

CORRELATION OF GESTATIONAL LIPID PROFILE WITH NEONATAL BIRTH WEIGHT

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ABSTRACT

Introduction: Lipids are heterogeneous group of water insoluble (hydrophobic) organic molecules that can be extracted from tissues by non polar solvent. Because of their property of insolubility in water they are mainly found in different compartments, mostly associated with membranes enclosing various cell organelles. The objective of this study was to find the correlation of gestational lipid profile with neonatal birth weight.

Methods: Prospective analytical study of 100 Pakistani pregnant women (non diabetics and non-hypertensive) was carried out at Social Security Hospital, Lahore. Blood samples were collected from all the pregnant women during 24 – 36 weeks of pregnancy. Serum was separated by centrifugation process and stored in deep freezer at –2 to –4°C prior to processing and later on used for the estimation of lipid profile. The weight of each baby was done at the time of delivery.

Results: Positive correlation was found between maternal cholesterol levels and neonatal birth weight.

Conclusion: Maternal lipid profile should be kept under check to control the weight of newborn baby.

Key words: Lipid profile, High density lipoprotein, Low density lipoprotein, Neonatal birth weight, Triglycerides.

INTRODUCTION

Lipids are heterogeneous group of water insoluble (hydrophobic) organic molecules that can be extracted from tissues by non polar solvent. Because of their property of insolubility in water they are mainly found in different compartments, mostly associated with membranes enclosing various cell organelles. In adiposites as droplets of triglycerides, when transported in cytosol, they are in the form of lipoprotein particles.¹ Lipids include; triglycerides (TGs), phospholipids (PL), cholesterol (CH) and cholesterolesters (CHE). The basic lipid moiety of the TGs and phospholipids is fatty acid, which is either saturated or unsaturated, although cholesterol does not contain fatty acid, its sterol nucleus is synthesised from degradation products of fatty acid molecules, thus giving it many of the physical and chemical properties of the lipids.²

Fetal growth is a complex process involving the interaction of mother, placenta, and fetus. Growth and development of the fetus depends upon nutrients such as glucose, lipids, and amino acids³. Genetic factors, in addition to the maternal and fetal status, are reported to play a role.⁴ Substantial evidence exists for clear relationship between lipid profile and neonatal birth weight.^{5,6} Maternal triglyce-

rides are found to have positive correlation with neonatal birth weight, in non-diabetic pregnancies. Increase in plasma lipid level is seen due to the hormonal changes during pregnancy. The triglycerides and cholesterol levels during a normal pregnancy are elevated to 332 mg/dL and 337 mg/dL, respectively (corresponding 95th percentile values). However, elevations over 95th percentile values can be observed during pregnancy and patients with levels over these expected adaptation levels can be divided into 2 groups: (1) supraphysiological hyperlipoproteinaemia during pregnancy and (2) extreme hyperlipoproteinaemia limited to gestational period (triglyceride level > 1000 mg/dL).⁷ But it is certain that hyperlipidaemia is characteristic feature of pregnancy and it results in increased birth weight of the baby.⁸ Maternal FFA and TGs levels, measured in third trimester of delivery are correlated with neonatal birth weight, although maternal circulating TGs do not cross the placenta⁹ but TGs are the strong predictors of maternal weight than glucose⁵. During the last trimester of pregnancy, there is a high fetal demand for fatty acids (FA), as they are critical to the normal neural and vascular development. The fetus is able to synthesise saturated and monounsaturated FAs from glucose and ketone

bodies¹⁰ but depends entirely on placental transport for its supply of the essential fatty acids. The FFAs and their derivatives are particularly important for the development of brain and retina.¹¹

Present study was aimed to evaluate the relationship of maternal lipid profile with neonatal birth weight in normal, non-diabetic, Pakistani pregnant women.

