appropriate for gestational age term neonates.
- To compare lipid profile between small for gestational age and appropriate for gestational age near term neonates.
- To compare lipid profile between male and female term neonates.
- To compare lipid profile between male and female near term neonates.

The present study was carried out in Government Medical College and Hospital, Nagpur. The period of study was from January 2011 to October 2012.

**Study design:** Hospital based prospective study.

A total of 300 newborns were included in the study, which were divided into 150 term and 150 near term neonates. The groups of a term neonate were subdivided according to weight into AGA and SGA, and according to gender (male and female). Similarly, the groups of near term neonates were subdivided according to weight into AGA and SGA and according to gender. Mother gave their informed consent. Protocol of study was approved by ethics committee.

**Inclusion criteria for mother:** Healthy mother only on iron, folic acid and calcium supplementation.

**Exclusion criteria for mother:** History with alcoholism, smoking, hypertension, thyroid disorders, diabetes mellitus, renal diseases, hypercholesterolemia, twins, liver diseases, tuberculosis and asthma, pregnancy induced hypertension.

**Inclusion criteria for newborns:**

- Gestational age between 35-42 weeks.
- One-minute APGAR [Appearance (skin color), Pulse (heart rate), Grimace (reflex irritability), Activity (muscle tone), and Respiration] score more than 7.
- Absence of any congenital anomalies.

**Exclusion criteria for neonates:**

- Congenital malformations.
Neonates born to mother with maternal illness which was already excluded in exclusion criteria for mother.

- Neonates with perinatal problems like hypoglycemia, pathological jaundice.
- Instrumental delivery, including extraction.
- Neonates with hypoxic ischemic encephalopathy, sepsis.

Clinical data recording:

All the mothers included in study were evaluated as per the proforma given herewith. Each mother underwent detailed clinical history, physical examination and investigations. Neonates were selected on the basis of gestational age ranging from 35 – 42 weeks and birth weight ranging from 1400 – 3800 grams. Birth weight was taken within 24 hrs of birth on an electronic weighing machine. Gestational age of newborn was confirmed by New Ballard et al [29] scoring system done within 24 hrs of birth. Newborns were divided into two groups- term and near term. Babies between 35-36.6 weeks of gestation were taken as near term and those with 37 completed weeks of gestation up to 42 weeks were taken as term after conformation of gestational age by history, clinical examination and ultra sonography by Obstetrics and Gynecology department. These were further divided as Small for Gestation Age (SGA) and appropriate for gestational age (AGA) according to birth weight. Babies with birth weight less than tenth percentile were SGA and those with birth weight between tenth and ninetieth percentile were AGA. The conformations of gestational age of neonates as SGA and AGA were done by department of Paediatrics.

We measured serum levels of lipid profile comprising of total cholesterol (TC), triglyceride (TG), high-density lipoprotein-cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C) and very low-density lipoprotein cholesterol (VLDL-C).

Specimen collection and preservation:

After delivery of the placenta and immediately after cord clamping, umbilical venous blood was obtained from maternal umbilical end. Serum was separated by centrifugation and analyzed immediately for lipid profile (total cholesterol, triglycerides, HDL cholesterol, VLDL cholesterol, LDL cholesterol).

1. Measurement of Serum Cholesterol [30]: It was measured by using Autozyme new cholesterol enzymatic, manufactured by Accurex Biomedical private limited, Thane, India. Kit.

Principle: Cholesterol esterase hydrolyses cholesterol esters in the specimen into free cholesterol and FA. In the second reaction, cholesterol oxidase converts cholesterol to cholest-4-en-3-one and hydrogen peroxide. In presence of peroxidase, hydrogen peroxide oxidatively couples with 4-aminantipyrine and phenol to produce red quinonimine dye which has absorbance maximum at 510 nm (505-530 nm). The intensity of red colour is proportional to the total cholesterol in the specimen.

2. Measurement of HDL cholesterol:[31]: It was measured by using Autozyme HDL cholesterol enzymatic, manufactured by Accurex Biomedical Private Limited, Thane, India. Kit.

