

## SERUM LIPIDS AND APOPROTEIN B LEVELS IN NEONATES AND THEIR CORRELATION WITH MATERNAL LIPID PROFILE & PLACENTAL WEIGHT

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### ABSTRACT

**Objective:** To establish correlation if any between neonatal lipid profile and Apoprotein B levels and maternal nutritional markers (lipids, Apo-B and placental weight). **Design:** Correlation of lipid profile of newborns with markers of maternal nutrition. Settings: Department of Pediatrics, Department of Obstetrics & Gynecology. **Subjects:** New born babies and their mothers. **Methods:** The cord blood samples at birth and peripheral blood samples at one week of age were taken from 500 neonates and their mothers and tested for lipid parameters viz. cholesterol, LDL, HDL, VLDL, Chylomicrons, LDL-C, HDL-C, and VLDL-C. The weight of mother's placenta was also taken upto the nearest 10 grams. **Results:** The mean maternal lipid values and Apo-B levels were significantly higher compared to their newborns. No significant correlation could be made between maternal lipids and neonatal plasma lipids except that infant's HDLC approached closest to maternal HDLC levels. Amongst the "preterms", babies born to mothers with acceptable cholesterol levels (less than 240 mg/dl) had favorable lipid profile compared to those born to mothers with unacceptably high cholesterol levels (more than 240 mg/dl). No such difference was seen amongst the term new borns. It was also noted that as the placental weight increases, the

cholesterol, LDL (low density lipoprotein) and Apo-B (Apoprotein B) rise correspondingly. This correlation was maintained even at one week of age. **Conclusion :** The strength of correlation between placental weight and mean lipid values highlights the importance of such a study, where placental weight and maternal lipid values have been taken as markers of maternal nutrition.

**Key words:** Maternal nutrition, Placental weight, lipid profile, Cholesterol, LDL, Apo-B

### INTRODUCTION

Birth weight and placental weight are highly correlated. The placental weight is said to predict about adult disorders independent of birth weight. Babies with placenta disproportionately large in relation to birth weight are said to be at higher risk of death from heart disease<sup>1</sup>. Not many studies have been done to correlate neonatal lipid levels with placental weight. In a study of men and women in Preston, there was an increase in Blood Pressure with increase in placental weight<sup>2,3</sup>. Recent study of four year old children in Salisbury have shown similar association between birth weight, placental weight and blood pressure. According to Potter, 1977<sup>4</sup>, neonatal plasma cholesterol was significantly correlated with maternal LDL, whereas neonatal plasma triglycerides were related to factors like maternal parity, hypertension, duration of labor

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and to the occurrence of fetal distress. A weak but positive correlation was also found between infant and maternal triglycerides. Similar observation was made by Tsang et al, 1974<sup>5</sup>. The positive correlation between maternal HDL-C and infant plasma cholesterol may reflect the known placental transfer of cholesterol, with infants plasma levels partly dampened through the negative feedback of its own cholesterologenesis. Fetal tissues are capable of cholesterologenesis from early gestation and there is also an in vivo placental transfer of cholesterol from maternal circulation, as has been reported by Hellig et al 1970<sup>6</sup>. Another study found that there is a common genetic control of lipid metabolism in fetus which is independent of that in the mother<sup>7</sup>. Hence it was considered appropriate to conduct a study where neonatal lipids and maternal markers of nutrition were correlated.

#### MATERIAL AND METHODS

A total of 500 neonates born over a one year period in the department of Obstetrics and Gynecology were included in the study. Babies with extremely low birth weight, birth asphyxia, or any other serious illness were excluded. The mothers of the above newborns were also included for biochemical assessment. The placental weight was taken at birth up to the nearest 10 grams.

The blood samples for lipid parameters were taken at birth from the umbilical cord (placental side). For estimation of cholesterol and HDL-C the CHOD-PAP method was used. For triglycerides GPO-PAP method was used. The formula of Friedwald, Levi and Fredrickson<sup>8</sup> was used to determine beta Lipoprotein cholesterol levels. Estimation of differential lipids was done by nephelometry. Mean, plus two standard deviations, was taken as cut of value for each.