MATERIAL AND METHODS

The whole work was conducted at Social Security Hospital, Lahore, Pakistan. A total of 110 pregnant women (n = 110) were enrolled. The Pregnant women with history of diabetes, chronic cardiac disease, Thyroid disease, Family history of having obese children, Fetal abnormality, Multifetal pregnancy were not enrolled and it was also planned that women who would have premature (before 37th weeks of pregnancy) and post mature delivery (after 40th weeks of pregnancy) were be excluded from the study. So total ten women were excluded due to the development of hypertension, diabetes and delivery before 37th weeks of pregnancy. Hence 100 women were left for study and were followed up to the time of delivery. The blood samples during third trimester were taken from each woman for biochemical analysis.

Sample Collection

The women were advised to come after overnight fasting and total 2 mL blood samples were collected using sterile technique (venepuncture). Serum was separated by centrifugation process at 3000 rpm for 10 minutes and stored at 2–4°C prior to processing.

Biochemical Analysis

The serum samples were analysed for the estimation of TC by using CHOD – PAP method,¹² TGs by GPO – PAP enzymatic colorimetric method¹³ and HDL by Lopes¹⁴ using commercially available enzymatic kits.

For the estimation of LDL in mg/dl following for-mula was used:

$$\text{LDL cholesterol} = \frac{\text{Total Cholesterol} - \text{triglyceride} - \text{HDL cholesterol}}{5}$$

Statistical Analysis

The data was analysed and represented by mean and standard deviation for lipid profile. Comparison between values of maternal lipid profile and neonatal birth weight was done. Differences were considered significant at p value of equivalent or ≤ 0.05 .¹⁶

RESULTS

Lipid profile (TC, TGs, HDL – C and LDL – C) was recorded in third trimester of pregnancy in 100 pre-

gnant women. The women were divided into three groups depending upon the cholesterol level. The weight of the each baby was taken at the time of delivery and was compared with the standard values. The mean neonatal weight calculated was 3.42 ± 0.04 kg. The results obtained from the study exhibited that mothers having cholesterol levels up to 200 mg/dL during their pregnancy had high percentage (65%) of babies with birth weight of 3 kg as compared to 3.5 kg babies which were only (34%) and none of the babies were born with birth weight of 4 kg. On the other hand mothers having cholesterol level upto 250 mg/dl had babies with birth weight of 3 kg (50%) and 3.5 kg (50%). The mothers having cholesterol levels up to 300 mg/dl gave birth to babies with birth weight of 3.5 kg (54%) and 4 kg (23.8%), and 3 kg only (20%). None of the babies were born with birth weight of less than 3 kg, indicating that positive correlation exists between mother's cholesterol level and neonatal birth weight (table 1).

Table 1: Correlation of maternal cholesterol levels and neonatal birth weight.

| Maternal Cholesterol levels (mg/dl) | Neonatal birth weight | | |
|-------------------------------------|-----------------------|--------|-------|
| | 3 kg | 3.5 kg | 4 kg |
| Up to 200 | 65% | 34% | Nil |
| Up to 250 | 50% | 50% | Nil |
| Up to 300 | 20% | 54% | 23.8% |

Table 2: Correlation of triglycerides and neonatal birth weight.

| Maternal triglycerides levels (mg/dl) | Neonatal birth weight | | |
|---------------------------------------|-----------------------|--------|------|
| | 3 kg | 3.5 kg | 4 kg |
| Up to 200 | 55.5% | 40.7% | 3.7% |
| Up to 250 | 17.3% | 73% | 9% |
| Up to 300 | 69.5% | 21.7% | 52% |

When maternal triglyceride levels and birth weight comparison was carried out it was seen that mothers having triglyceride levels up to 200 mg/dL, during pregnancy had high percentage of babies with birth weight 3 kg (55.5%) as compared to mothers with cholesterol levels 250 mg/dL had high percentage of babies with birth weight 3.5 kg (73%). On the other hand mothers with 300 mg/dL had greater percentage of babies with birth weight of 3.5 kg (21.7%) and 4kg (52%) which indicate positive correlation between TGs and birth weight (table 2).

