

Assessment of Triglycerides Levels in Gestational Diabetes - A cross-sectional study

Mumtaz Jahan¹, Hira Sulaman², Naila Qazi³, Uzma Manzoor⁴, Sajida Asghar⁵, Madiha Shaheen⁶

^{1,3} Senior Registrar, Department of Obs/Gynae, Rawal Institute of Health Sciences, Islamabad.

^{2,6} Senior Registrar, Department of Obs/Gynae, Shifa International Hospital Islamabad.

⁴ Assistant Professor, Department of Obs/Gynae, Independent University Hospital, Marzi Pura, Faisalabad,

⁵ Assistant Professor, Department of Obs/Gynae, HBS Medical and Dental College Islamabad.

Author's Contribution

¹ Conception of study

^{2,6} Experimentation/Study conduction

³ Analysis/Interpretation/Discussion

¹ Manuscript Writing

^{4,5} Critical Review

Corresponding Author

Dr. Mumtaz Jahan,

Senior Registrar,

Department of Obs/Gynae,

Rawal Institute of Health Sciences,

Islamabad

Email: mumtaz.182000@gmail.com

Article Processing

Received: 01/02/2021

Accepted: 22/05/2021

Cite this Article: Jahan, M., Suleman, H., Qazi, N., Manzoor, U., Asghar, S., Shaheen, M. Assessment of Triglycerides Levels in Gestational Diabetes - A cross-sectional study. *Journal of Rawalpindi Medical College*. 30 Jun. 2021; 25(2): 234-238.

DOI: <https://doi.org/10.37939/jrmmc.v25i2.1578>

Conflict of Interest: Nil

Funding Source: Nil

Access Online:



Abstract

Introduction: Gestational diabetes mellitus (GDM) is the impaired glucose tolerance that is recognized first time during pregnancy. When a woman gets pregnant, glucose intolerance increases and manifests as a positive GDM diagnosis. It has been considered a transient condition because after delivery the majority of cases return to normoglycemic levels.

Materials and Methods: This cross-sectional study was conducted in the Department of Obstetrics and Gynecology, Rawal Institute of Health Sciences, Islamabad. Data were collected in a period of 06 months between July 2020 to January 2021. A total of 100 women were included in the study and 5cc of their blood was taken from the vein under aseptic measures for measuring serum triglyceride levels after 12 hours of overnight fasting. Data were analyzed in SPSS version 20.0.

Results: The overall mean Serum Triglyceride level of study subjects was 181.17±33.62 mg/dl, with a range of 151-359 mg/dl. Around two-third, 66% of women had <181 mg/dl of Serum Triglyceride level, and 34% of patients had it >181 mg/dl. Our observation was that the mean level of Serum Triglyceride was not different significantly among age, BMI, gestational age, educational and socio-economic groups with p-value >0.05.

Conclusion: This study highlights that the circulating mean triglyceride level in GDM subjects was significantly elevated from the normal pregnancy levels.

Keywords: Serum Triglyceride Level, Gestational Age, Gestational Diabetes Mellitus, BMI.

Introduction

The new onset of glucose intolerance in pregnancy is called GDM.¹ During the second half of pregnancy placental hormones like HPL, progesterone, cortisol, prolactin, and TNF-alpha oppose the insulin effect leading to insulin resistance. This increases the insulin required creating a diabetogenic environment.² In other words we can say a combination of pancreatic beta-cell insufficiency, insulin resistance with genetic factors manifest as GDM. As in most cases, postpartum blood sugar levels become normal, GDM is considered a 'transient condition'. However, mounting evidence suggests that GDM should be viewed more as a marker for chronic disease.

GDM affects 7% of all pregnancies in the US and 2-6% of pregnancies in Europe.³ Globally, prevalence estimates vary greatly depending on the population studied and the diagnostic test used, from 1% among Nigerian women to 19% among women of Chennai, India.⁴ Several studies also indicated its parities by race/ethnicity, with higher prevalence among minorities.⁵ GDM rates are increasing, with a 100% increase in incidence for some ethnic groups compared to 20 years ago.⁶ This reflects the increasing incidence of obesity and diabetes even in non-pregnant women. GDM rates tend to follow T2DM rates, and both increased pre-pregnancy BMI and weight gain in adulthood are risk factors for GDM.⁷

According to a recent systematic review report overweight women two times and obese women greater than three times are more likely to develop GDM when compared with normal weight women.⁸ GDM is accompanied by alterations in pre and post-meal and 24-hour plasma concentrations of glucose, lipids, and amino acids. Clark and colleagues reported that women with GDM have higher triglycerides, free fatty acids, and beta hydroxyl butyrate and lower high-density lipoprotein (HDL) cholesterol than normal pregnant subjects.⁹

In one of the study the mean triglycerides (TG) level was found to be 1.83 ± 0.10 mmol/L and the total cholesterol was 5.71 ± 0.24 mmol/L.¹⁰ In another study TG was found to be 216.20 ± 15.18 gm/dl in women with gestational diabetes mellitus. Therefore, women with GDM are at greater risk for developing hypertension, hyperlipidemia, and electrocardiogram abnormalities.¹¹

The rationale of the study was to estimate the level of TG in GDM cases as local data is scarce on this topic. The aim was to determine the mean level of TG in

women with GDM presenting to a tertiary care hospital.

