

**Prediction of gestational diabetes mellitus on the basis of elevated serum triglyceride levels - An observational study**

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**Abstract**

**Background:** In pregnancy there is increase in the lipid level with the increase in period of gestation. Maternal dyslipidemia which is elevated over a physiological range is a common phenomenon during pregnancy to provide metabolic fuel and nutrients to the fetus. Insulin resistance which is one of the primary defects of gestational diabetes mellitus presumed to have important relationship with dyslipidemia in pregnancy and further cardiovascular risk. So, this study aims to determine the relation between serum triglyceride levels and development of gestational diabetes mellitus.

**Material and Methods:** An observational study was carried out among 230 pregnant women who received regular antenatal care in the department of Obstetrics and Gynecology, SMS medical college, Jaipur from May 2021 to March 2022. Serum triglyceride levels were

measured at 12 weeks and 24-28 weeks along with random blood sugar and DIPS1 respectively.

**Results:** Among 230 women 45 participants were having increased serum triglyceride level at 12 weeks while 80 were having increased level at 24-28 weeks. Out of the total women who had increased serum triglyceride level 54 developed gestational diabetes mellitus. 66% of the participants who developed gestational diabetes mellitus were having increased value of serum triglyceride level at 12 weeks whereas only 34% were having normal level while 100% of them were having normal values at 24-28 weeks. Thus, elevated triglycerides at early gestation were associated with development of gestational diabetes mellitus by logistic regression (odds ratio: 0.03, 95%CI: 0.01–0.07,  $p < 0.001$ ).

**Conclusion:** Elevated triglycerides in early gestation were associated with insulin resistance and  $\beta$ -cell

dysfunction leading to increased risk of development of gestational diabetes mellitus.

**Keywords:** Gestational, Serum triglyceride, metabolic fuel.

**Introduction**

Gestational Diabetes Mellitus is defined as any degree of glucose intolerance diagnosed or having onset during pregnancy.<sup>1</sup>It is one of the most common medical complication and medical disorder of the pregnancy.<sup>2</sup>This metabolic disorder is associated with many maternal and fetal complications like preeclampsia, fetal macrosomia, low birth weight, increased risk of caesarean section etc.<sup>3</sup>Pregnancy is a diabetogenic state characterized by hyperinsulinemia and insulin resistance. In early pregnancy maternal hormone promote the release of insulin with increased peripheral utilization leading to decrease maternal glucose level.<sup>4</sup> as pregnancy advances the level of cortisol and estrogen increase and lead to insulin resistance<sup>4</sup>. Hyperinsulinemia increases the storage of fat with decline in lipolysis.<sup>4</sup>during middle and last trimester maternal fuel adjustment occur leading to sparing of glucose for the fetus and increased concentration of fatty acid in plasma leading to gestational Diabetes mellitus.<sup>5</sup>From the 12th week of pregnancy, lipid parameters, including total cholesterol, triglycerides, low-density lipoprotein-cholesterol, high density lipoprotein-cholesterol and phospholipids gradually increase, especially in the second and third trimesters.<sup>6,7</sup> Maternal triglyceride represent a “floating energy depot”<sup>1</sup>. Under fasting condition, triglyceride is efficiently used by the maternal liver to synthesize ketone bodies. This mechanism spares glucose for use by the fetus for energy. Excess free fatty acids result in generation of toxic lipids including diacylglycerides and ceramides which contribute to endoplasmic reticulum stress, mitochondrial dysfunction and generation of

reactive oxygen species which trigger inflammation and insulin resistance.<sup>9,10</sup> According to "American college of cardiology" There is increased lipid concentration as gestation progresses. But the evidence is emerging that presence of dyslipidemia characterized by high triglyceride, small dense low-density lipoprotein, low high-density lipoprotein in the pre-pregnancy and early gestation confer increase risk of adverse pregnancy outcome<sup>11</sup>.

**Methods**

A prospective hospital-based observational study was conducted in the Department of Obstetrics and Gynecology, SMS Medical College and Attached group of hospitals, Jaipur between May 2021 to March 2022. Pregnant women attending antenatal clinic at the Department of Obstetrics and Gynecology, SMS Medical College, Jaipur were included in the study after taking informed and written consent. Pregnant women with pre-existing diabetes mellitus, not participating in the other studies, with inflammatory conditions like sepsis, rheumatoid arthritis, asthma, and who is on the drugs affecting serum triglyceride levels like statins, fibrates were excluded from the study. Serum triglyceride and other lipid profiles were measured at 12 weeks as well as at 24-28 weeks. Fasting blood glucose were measured at 12 weeks and DIPSI were measured at 24-28 weeks. Gestational Diabetes Mellitus was diagnosed using DIPSI criteria on the basis serum triglyceride level.