Results: The mean maternal lipid values and Apo-B levels were significantly higher compared to their newborns. No significant correlation could be made between maternal lipids and neonatal plasma lipids except that infant's HDLC approached closest to maternal HDLC levels. Amongst the "preterms", babies born to mothers with acceptable cholesterol levels (less than 240 mg/dl) had favorable lipid profile compared to those born to mothers with unacceptably high cholesterol levels (more than 240 mg/dl). No such difference was seen amongst the term newborns. It was also noted that as the placental weight increases, the cholesterol, LDL (low density lipoprotein) and Apo-B) Apoprotein B) rise correspondingly. This correlation was maintained even at one week of age.

"MEAN" NEONATAL AND MATERNAL LIPID AND APO-B VALUES (mg/dl) AT BIRTH

Lipids (mg/dl)	Neonate Mean $\pm$ SD	Normal Neonates* Mean $\pm$ SD	Mother Mean $\pm$ SD	Normal Adults <sup>+</sup> Mean $\pm$ SD
Cholesterol	83.8 $\pm$ 28.1	73.64 $\pm$ 21.61	199.0 $\pm$ 65.8	170.6 $\pm$ 38.93
HDL- C	32.5 $\pm$ 15.2	23.25 $\pm$ 7.66	44.4 $\pm$ 21.5	47 $\pm$ 9.88
Triglycerides	64.8 $\pm$ 43.6	33.75 $\pm$ 16.39	220.5 $\pm$ 110.0	72.29 $\pm$ 27. 26
VLDL-C	19.28 $\pm$ 17.50	12.81 $\pm$ 11.08	30.27 $\pm$ 19.07	14.36 $\pm$ 5.38
LDL-C	41.08 $\pm$ 24.1	41.81 $\pm$ 17.88	108.8 $\pm$ 53.9	108.70 $\pm$ 37.27
Apo-B	28.1 $\pm$ 16.9	32.15 $\pm$ 16.10	97.1 $\pm$ 40.2	91 $\pm$ 16

\* Kharb S, Kaur R, Singh V, Sangwan K. Birth Weight, Cord Blood Lipoprotein and Apolipoprotein Levels in Indian Newborns. International Journal of Preventive Medicine, 2010; 1 (1) :29-33

+ Sayyed A, Patil J, Chavan V, Patil S, Charugulla S, Sontakke A, Kantak N. Study of Lipid Profile and Pulmonary Functions in Subjects Participated in Sudarshan Kriya Yoga, Al Ameen J Med Sci 2010; 3(1): 42-49 (P Value <0.0001). The table shows that all the lipids values were significantly higher in the mother compared to the neonate. Interestingly triglyceride values were less than 1/3 of the maternal values.

#### **CORRELATION OF MATERNAL CHOLESTEROL VALUES WITH LIPID AND APO-B VALUES (mg/dl) OF TERM AND PRETERM NEONATES AT BIRTH.**

Lipids	MATERNAL CHOLESTEROL LESS THAN 240 mg/dl		MATERNAL CHOLESTEROL MORE THAN 240 mg/dl	
	TERM	PRETERM	TERM	PRETERM
Cholesterol	80.08 ± 25.0	104.3 ± 32.39	86.3 ± 29.7	98.0 ± 36.8
HDL-C	31.7 ± 14.4	35.2 ± 15.7	34.3 ± 17.6	31.8 ± 11.6
Triglycerides	64.1 ± 40.6	70.9 ± 68.3	65.3 ± 48.3	63.8 ± 80.8
Chylomicron	26.3 ± 25.5	45.0 ± 38.9	27.9 ± 30.0	39.7 ± 16.5
VLDL-C	18.08 ± 16.29	35.39 ± 22.81	17.57 ± 16.72	32.16 ± 25.24
LDL-C	39.3 ± 28.6	52.6 ± 27.6	44.2 ± 27.5	61.9 ± 29.0
Apo-B	28.3 ± 18.1	27.3 ± 18.9	26.7 ± 13.5	34.6 ± 16.4

The lipid values in preterms were significantly higher than those of the term neonates in both the groups. A significant and striking observation is noted in the higher values of protective HDLC and lower values of atherogenic LDLC and Apo-B amongst the preterms, whose mothers had cholesterol in acceptable range (less than 240 mg/dl) compared to those preterms whose mothers had cholesterol more than 240 mg/dl (p values less than 0.05)