Materials and Methods

This cross-sectional study was conducted in the Department of Obstetrics and Gynaecology, Rawal Institute of Health Sciences, Islamabad. A total of 100 pregnant women were enrolled in a period of 6 months from July 2020 to January 2021.

The women between 25-35 years of age, those with gestational age >12 weeks (on dating scan), with singleton pregnancy confirmed on ultrasound, having parity <3 and BMI levels of < 30 kg/m² were included in the study. Those women with known DM, hypertension, heart disease, or chronic renal disease were excluded from the study. Women were also excluded if they had a prior history of lipid disorder or metabolic syndrome, were suffering from thyroid diseases, liver diseases, and those women who were taking medications that alter lipid metabolism.

Women attending the outpatient departments of Obstetrics and Gynaecology departments were enrolled. Written informed consent was taken from women prior to enrollment. Demographic characteristics as age, gestational age, and BMI were noted. Moreover, educational status and socioeconomic status were also noted.

Women's 5cc blood was taken from the vein under aseptic measures for testing TG level after 12 hours overnight fast and the findings of serum TG levels were noted.

SPSS version 20 for Windows was used for data analysis. Mean \pm SD was measured for the age of the patient, TG levels, gestational age, height, weight, and BMI. Frequency and percentage were presented for qualitative data like Parity, educational status, and economic status. Stratification was done for TG levels <181 mg/dl and >181 mg/dl. The sociodemographic characteristics and gestational history parameters of women were associated with TG categories using t-test for age, gestational age, and BMI and ANOVA for Education and socioeconomic status. A p-value less than or equal to 0.05 was taken as significant.

Sample size: Mean \pm SD of TG level in women with GDM = 1.83 ± 0.10 mmol/L

Confidence Level (C.L) = 95%

Absolute precision (d) = 0.05%

Sample size (n) = 15, considering stratification the sample size increased to 100 women with GDM on diet control

Sampling technique: Non-probability consecutive

Results

A total of 100 women were evaluated to determine the mean level of triglycerides level (TG) in women with Gestational Diabetes Mellitus. The overall mean age of study subjects was 28.39 ± 2.05 years, with a range of 8 (25-33) years. There were 55% patients of <28 years of age and 45% patients were >28 years. The overall mean weight was 42.05 ± 6.55 Kg, with a range of 33 to 69 Kg. The overall mean height was 154.18 ± 10.73 cm, with a range of 142 to 173cm. The socio-economic status was also assessed and it was observed that 38% of patients belonged to the poor class, 47% of patients belonged to the lower middle class and 15% of patients belonged to the upper middle class. (Table 1)

The overall mean gestational age was 29.1 ± 2.1 weeks, with a range of 24 to 34 weeks. The average parity was 2.17 ± 0.79 with a range of 1 to 3. The overall mean BMI was 17.73 ± 2.30 Kg/m² with a range of 14.3 to 23.1 Kg/m². The educational status was assessed, results showed that 2 patients were illiterate, 12 patients got education till primary, 20 patients had done matric and 66 patients had an education level of intermediate or above. (Table 2)

The overall mean Serum Triglyceride level of study subjects was 182.3 ± 32.6 mg/dl, ranging from 151 to 359 mg/dl. There were 66% patients with triglyceride levels ≤ 181 mg/dl and 34% patients with >181 mg/dl. (Table 3)

Furthermore, the mean triglyceride levels were stratified according to the socio-demographic characteristics of patients. A post-stratification t-test was applied to evaluate a significant difference in mean Serum Triglyceride level between age, gestational age, and BMI groups. ANOVA was applied to evaluate the significant difference of mean Serum Triglyceride level between educational and socio-economic status. There was no significant variation in triglyceride levels according to age, BMI, education, and socioeconomic status of patients. However, higher gestational age was found significantly associated with an increased level of serum triglyceride in women (p-value, 0.04). (Table 4)

Table 1: Baseline characteristics of patients (n=100)

	No of cases	%age
Age categories		
< 25	55	55.0%
≥ 25	45	45.0%
Mean \pm SD	28.39 ± 2.06	
Weight (kg)		
Mean \pm SD	42.05 ± 6.55	

Height (cm)		
Mean \pm SD	154.18 ± 10.73	
Socioeconomic status		
Poor class	38	38.0%
Lower middle class	47	47.0%
Upper middle class	15	15.0%

Table 2: Gestational history, BMI, and educational level of patients (n=100)

	No of cases	%age
Gestational age (weeks)		
Mean \pm SD	29.12 ± 2.10	
Parity		
Mean \pm SD	2.17 ± 0.79	
BMI (kg/m²)		
Mean \pm SD	17.73 ± 2.30	
Educational status		
Illiterate/primary	14	14.0%
Matric	20	20.0%
Intermediate or more	66	66.0%

Table 3: Overall Serum Triglyceride Levels in the Study (n=100)

	No. of cases	%age
Triglycerides		
< 181 mg/dl	66	66.0%
181 or above	34	34.0%
Mean \pm SD	182.5 ± 36.4	

