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# Role of Maternal Lipid Profile and Cord Blood Lipid Profile in the GDM Mothers and their Infants

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**Abstract:** ***Background: Gestational Diabetes mellitus (GDM) is considered as one of the most common complication of pregnancy has major effects in mother and the child. Physiological maternal dyslipidemia normally occurs in pregnancy as an outcome for increased demand of nutrients to the fetus but GDM might be associated with further detrimental effects on the lipoprotein metabolism in the mother leading to dyslipidemia in the newborn. Hence serum lipid profile in childhood might be considered as a predictive factor for serum lipid level later in life. Aim: To study the role of maternal lipid profile and the cord blood lipid profile in the infants with GDM mothers. Methodology: Maternal blood was used to measure mother's serum lipid profile. Cord blood sample from maternal side was also used to estimate lipid profile .The newborn birth weight and placental weight were also measured in 50 diagnosed cases of GDM and 50 controls. Statistical analyses was done using SPSS 21 software. Results: There was a significant difference (p<0.001) in the mean birth weight and the mean placental weight in the GDM mothers. All the lipid parameters including serum cholesterol, serum triglyceride and LDL levels except HDL (124.2±24.3,72.0±28.26, 40.18± 19.65mg/dl respectively) were significantly different in GDM mothers as compared to the non GDM mothers (73.5±22.68, 61.4±7.94, 22.6±4.95 mg/dl). A significant association (p<0.001) between neonatal weight and placental weight to that of the lipid parameters in the cord blood was also established. Conclusion: GDM causes alteration in lipoprotein metabolism in both mother and child whichsuggest that metabolic dysfunction and dyslipidemia in mother can have long term affect on the lipid profile of the newborns may increase the risk of cardiovascular diseases in the future.***

## 1. Introduction

Gestational Diabetes mellitus (GDM) is considered as one of the most common complications of pregnancy which is known to have serious health implications for both mother and child [1]. WHO defines GDM as first onset of glucose intolerance or hyperglycemia diagnosed anytime during the period of gestation if one or more of the following criteria are met: 1) fasting plasma glucose> 92mg/dl 2) 1hour plasma glucose after 75 gm glucose load >180mg/dl and 2hr plasma glucose > 153 mg/dl [2].Worldwide incidence of GDM is estimated to be around 12% [3]. In India its incidence has increased in last ten years from about 2% to 7% with complicating almost around 4 million pregnancies across the country [4]. A substantial risk of 35-60% of developing DM in the next 10-20years was also noted [5].

Fetal development is known to be influenced by various factors like placental transfer of nutrients, maternal metabolic and dietary factors. Glucose (a teratogen at high concentrations) is one of major nutrient crossing the placenta (whereas insulin does not) therefore any alteration in its levels can affect the fetal development. GDM can be related with numerous adverse outcomes in a newborn therefore its diagnosis is essential for identifying conditions like macrosomia, hypocalcaemia, hypoglycemia and hyperbilirubinemia [6, 7, 8]. In recent years the prevalence of risk factors of cardiovascular diseases (CVD), especially obesity and hyperlipidemia has been increasing among children and adolescent. Physiological maternal dyslipidemia normally occurs in pregnancy as an outcome for increased demand of nutrients to the fetus [9]. Studies had suggested that GDM might be associated with further detrimental effects on the lipoprotein metabolism in the mother but the results have been inconsistent [10, 11]. Moreover it can lead to dyslipidemia in the newborn leading to elevated lipoprotein levels later in life, thus playing a role in the development of obesity, atherosclerosis and diabetes in later stages of adolescence [12]. Therefore serum lipid profile in childhood is considered as a predictive factor for serum lipid level later in life.

So not only diet but also other risk factors can affect serum lipid level from birth. The effects of intrauterine factors such as GDM are emerging as these risk factors, have been suggested as one of the major contributors to metabolic abnormalities. Therefore in the present study, we aim to study the role of maternal lipid profile and the cord blood lipid profile in the infants of GDM patients.

## 2. Material and Method's

**Study group**

It was a hospital based study (case control study) conducted in a 400 bedded, tertiary care super specialty hospital in New Delhi and included 50 diagnosed cases of GDM and 50 controls. The study had the approval of the Institutional ethical committee of Sri Balaji Action Medical Institute, New Delhi.