#### **CORRELATION OF MEAN LIPID VALUES AND APO-B LEVELS (mg/dl) WITH PLACENTAL WEIGHT (AT BIRTH).**

Lipids	PLACENTAL WEIGHT (in grams)			
	Less than 450	450 – 549	550 – 649	650 and above
Cholesterol	78.7 ± 23.4	83.8 ± 28.09	86.7 ± 33.7	77.3 ± 14.7
HDL-C	32.7 ± 14.8	31.7 ± 15.7	36.2 ± 19.3	28.7 ± 7.6
Triglycerides	64.1 ± 36.8	62.1 ± 43.5	76.4 ± 56.5	66.2 ± 29.6
Chylomicron	26.8 ± 25.9	27.4 ± 27.4	23.2 ± 25.7	25.2 ± 25.5
VLDL-C	17.02 ± 14.16	19.15 ± 17.62	16.49 ± 6.86	14.01 ± 10.44
LDL-C	37.0 ± 19.4	42.5 ± 23.8	43.9 ± 32.4	34.8 ± 13.6
Apo-B	23.9 ± 12.5	29.3 ± 18.2	31.1 ± 17.1	34.3 ± 26.2

The table shows that as the placental weight increases cholesterol, LDLC and Apo-B also correspondingly except for those, whose placental weight is 650 grams or more. This is because twin pregnancies have been included in the last group. This pattern was maintained even at one week of age.

## DISCUSSION

The present study tried to correlate the main lipid values with different placental weight categories and it was seen that as the placental weight increases, the mean lipid value also increases. However in case of twins, where the placental weight was more than 650 grams this did not hold true. The correlation was maintained even at one week of age signifying the strength of association between the two. On comparing with the overall mean cord blood values, it was observed that babies with heavier placenta had higher triglycerides and LDL values. There have been several studies to correlate the presence of coronary heart disease in later life with the placental weight at birth which was indirectly meant to reflect the nutritional status of the mother<sup>9</sup>. Cardiovascular death rates were high in men with high ratio of placental weight to birth weight<sup>10</sup>. The present study showed that the overall mean infant lipid values were much lower than the maternal levels (40-50%), the triglycerides being the lowest (30 – 33%). In case of preterms, the Chylomicron levels were almost the same and VLDL level was higher than those of the mother. Studies by Kaplan & Lee 1965<sup>11</sup>, Potter 1977<sup>4</sup>, Brody & Carlson 1962<sup>12</sup> reported triglycerides to be much lower in new borns than their mothers (20%) whereas cholesterol levels were reported to be around 40 – 50% of maternal values. In the present study HDLC/LDLC was 0.75 in babies compared to 0.4 in the mothers. Also in the infant HDLC values were 70 – 75% of the mothers HDLC values. Both the above mentioned facts indicate placental transfer of intact HDL particles from mother to baby which has also been reported by Nakai et al, 1980<sup>13</sup>. According to Herrera E et al. 1988 the changes in the magnitude and direction of lipoprotein lipase activity in different tissues during pregnancy actively contributes to

metabolic fate of circulating triglycerides and development of higher triglycerides in pregnant women as seen in our study<sup>14</sup>. Secondly, higher triglycerides could reflect the presence of maternal obesity which is quite prevalent in Punjab where the study was conducted. The 'developmental overnutrition hypothesis' explains the link between maternal high triglycerides and those of their offsprings. The hypothesis states that high maternal free fatty acids (which is reflected by triglyceride levels) contribute in the development of in permanent changes in energy metabolism in the developing foetus, (Armitage et al. 2008)<sup>15</sup>. A comparison was also made amongst the babies of mothers who had high cholesterol levels (greater than 240 mg per dl.) with those whose mothers had lower cholesterol levels (less than 240 mg per dl.) It was found that pre-terms whose parents had unacceptable cholesterol levels had significantly higher levels of LDLC and Apo B and lower HDLC values than the babies whose parents had normal cholesterol values.

Although The higher lipid values in preterms than those of the term counterparts appear contradictory to the fact that higher lipid values were noted with corresponding higher placental weight one must realize that heavier placenta need not always be due to higher birth weight Rather Maternal anemia during pregnancy (quite common in india) is an independent risk factor for preterm delivery as well as increased placental weight and increased ratios of placental weight to birth weight<sup>16,17</sup>.

**Key Message:** Our findings reflect the possible interaction of fetal growth, gestation and the in utero lipid metabolism. The present study showed significant association between the neonatal lipid parameters and placental weight, placental weight / birth weight ratio, giving further credence to the theory that

cardiovascular diseases have their origin in childhood. Long-term longitudinal studies in different ethnic groups would help to elucidate the relationship

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