**Results**

Table 1: Association between Fasting Blood Sugar (mg/dL) at 12 Weeks and Serum Triglyceride (mg/dL) 12 Weeks-

Correlation	Spearman Correlation Coefficient	P Value
Blood Sugar (mg/dL) (Fasting - 12 Weeks) vs Serum Triglyceride (mg/dL) (12 Weeks)	-0.1	0.321

Table 2: Assessment of change in Serum Triglyceride (mg/dL) over time-

Timepoint	Serum Triglyceride (mg/dL)			Wilcoxon Test	
	Mean (SD)	Median (IQR)	Range	V	P Value
12 Weeks	126.80 (48.04)	120.00 (52.00)	51.29 - 290.00	265.0	<0.001
24-28 Weeks	203.87 (67.12)	199.00 (103.00)	81.00 - 397.00		
Absolute Change	77.07 (62.56)	61.00 (83.00)	-87.00 - 309.00		
Percent Change	73.6% (69.8)	48.6% (87.0)	-32% - 396%		

Table 3: Association Between GDM and Serum Triglyceride at 12 Weeks-

Serum Triglyceride (12 Weeks)	GDM (N=230)			Chi-Square Test	
	Yes	No	Total	$\chi^2$	P Value
WNL	18 (34.0%)	166 (94.3%)	185 (80.3%)	93.980	<0.001
Deranged	35 (66.0%)	10 (5.7%)	45 (19.7%)		
Total	53 (100.0%)	176 (100.0%)	230 (100.0%)		

Table 4: Association Between Gestational Diabetes Mellitus and Serum Triglyceride at 24-28 Weeks-

Serum Triglyceride (24-28 Weeks)	GDM (n=230)			Chi-Squared Test	
	Yes	No	Total	$\chi^2$	P Value
WNL	54 (100.0%)	176 (100.0%)	230 (100.0%)	-	-
Total	54 (100.0%)	176 (100.0%)	230 (100.0%)		

Table 5: Association between Gestational Diabetes Mellitus and change in Serum Triglyceride (mg/dL) at 24-28 Weeks-

Change in Serum Triglyceride (mg/dL) (24-28 Weeks)	GDM		Wilcoxon-Mann-Whitney U Test	
	Yes	No	W	p value
Mean (SD)	71.43 (65.05)	78.77 (61.88)	4388.500	0.515
Median (IQR)	60 (28-100)	62.45 (27.75-119.42)		
Min - Max	-87 - 287	-30 - 309		

**Discussion**

In the present study it was found that 45 participants were having increased triglyceride level - at 12 weeks while 80 of the participants were having increased value

at 24-28 weeks. The mean value in first trimester was 126.80 mg/dl with standard deviation of 48.04 while in third trimester was 203.07mg/dl with standard deviation of 67.12. When compared at two points of time the mean increase was from minimum 126.80 mg/dl at 12weeks to maximum of 203.87 at 24- 28 weeks which was statistically significant. The results were found consistent with the results in the study done by Raghuram Pusukuru et al (2016)<sup>13</sup>. The mean value of serum triglyceride in third trimester was 216.78 mg/dl with standard deviation of 20.09. KK Ryckman et al (2015)<sup>14</sup> found that Triglyceride levels were significantly elevated in women with Gestational diabetes mellitus compared with those without gestational diabetes mellitus (WMD 30.9, 95% confidence interval [95% CI] 25.4–36.4). This finding was consistent in the first, second and third trimesters of pregnancy<sup>14</sup>. Shen H, Liu X, Chen Y et al (2016)<sup>15</sup> observed that compared with the normal women group, the gestational diabetes mellitus groups showed higher triglyceride concentrations throughout the pregnancy. The 4th quartile levels of triglyceride were associated with increased risks of gestational diabetes mellitus with an ORs (95% CI) of 2.09 (1.37 to 3.17) and 1.93 (1.25 to 2.98) in the first and second trimesters, respectively. However elevated triglyceride level in the third trimester was not a risk factor for gestational diabetes mellitus (a OR=1.51, 95% CI 0.99 to 2.28, p=0.54). Chen Wang et al (2016)<sup>16</sup> also found that early pregnancy serum fasting glucose, cholesterol, and triacylglycerol levels as well as TG/HDL-C and LDL-C/HDL-C ratios were significantly elevated in women with gestational diabetes mellitus as compared with healthy pregnant women. Ning Liang et al (2018)<sup>17</sup> studied that high maternal triglyceride level at very early trimester was associated with the increased risk of large for gestational age in obese pregnant women. However high maternal

triglyceride level at first trimester may be early predictor of large for gestational age. This is in the line with the study conducted by Daniel Eppel et al (2020)<sup>18</sup>. In their study maternal serum triglyceride level at early gestation were associated with gestational diabetes mellitus (OR 1.16, 95%CI: 1.03–1.34, p=0.022). And concluded that even moderately elevated triglycerides at the beginning of pregnancy are associated with impaired insulin action and  $\beta$ -cell dysfunction and hence with a potential risk factor for development of gestational diabetes mellitus. Similar results were found in the study done by Ming hu et al (2021)<sup>19</sup> who showed that plasma glucose and triglyceride (TG) levels in the first and second trimesters were associated with a high risk of Gestational diabetes mellitus ( $p < 0.05$ ). Babita Ggidke et al (2017)<sup>20</sup> stated that the values of total Cholesterol, high density lipoprotein and low-density lipoprotein cannot predict the occurrence of gestational diabetes mellitus but an association between maternal early pregnancy triglyceridemic and the subsequent risk of preeclampsia, gestational diabetes, and preterm deliveries was observed.

### Conclusion

Gestational diabetes mellitus is the most common metabolic disorder of the pregnancy and is considered as a silent disease that can have adverse effect on fetus and mother both. Higher levels of serum triglyceride in first trimester of pregnancy has been found to be associated with the development of gestational diabetes mellitus. Hence it is useful in prediction of gestational diabetes mellitus. Thus, the authors recommend estimation of serum triglyceride in first trimester as a routine investigation in antenatal clinic to prevent maternal and fetal complications.

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