Principle: Phosphotungstate/Mg2+precipitates chylomicrons, low density lipoprotein cholesterol (LDL-C) and very low density lipoprotein cholesterol (VLDL-C) fractions. After centrifugation, high Density Lipoprotein (HDL) fraction remains unaffected in supenatant. Cholesterol content of HDL fraction is assayed using ready to use reagent supplied with cholesterol kit.

3. Measurement of Serum triglyceride [32]: It was measured by using Autozyme new triglyceride enzymatic kit manufactured by Accurex Biomedical Private Limited, Thane, India. Kit.

Principle: Glycerol released from hydrolysis of serum triglycerides by lipoprotein lipase of the kit is converted by glycerol kinase to glycerol 3-phosphate, which is oxidized by glycerol phosphate oxidase to dihydroxyacetone phosphate and H2O2. In presence of peroxidase, H2O2 oxidizes phenolic chromogen to a red coloured compound. The intensity of the colour was measured on autoanalyzer.

4. Estimation of LDL:

Following formulae were used:

VLDL Cholesterol in mg % = Serum

Triglyceride / 5

LDL-cholesterol calculated by Friedewald formula [33].

 Serum LDL = Serum total cholesterol - (serum VLDL + Serum HDL)

Statistical analysis:

Mean values and standard error of mean (SEM) had been used to define data in each group. These values were compared between preterm and term babies of AGA group and preterm and term newborns of SGA group. Student unpaired ‘t’ test was used to test the significance between the data. The p value less than 0.05 was considered as significant and the p value less 0.001 was considered as highly significant. Graph Pad Prism version 6.00 software was used for analysis.
Observation & Results: Three hundred neonates were included in the study, which were divided into 150 term and 150 near term neonates. The groups of term (n=150) subdivided into term AGA (80) and term SGA (n=70). The groups of term subdivided into term male (n=77) and term female (n=73). The groups of near term subdivided into near term AGA (n=76) and near term SGA (n=74). The groups of near term subdivided into near term male (n=82) and near term female (n=68).

Table 1: Distribution of newborns according to gestational age and weight:

<table>
<thead>
<tr>
<th>Term neonates</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>AGA (n=80) (Mean ±SEM)</td>
<td>SGA (n=70) (Mean ±SEM)</td>
<td></td>
</tr>
<tr>
<td>Gestational Age [In weeks ]</td>
<td>38.14 ± 0.06</td>
<td>38.24 ± 0.06</td>
</tr>
<tr>
<td>Weight [ In kg]</td>
<td>2.71 ± 0.017</td>
<td>2.04 ± 0.015</td>
</tr>
</tbody>
</table>

The mean gestational age of distribution in term AGA and term SGA was found to be 38.14 ± 0.06 and 38.24 ± 0.06 respectively. The mean weight of distribution in term AGA and near term SGA was found to be 2.71 ± 0.017 and 2.04 ± 0.015 respectively.

Table 2: Distribution of newborns according to gestational age and weight

The mean gestational age of distribution in near term AGA and near term SGA was found to be 35.56 ± 0.055 and 35.64 ± 0.055 respectively. The mean weight of distribution in near term AGA and near term SGA was found to be 2.10 ± 0.016 and 1.55 ± 0.014 respectively.

Table 3: Serum lipid profile in term and near term neonates:

<table>
<thead>
<tr>
<th>SERUM LIPID S (mg/dl)</th>
<th>TERM(n=150) (Mean±SEM)</th>
<th>NEAR TERM (n=150) (Mean ±SEM)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Cholesterol</td>
<td>66.05 ± 0.65</td>
<td>70.28 ± 0.63</td>
<td>0.000***</td>
</tr>
<tr>
<td>Triglycerides</td>
<td>51.17 ± 0.54</td>
<td>48.79 ± 0.63</td>
<td>0.0048**</td>
</tr>
<tr>
<td>HDL Cholesterol</td>
<td>29.17 ± 0.40</td>
<td>30.16 ± 0.42</td>
<td>0.0916</td>
</tr>
<tr>
<td>LDL Cholesterol</td>
<td>26.64 ± 0.78</td>
<td>30.36 ± 0.75</td>
<td>0.000***</td>
</tr>
<tr>
<td>VLDL Cholesterol</td>
<td>10.23 ± 0.10</td>
<td>9.75 ± 0.12</td>
<td>0.0048**</td>
</tr>
</tbody>
</table>

*= (p<0.05), **= (p<0.01), ***= (p<0.001)

The mean value of serum total cholesterol in term and near term neonates was found to be 66.05 ± 0.63 and 70.28 ± 0.63 respectively. Significant higher values of serum total cholesterol were observed in near term neonates as compared to term neonates (p<0.0001).