Table 3: Correlation of maternal HDL levels and neonatal birth weight.

| Maternal HDL levels (mg/dl) | Neonatal birth weight | | |
|-----------------------------|-----------------------|--------|-------|
| | 3 kg | 3.5 kg | 4 kg |
| Up to 50 | 75% | 25% | Nil |
| Up to 55 | 36.4% | 46.8% | 16.6% |

Table 4: Correlation of maternal LDL levels and neonatal birth weight.

| Maternal LDL levels (mg/dl) | Neonatal birth weight | | |
|-----------------------------|-----------------------|--------|------|
| | 3 kg | 3.5 kg | 4 kg |
| Up to 100 | 65.6% | 34.3% | Nil |
| Up to 150 | 63.6% | 18% | 18% |
| Up to 200 | Nil | 53% | 46% |

Results obtained from correlation of HDL levels with birth weight it was seen that babies with birth weight of 3kg were born in high percentage (75%) with maternal HDL – C level (50 mg/dl) as compared to mothers having HDL – C (55 mg/dl) in whom 3.5 (36.4%) and 4kg (46.8%) babies were more in number, showing positive correlation (table 3).

The results showed that positive correlation existed between maternal LDL level and neonatal birth weight. Mothers having 100 mg/dl levels have high tendency to give birth to babies having 3 kg body weight than those mothers who were having 150 and 200 mg/dl who delivered more babies with 3.5 and 4 kg body weight (table 4).

DISCUSSION

The main objective of the present study was to investigate the effect and correlation of the lipid profile; TC, TGs, HDL and LDL with neonatal birth weight. A total of 100 pregnant women were included in the study. The weight of each baby was noted immediately after delivery. To calculate the correlation pregnant women were divided into three groups, depending upon their lipid levels, and newborn babies were also divided into three groups according to their birth weight.

The correlation between maternal cholesterol levels and neonatal birth weight indicated that mothers having cholesterol levels up to 200 mg/dL during their pregnancy gave birth to babies with birth weight of 3 kg in greater percentage as compared to 3.5 and 4 kg. While those with 250 mg/dl had more number of babies with birth weight of 3 and 3.5 kg and mothers having cholesterol levels up to 300 mg/dl gave birth of 3.5 and 4 kg babies in greater percentage, this indicated positive correlation

between mother cholesterol levels and neonatal birth weight. These findings are in line with Schaefer et al⁸ who observed that circulating maternal cholesterol levels during third trimester had positive correlation with the neonatal birth weight. It has also been reported that lipid profile plays a major role on fetal weight as compared to glucose.¹⁷

It was found from correlation between TGs level and neonatal birth weight, mothers who were having triglycerides levels up to 200 mg/dL during pregnancy had greater percentage of 3 kg birth weight babies as compared to mothers with cholesterol levels 250 mg/dL and 300 mg/dL. These findings indicated that with the increase in maternal triglycerides, birth weight also increased accordingly; so positive correlation was found between maternal TGs and neonatal birth weight. This is in agreement with the studies of Kitijima et al⁵ who stated that TGs in third trimester are stronger predictor of birth weight. Raised levels of triglycerides and its positive correlation with neonatal birth weight can be explained by the fact that increased triglycerides level during late gestation are due to the increased hepatic production of VLDL under the effect of increased production of oestrogen, and due to the decreased activity of extra-hepatic lipoprotein lipase. This results in decreased utilization of TGs, hence the level increases.⁶

The maternal HDL and neonatal birth weight relationship shows that babies with birth weight 3 kg were born in greater percentage (75%) with maternal HDL – C level (50 mg/dl) as compared to mothers having HDL-C (55 mg/dl). While 3.5 and 4kg babies were maximally seen in 55 mg/dl HDL level containing mothers.

Positive correlation existed between maternal HDL levels and neonatal birth weight. Similar type of study was conducted by Yang et al,¹⁸ who concluded that correlation existed between HDL and neonatal birth weight, although in contrast to our study he stated that negative correlation was found between the two. When correlation was calculated between maternal LDL and birth weight, it was observed that mothers having 100 mg/dl of LDL level had high percentage of 3 kg babies as compared to mothers having 150 and 200 mg/dl of LDL. This indicated positive correlation between maternal LDL level and neonatal birth weight, and is supported by the studies of Schaefer et al⁸ who studied that maternal lipids TC and LDL in third trimester are strongly correlated with neonatal birth weight.

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