**Inclusion criteria**

50 diagnosed cases of GDM with no other systemic illnesses in age group between 20-30 years along with 50 age matched healthy controls were included. Informed consent and a detailed history of signs and symptoms, dietary history and drug intake history were taken and recorded on the data capture formats from each subject. Patients with history of pre-existing diabetes mellitus, hypertension, malignancy or any acute or chronic liver diseases were excluded from the study.

OGTT (Oral glucose tolerance test) was done with 75 grams of glucose and diagnosis of GDM was made at 24-28 weeks of gestation according to the ADA criteria as≥ 1of the following glucose levels: fasting blood glucose > 92mg/dl, after 1 hr > 180mg/dl, and after 2 hr > 153mg/dl [13]. All the patients were receiving oral hypoglycemic drugs from 16 weeks of pregnancy till delivery.

Serum samples (about 3ml) were collected from the mother and cord blood was collected from maternal end of umbilical cord to coincide precisely with the newborn venous sample. Maternal blood was used to measure mother's serum cholesterol, triglyceride, HDL, LDL levels. Cord blood sample was also used to estimate cholesterol, triglyceride, and HDL and LDL levels. Further the newborn birth weight and placental weight were also measured. Lipid parameters were measured using Autoanalyzer(COBAS c311).

**Statistical Analysis**

Statistical analysis was done using SPSS 21 software. Data was presented as mean ± Standard deviation as appropriate. Student's t-test was used to compare the means between the two group of cases and controls. Correlation between variables was calculated using Pearson's correlation and p <0.05 was considered to be significant. Our data followed normality and it was estimated using the Shapiro wilk test.

## 3. Results

The results showed that the mean birth weight of the newborns of GDM patients was 2.95 ± 0.12 Kg as compared to newborns of non GDM patients which was around 2.7± 0.15 Kg. We could establish a significant difference in the birth weights between the two groups ($p < 0.001$) as depicted in Table 1. Similarly, our study also revealed a significant difference ($p<0.001$) in the mean placental weight between the GDM mothers (579±18.3) to that of non-GDM mothers (454.2 ±17.1) [Table 1]. In our study we could further establish a significant difference in the levels of serum cholesterol, serum triglyceride levels and serum LDL levels between the GDM and non-GDM patients ($p<0.001$) [Table2] . The mean serum cholesterol was 124.2 ± 24.35mg/dl in GDM cases compared to mean±SD of 73.5 ±22.68 mg/dl in the controls. Similarly serum TG and LDL levels were 72±28.26 and 40.18± 19.65 in GDM cases as compared to mean 61.4±7.94 mg/dl and 22.6±4.95 mg/dl in non GDM patients, respectively. HDL was not found to be significantly different in both the groups. Further in our study we tried to correlate the neonatal weight of newborns and placental weight of the mother with that of cord blood cholesterol, triglyceride and LDL levels. As depicted in the Table 3, the association between neonatal weight and placental weight to that of the lipid parameters in the cord blood were found to be highly significant ($p <0.001$).

**Table 1:** Birth weight, placental weight of cases and controls

| Parameter | Newborns of GDM cases(n=50) | Newborns of Non GDM cases(n=50) | p value |
|---|---|---|---|
| Birth weight in Kg | 2.95±0.12 | 2.7±0.15 | <0.001 |
| Placental weight in gm | 573±18.3 | 454.2±17.1 | <0.001 |

**Table 2:** Lipid profile of cases and controls

| Parameter | GDM cases (n=50) | Non GDM controls (n=50) | p value |
|---|---|---|---|
| Serum cholesterol(mg/dl) | 124.2±24.35 | 73.5±22.68 | <0.001 |
| Serum triglyceride | 72.0±28.26 | 61.4± 7.94 | <0.001 |
| High density lipoprotein | 40.05± 4.6 | 40.08±2.7 | NS |
| Low density lipoprotein | 40.18± 19.65 | 22.6±4.95 | <0.001 |

**Table 3:** Correlation with the lipid parameters in the cord blood

| Parameter | Cord blood cholesterol | Triglyceride | LDL |
|---|---|---|---|
| Neonatal weight | p <0.001 | p <0.001 | p <0.001 |
| Placental weight | p <0.001 | p <0.001 | p <0.001 |

## 4. Discussion

Diabetes can be considered as one of the prime factors associated with alteration in maternal metabolism and adverse fetal outcomes [14]. It is also related with alteration in lipid metabolism as well as derangements in the serum lipoproteins levels. GDM may further alter the lipoprotein metabolism in the newborns leading to dyslipidemia and other associated complications. Studies have considered the lipid profile in the early childhood as a predictor of serum lipid levels later in life [15, 16]. Therefore it is hypothesized that not only diet but other risk factors like GDM may have a major role in altered lipid levels in the newborn leading to increased incidence of cardiovascular diseases later in life.