The mean value of serum triglycerides in and near term neonates was found to be 51.17 ± 0.54 and 48.79 ± 0.63 respectively. Significant lower values of serum triglycerides were observed in near term neonates as compared to term neonates (p<0.05).

The mean value of serum high density lipoprotein cholesterol (HDL) in term and near term neonates was found to be 29.17 ± 0.40 and 30.16 ± 0.42 respectively. No significant difference was observed in HDL-cholesterol values in near term neonates as compared to term neonates.

The mean value of serum low density lipoprotein cholesterol (LDL) in term and near term neonates was found to be 26.64 ± 0.78 and 30.36 ± 0.75 respectively. Significant higher values of serum LDL-cholesterol were observed in near term neonates as compared to term neonates (p<0.0001).

The mean value of serum very low density lipoprotein cholesterol (VLDL) in term and near term
term neonates was found to be 10.23 ± 0.10 and 9.7587 ± 0.12 respectively. Significant lower values of serum VLDL-cholesterol were observed in near term neonates as compared to term neonates (p<0.01).

**Table 4 : Serum lipid profile in term AGA and term SGA neonates:**

<table>
<thead>
<tr>
<th>SERUM LIPIDS (mg/dl)</th>
<th>Term AGA(n=80) (Mean ± SEM)</th>
<th>Term SGA (n=70) (Mean ± SEM)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Cholesterol</td>
<td>65.39 ± 0.81</td>
<td>66.80± 0.99</td>
<td>0.2704</td>
</tr>
<tr>
<td>Triglycerides</td>
<td>52.03 ± 0.74</td>
<td>50.20 ± 0.80</td>
<td>0.0967</td>
</tr>
<tr>
<td>HDL Cholesterol</td>
<td>28.69 ± 0.54</td>
<td>29.73 ± 0.59</td>
<td>0.1966</td>
</tr>
<tr>
<td>LDL Cholesterol</td>
<td>26.30 ± 1.08</td>
<td>27.03 ± 1.16</td>
<td>0.6433</td>
</tr>
<tr>
<td>VLDL Cholesterol</td>
<td>10.41 ± 0.14</td>
<td>10.04 ± 0.16</td>
<td>0.0967</td>
</tr>
</tbody>
</table>

The mean value of serum total cholesterol in term AGA and term SGA neonates was found to be 65.39 ± 0.81 and 66.80 ± 0.99 respectively. Higher values of serum total cholesterol observed in term SGA as compared to term AGA neonates and the difference was not statistically significant.

The mean value of serum triglycerides in term AGA and term SGA neonates was found to be 52.03 ± 0.74 and 50.20 ± 0.80 respectively. Lower values of serum triglyceride observed in term SGA as compared to term AGA neonates and the difference was not statistically significant.

The mean value of serum high density lipoprotein cholesterol (HDL) in term AGA and term SGA neonates was found to be 28.69 ± 0.54 and 29.73 ± 0.59 respectively. No significant difference was observed in HDL-cholesterol in term AGA neonates as compared to term SGA neonates.

The mean value of serum low density lipoprotein cholesterol (LDL) in term AGA and term SGA neonates was found to be 26.30 ± 1.08 and 27.03 ± 1.16 respectively. Higher values of serum LDL-cholesterol in term SGA neonates as compared to term AGA neonates and the difference was not statistically significant.

The mean value of serum very low density lipoprotein cholesterol (VLDL) in term AGA and term SGA neonates was found to be 10.41 ± 0.14 and 10.04 ± 0.16 respectively. No significant difference was observed in VLDL-cholesterol in term AGA neonates as compared to term SGA neonates.

**Table 5 : Serum lipid profile in nearterm AGA and nearterm SGA neonates:**

<table>
<thead>
<tr>
<th>SERUM LIPIDS (mg/dl)</th>
<th>Near term AGA (n=76) (Mean± SEM)</th>
<th>Near term SGA (n=74) (Mean ± SEM)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Cholesterol</td>
<td>69.76 ± 0.95</td>
<td>70.81 ± 0.83</td>
<td>0.4096</td>
</tr>
<tr>
<td>Triglycerides</td>
<td>49.09 ± 0.93</td>
<td>48.49 ± 0.86</td>
<td>0.6348</td>
</tr>
<tr>
<td>HDL Cholesterol</td>
<td>30.11 ± 0.62</td>
<td>30.22 ± 0.57</td>
<td>0.89</td>
</tr>
<tr>
<td>LDL Cholesterol</td>
<td>29.84 ± 1.10</td>
<td>30.90 ± 1.02</td>
<td>0.4846</td>
</tr>
<tr>
<td>VLDL Cholesterol</td>
<td>9.81 ± 0.18</td>
<td>9.69 ± 0.17</td>
<td>0.6348</td>
</tr>
</tbody>
</table>

The mean value of serum total cholesterol in near term AGA and near term SGA neonates was found to be 69.76 ± 0.95 and 70.81 ± 0.83 respectively. Higher values of serum total cholesterol observed in near term SGA as compared to near term AGA neonates and the difference 76was not statistically significant.

The mean value of serum triglycerides in near term AGA and near term SGA neonates was found to be 49.09 ± 0.93 and 48.49 ± 0.86 respectively. Lower values of serum triglyceride observed in near term SGA as compared to near term AGA neonates and the difference was not statistically significant.

The mean value of serum high density lipoprotein cholesterol (HDL) in near term AGA and near term SGA neonates was found to be 30.11 ± 0.62 and 30.22 ± 0.57 respectively. No significant difference was observed in HDL-cholesterol in near term AGA neonates as compared to near term SGA neonates.

The mean value of serum low density lipoprotein cholesterol (LDL) in near term AGA and near term SGA neonates was found to be 29.84 ± 1.10 and 30.90 ± 1.02 respectively. Higher values of serum LDL-cholesterol in near term SGA neonates as compared to near term AGA neonates and the difference was not statistically significant.
SGA neonates was found to be 30.11 ± 0.62 and 30.22 ± 0.57 respectively. No significant difference was observed in HDL-cholesterol in near term AGA neonates as compared to near term SGA neonates.

The mean value of serum low density lipoprotein cholesterol (LDL) in term AGA and term SGA neonates was found to be 29.84 ± 1.10 and 30.90 ± 1.02 respectively. Higher values of serum LDL cholesterol observed in near term SGA as compared to near term AGA neonates and the difference was not statistically significant.

The mean value of serum very low density lipoprotein cholesterol (VLDL) in term AGA and term SGA neonates was found to be 9.81 ± 0.18 and 9.69 ± 0.17 respectively. Lower values of VLDL Cholesterol observed in near term SGA as compared to near term AGA neonates and the difference was not statistically significant.

The mean value of serum total cholesterol in term male and term female neonates was found to be 65.09 ± 0.82 and 67.05 ± 0.97 respectively. Higher values of serum total cholesterol observed in term female as compared to term male neonates and the difference was not statistically significant.

Table 6: Serum lipid profile in term male and term female neonates:

<table>
<thead>
<tr>
<th>SERUM LIPIDS (mg/dl)</th>
<th>Term male (n=77) (Mean ± SEM)</th>
<th>Term female (n=73) (Mean ± SEM)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Cholesterol</td>
<td>65.09 ± 0.82</td>
<td>67.05 ± 0.97</td>
<td>0.124</td>
</tr>
<tr>
<td>Triglycerides</td>
<td>51.74 ± 0.74</td>
<td>50.58 ± 0.80</td>
<td>0.2895</td>
</tr>
<tr>
<td>HDL Cholesterol</td>
<td>28.51 ± 0.57</td>
<td>29.82 ± 0.55</td>
<td>0.3957</td>
</tr>
<tr>
<td>LDL Cholesterol</td>
<td>25.24 ± 1.06</td>
<td>28.12 ± 1.55</td>
<td>0.068</td>
</tr>
<tr>
<td>VLDL Cholesterol</td>
<td>10.35 ± 0.14</td>
<td>10.12 ± 0.16</td>
<td>0.2895</td>
</tr>
</tbody>
</table>