In our study the mean birth weight of the newborns in the GDM mothers was 2.95±0.12 kg as compared to the 2.7±0.15 kg in the non GDM mothers. The birth weight was found to be significantly higher in the GDM patients. These findings were in accordance to other studies. Macrosomia is the most common complication associated with GDM [17]. Hyperglycemia in mother leads to increased transplacental transfer of glucose to the fetus which in turn can lead to rise in the fetal insulin levels and insulin like growth factors. The anabolic effects of insulin causes increased growth and adiposity in the fetus. Similarly our study also revealed a significant higher placental weight in patients with GDM as compared to the controls. Taricco E et al in 2003 also had shown a significant increase in placental weight and low fetal to placental weight ratio in pregnancies complicated with GDM [18]. This could be explained as a compensatory increase in the placenta in response to fetal overgrowth related to hyperinsulinemia.

In our study we further compared the lipid profile of GDM mothers to that of the non GDM mothers. Both the groups showed a highly significant difference in the mean levels of serum cholesterol, triglyceride and the LDL levels ($p<0.001$) with a higher concentration in the GDM mothers. On the other hand HDL levels were not found to be significantly different in both the groups. Wang J et al in 2019 had shown significant higher levels of TG and low HDL levels in the GDM females as compared to controls, but in their study serum TC and LDL did not show any significant difference between the two groups [19]. Similarly another study by Liang Z et al in 2016 revealed a significant increase in TG and TC levels in GDM patients compared to non- GDM patients [20]. Lipid metabolism is normally altered in pregnancy due to estrogen and insulin resistance in order to

meet the increased demand for the fetal development [21-24]. Diabetes can exaggerate this metabolic dysfunction and thus lead to dyslipidemia in the GDM mothers. Hypertriglyceridemia and low HDL levels are the most common pattern of dyslipidemia seen in glucose intolerance.

We further correlated the cord blood lipid parameters to that of the placental weight and the neonatal weight. Interestingly in our study cord blood cholesterol levels, triglyceride levels and the LDL levels showed a highly significant positive association with both the neonatal and the placental weight ($p<0.001$). These findings suggested that placental transfer of maternal lipids and interplay of hormones like insulin can affect the fetal growth and development. As suggested earlier placental weight and size is increased in GDM patients [17, 18]. This increase in surface area can thus, escalate the exchange of TAG and NEFA (non esterified fatty acids) to the fetus and thus, get deposited in the adipose tissue leading to increase in birth weight. Our findings were in accordance with Aletayeb SMH et al in 2013 had shown high TC , TG and LDL levels in the cord blood of large for gestational age babies as compared to the normal newborns[25]. Similarly Koklu et al in 2007 had also shown higher levels of TC, TG, LDL and VLDL in macrosomic babies as compared to normal babies [26]. Thus our study suggested that birth weight might be related with the cord blood lipid profile. All these findings in our study suggest that there exists interplay of several intrauterine factors including maternal age, BMI, maternal metabolic defects like diabetes especially GDM, which can alter the lipid profile of the newborns. Moreover these factors can further increase the risk of hyperlipidemia and obesity in the early childhood thus elevating the risk of cardiovascular diseases later in future.

## 5. Conclusion

Our results concluded that GDM is a metabolic condition associated with hyperglycemia in mother and hyperinsulinemia in the fetus which leads to increase in the birth weight and the placental size. Our study showed significant higher levels of TC, TG and LDL in the serum of mothers with GDM compared to controls. Thus concluding that GDM causes alteration in the normal physiological lipoprotein metabolism in both mother and child. We could further establish a highly significant association between the cord blood lipid parameters (TC, TG and LDL) and the placental as well as the neonatal weight. All these findings suggest that metabolic dysfunction and dyslipidemia in mother can have long term affect on the lipid profile of the newborns thus increasing the risk of cardiovascular diseases in the future. Therefore early diagnosis of GDM and dyslipidemia in mother and its proper management could be beneficial.

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