Table 7: Serum Lipid Profile in near term male and near term female neonates:

<table>
<thead>
<tr>
<th>SERUM LIPIDS (mg/dl)</th>
<th>Near term male (n=82) (Mean±SEM)</th>
<th>Near term female (n=68) (Mean±SEM)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Cholesterol</td>
<td>69.56 ± 0.88</td>
<td>71.14 ± 0.89</td>
<td>0.2132</td>
</tr>
<tr>
<td>Triglycerides</td>
<td>49.12 ± 0.93</td>
<td>48.40 ± 0.84</td>
<td>0.5713</td>
</tr>
<tr>
<td>HDL Cholesterol</td>
<td>29.63 ± 0.50</td>
<td>30.79 ± 0.63</td>
<td>0.1729</td>
</tr>
<tr>
<td>LDL Cholesterol</td>
<td>30.10 ± 0.99</td>
<td>30.67 ± 1.15</td>
<td>0.7073</td>
</tr>
<tr>
<td>VLDL Cholesterol</td>
<td>9.82 ± 0.18</td>
<td>9.67 ± 0.16</td>
<td>0.5713</td>
</tr>
</tbody>
</table>
The mean value of serum total cholesterol in near term male and near term female neonates was found to be 69.56 ± 0.88 and 71.14 ± 0.89 respectively. Higher values of serum total cholesterol observed in near term female as compared to near term male neonates and the difference was not statistically significant.

The mean value of serum triglycerides in near term male and near term female neonates was found to be 49.12 ± 0.93 and 48.39 ± 0.84 respectively. Lower values of serum triglyceride observed in near term female as compared to near term male neonates and the difference was not statistically significant.

The mean value of serum high density lipoprotein cholesterol (HDL) in near term male and near term female neonates was found to be 29.63 ± 0.50 and 30.79 ± 0.63 respectively. No significant difference was observed in HDL-cholesterol in near term male neonates as compared to near term female neonates.

The mean value of serum low density lipoprotein cholesterol (LDL) in term male and term female neonates was found to be 30.10 ± 0.99 and 30.67 ± 1.15 respectively. Higher values of serum LDL Cholesterol observed in near term male as compared to near term male neonates and the difference was not statistically significant.

The mean value of serum very low density lipoprotein cholesterol (VLDL) in near term male and near term female neonates was found to be 9.82 ± 0.18 and 9.67 ± 0.16 respectively. Lower values of VLDL Cholesterol observed in near term female as compared to near term male neonates and the difference was not statistically significant.

Discussion:

To the best of my knowledge, this study was first of its own kind where sample size was robust, thus differs from previous studies.[15,16] None of the studies were conducted in our region. In one study[15] lipid profile comparison was made between preterm AGA (appropriate for gestational age) and term AGA and between preterm SGA (small for gestational age) and term SGA. Ours was the first study, where we compared lipid profile between near term AGA and near term SGA and comparison of lipid profile between term AGA and term SGA. We have not only compared lipid profile in term male and female newborns but also in between near term male and female, thus differ from previous study[16].

Worldwide, 15.5 per cent of all births, more than 20 million, are born as low birth weight (LBW) babies. India alone accounts for 40 per cent of the incidence of LBW babies in the developing world[34] LBW is associated with increased incidence of CVD, hypertension, and type 2 diabetes in adult life[11]. LBW is a risk of later atherosclerotic diseases that is equal to smoking or hypertension at puberty. Changes in blood lipids in LBW newborns with relative insulin intolerance can increase the risk of CVD in adulthood[35,36,37]. According to Barker et al, the newborn with low body mass index and thin built at birth will under lesser risk of CVD in a future. Risk will increase further if there any rapid weight and/or fat gain during childhood after infancy and adolescence[37].

Measurement of serum lipoproteins in infancy and childhood could be predictive for lipoprotein disorders and CVD in adulthood since LBW is an important risk factor for CVD, especially in low income countries[43]. It is worth mentioning that the lipid composition of the umbilical cord blood drawn immediately after birth corresponds exactly to that of blood drawn from a peripheral vein[46]. This procedure avoids the traumatism that venous punctures may cause to newborns.

Increased concentration of cholesterol in plasma is associated with a higher risk of atherosclerosis.[38] HDL-C is responsible for transport of cholesterol from the tissues back to the liver. LDL-C is the major cholesterol carrying particle in plasma. High blood levels of LDL-C and low concentrations of HDL-C are widely accepted as independent risk factors for coronary heart disease[39]. The protein component of LDL-C consists of one molecule of apo B, and most of the apo B found in plasma circulates in LDL-C. Apo B is a ligand for the LDL receptor which controls cellular uptake of LDL-C. Similarly, most of the protein content of HDL-C consists of apo A-I and most apo A-I in plasma exist in association with HDL-C. Apo A-1 modulates HDL metabolism, it is a ligand for HDL uptake and a cofactor for lecithin cholesterol acyl transferase (LCAT), which esterifies cholesterol in HDL-C. These associations have led to the view that apo A-I and apo B may be useful adjuncts to more conventional lipid and lipoprotein measurements in the assessment of coronary risk.[40] Increased blood concentrations of TC, LDL-C and apo B, and decreased HDL-C and apo A-1 have been shown to correlate with increased risk of developing coronary heart disease[30,39,40].
Serum Total Cholesterol:

Our results demonstrated that, the serum TC levels in the near term group were significantly higher than those in the term group, which is in agreement with Diaz M et al (2004) [23] Our finding coincides with the findings of Donegá S et al (2006) [20].

Similarly, our finding also mimics with Ginsburg BE et al (1980) [28] they found the TC concentration in cord blood was higher in preterm infants than term infants. In their study, free and esterified cholesterol was determined in 26 infants of varying gestational ages. They observed about one-third of the TC was in the free form in pre-term and term infants at birth and during the first days of life.

From our study, it was evident that the mean value of serum TC was higher in near term than term neonates. It has been reported that the plasma depletion of cholesterol that occurs at term is due to a decrease in HDL-C and LDL-C levels. LDL-C plasma levels are low in term neonates, most likely due to its rapid uptake and metabolism by the fetal adrenal as precursor or substrate for steroid hormone biosynthesis, postulated by Parker Jr et al. [27]. They found that TC and LDL-C levels in fetal plasma declined progressively from 33 to 42 weeks of gestation. At 41 to 42 weeks of gestation, the fetal plasma concentrations of TC and LDL-C were significantly lower than those at 33 to 34 weeks of gestation. Spear et al [44] demonstrated that LCAT activity was lower in near-term neonates than the term neonates. So, fall HDL-C may be associated with an increase in the activity of the LCAT activity during intrauterine life of fetus. However, we found that the lower level of TC was due to LDL-C, whereas there was no fluctuation in the concentration of HDL-C. This finding is in agreement with the results of Parker Jr et al., [27] but in conflict with the results of Spear et al. [44] This discrepancy might be explained by the group selected for study (very near term) or by differences in the design of the studies.

The cholesterol levels in umbilical cord blood of neonates were lower than those in adults. We found levels of TC were higher in near term neonates than in term infants. Moreover, our study indicated that this difference exists even though the premature neonates were near term, with a gestational age between 35 and 36.6 weeks.

Serum LDL-Cholesterol:

We observed that in near term group, LDL - cholesterol in near term group was higher than those in term groups, which was a statistically significant finding. This finding of our study is in agreement with previous reports [20,23,27].

As we have already discussed, the cause of the fall in plasma, LDL-C concentration is explained by the increase of its uptake by the fetal adrenal gland for steroid hormone production during fetal development, as postulated by Parker Jr et al. [27].

Serum HDL-Cholesterol

We found HDL – C in near term group was higher than those in term groups, which was not statistically significant. Spear et al [44] demonstrated that LCAT activity was lower in near-term neonates than the term neonates. Our study result were in accordance with those of with study conducted by Parker CR et al (1983) [27] and Pardo IMCG et al (2005) [21].

Serum Triglyceride:

In our study, triglyceride level was significantly higher in term neonates as compared to near term neonates. Similarly, our study finding is in agreement with those of Donegá S et al (2006) [20] in their study on newborns of both term and preterm groups. Serum triglyceride values were lower in preterm newborns than in full-term newborns.

Badiee et al (2008) [19] has reported very high level of cord blood triglyceride in full term Iranian newborn infant compared to other countries. Vaziri Esfarjani Sh et al (2004) [22] reported that the mean cord blood triglyceride level was meaningfully more than its level in the Nelson textbook of pediatrics.

Serum VLDL: We observed VLDL was statistically higher in term neonates as compared to near term neonates. This finding of present study is in agreement with study conducted by Yonezawa et al (2009) [18]. They studied that the TG distribution in preterm neonate cord blood and the relationship of VLDL-TG levels with respiratory distress syndrome (RDS). Term neonates had low cord blood TG concentrations distributed equally to the LDL and VLDL fractions. However, preterm neonates had even lower TG concentrations, with VLDL as the dominant carrier. Cord blood VLDL-TG concentrations increased dramatically from 32 to 34 weeks of gestational age. After extensive search the overall pattern of change in triglyceride and VLDL-C is not clearly outlined.

In this study, the lipid profile in term male and female newborns was not significantly different from...
each other; however, the mean levels of all lipid indicators for term female newborns were higher than those for male except TG and VLDL. These findings of our study coincide with the study conducted by Kazemi SAN et al (2010) [17] they found that all lipid levels were not significantly different between genders. Gender of the baby did not influence the cholesterol values found in study conducted by Singh J et al (1994) [25] and Mathur PP et al (1986) [26]. As in our study, TG and VLDL - C were higher in males than in females, this finding mimics with study conducted by Kharb S et al (2009) [16],Badiee et al(2008) [19] and Bastida S et al (1997) [24] reported that values of triglycerides in boys and girls which was not statistically significant, this finding supports our study.

Similarly, the lipid profile in near term male and female infants was not significantly different from each other, however, the mean levels of all lipid indicators for near term female newborns were higher than those for male except triglyceride and VLDL.

In present study, the mean levels of all lipid indicators for term SGA and term AGA newborns were not significantly different from each other, however, the mean levels of TC and LDL-C for term SGA were higher except TG, VLDL and HDL. Similarly, the mean levels of all lipid indicators for near term SGA newborns and near term AGA newborns were not significantly different from each other, however, the mean levels of TC and LDL-C for near term SGA higher except TG, VLDL and HDL.

When breastfeeding starts, a sharp increase in serum levels of the lipid profile during the first week of life up to six months of age is reported by various studies [45]. Mean values of a TC rise to 150 mg/dl from 70 mg/dl and those of LDL-C and TG to 100 mg/dl and 58 mg/dl from 30 and 32 mg/dl respectively [28]. After the first year of life, these values rise slowly and, around the second year of life, come close to those observed in adolescents and adults [42]. For this reason, newborns have a peculiar lipid profile when compared to neonates, children, or adolescents.

Conclusion:

CAD remains one of the leading causes of mortality in the world. Further reduction in the disease burden, however, may require that other influences on atherogenesis be investigated both early and late in its development. Genetic factors and in utero growth are of particular interest because of their consistent associations with coronary heart disease mortality and risk factors. There are several possible ways in which this association with intrauterine factors could be mediated, including programming of risk factor development or by altered susceptibility to them in later life. Alternatively, there may be a primary influence of prenatal factors on the atherosclerotic process itself from early in the disease.

The primary prevention of risk of cardiovascular diseases in future may depend on strategies that promote fetal growth. Early diagnosis followed by prudent dietary and drug therapy in this high risk neonates may provide an opportunity for a long range over primary amelioration of risk factors that contribute to development of CVD in adult life.

From this study, it is evident that the total cholesterol and LDL cholesterol in near term group was higher than a term; triglyceride and VLDL were higher in term neonates as compared to near term neonates. Fall in HDL was not significantly observed in term neonates as compared to near term neonates.

Hence, it was clearly visible a trend to worse lipid profile in Indian near-term infants. It may be interesting to see whether these susceptible neonates are at increased risk of developing cardiovascular diseases in future. The study also hints about the role of adverse maternal conditions in origin of early onset.

References:


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