Table 4: Stratified analysis of Triglyceride levels according to sociodemographic characteristics of study patients (n=100)

	Triglycerides (mg/dl) (Mean \pm SD)	p-value
Age (years)		
< 28 years	183.0 ± 28.7	0.88
≥ 28 years	182.3 ± 39.6	
Gestational age (weeks)		
< 30	176.4 ± 23.1	0.04
≥ 30	190.3 ± 47.5	
BMI		
< 18	178.8 ± 25.7	0.15
≥ 18	187.4 ± 46.9	
Education		
Illiterate/primary	172.67 ± 16.946	0.35
Matriculate	175.42 ± 15.565	
Intermediate or above	184.97 ± 39.449	
Socioeconomic status		
Poor class	188.24 ± 41.915	0.15
Lower middle class	183.00 ± 35.848	
Upper middle class	166.93 ± 13.440	

Discussion

Women with GDM are at high risk of maternal and fetal complications during pregnancy.

Abnormal maternal metabolism affects the growth of the fetus, because diabetes produces changes in maternal metabolic fuels and because diabetic pregnancy is often associated with complications, the effects of maternal diabetes on lipid metabolism are unclear.¹²

In the current study, the triglycerides (TG) levels were found higher with a mean value of 181.18 ± 33.62 mg/dl. These results confirmed the previous results reviewed for lipidemia of pregnancy.¹³ There is Hyperlipidemia in normal pregnancy and consisting of main triglycerides with smaller rises in cholesterol. Triglycerides level was studied in normal and GDM pregnancies by Ren Z et al and results reported to show a trend towards being higher in diabetic patients.¹⁴ Their results showed that the mean serum triglycerides concentration for the GDM (2.29 ± 0.074 mmol/L) was statistically significantly higher ($p < 0.001$) than controls (1.75 ± 0.083 mmol/L). In this study results, there was also an elevation of triglycerides level in GDM cases which is consistent with results reported by many investigators.

The current study revealed that women who had GDM had a prevalence rate (34%) of high triglyceride levels. Increased TG during pregnancy occurs due to enhanced hepatic production of very-low-density lipoprotein (VLDL) under the effect of high estrogen.¹⁵ In addition, intestinal absorption of dietary lipid is increased while TG clearance is reduced due to decreased extrahepatic lipoprotein lipase activity. These changes coincide with reduced insulin sensitivity, which may also contribute to the increase in TG levels.¹⁶ This hyperlipidemia including hypertriglyceridemia is pronounced in GDM pregnancies.¹⁷ Maternal insulin sensitivity has a negative association with newborn birthweight.¹⁸

Elevated triglyceride levels are also suggestive of overall elevated risk of cardiovascular disease in women with a history of GDM. Women with prior GDM are known to have a higher prevalence of cardiovascular disease and occurrence of CVD events at a younger age.^{19,20}

One study shows that there is a link between women GDM or a family history of type 2 diabetes mellitus and their CVD risk. Results from this study showed that women were at a significantly increased risk of developing CVD at a young age. The researchers recommended that cardiovascular interventions

should be considered in this group before the advent of disease in order to reduce or prevent the risk of CVD.²⁰ Studies in other populations have identified risk factors for cardiovascular disease such as hypertension, central obesity, and atherosclerosis, and type 2 diabetes mellitus to be increased in women with prior GDM.²¹

Maternal factors such as BMI (body mass index), maternal weight, gestational age, pre-pregnancy lipid levels, and various medical complications of pregnancy may also have significant effects on lipid metabolism and plasma lipid levels.²² In this study, it was observed that triglyceride level was significantly elevated in lower gestational age. This agreed with a study by Amraei and Azemati who reported a significant increase in the concentration of triglycerides levels in pregnancy complicated by glucose intolerance as compared to normal pregnancy.²³

The advantages of the study lie in the fresh evidence on women with gestational diabetes mellitus and its effect on triglyceride levels. There were some potential limitations of this study. Firstly, there was a short follow-up period which consisted of one GDM review for each patient. This aspect of our study may have affected our results due to existing evidence that the prevalence rate of GDM complications increases with time. In addition, we did not have access to a patient's pre-pregnancy medical history and it is possible that some women had pre-existing diabetes and did not disclose this at the antenatal clinic.

Conclusion

The study highlights and validated that serum triglyceride levels are significantly high in women with GDM. The mean triglyceride level was found more raised in women with high BMI and advanced gestational age. Since the sample was small scale and the study was conducted in an urban setting, the results cannot be generalized. Further large-scale trials in different geographical locations and with rigorous research methods are mandated.

References

1. Poprzeczny AJ, Louise J, Deussen AR, Dodd JM. The mediating effects of gestational diabetes on fetal growth and adiposity in women who are overweight and obese: secondary analysis of the LIMIT randomised trial. *BJOG: An International Journal of Obstetrics & Gynaecology*. 2018 Nov 1;125(12):1558-66.

2. Dahlgren J. Pregnancy and insulin resistance. *Metab Syndr Relat Disord.* 2006; 4(2):149-52. (DOI: 10.1089/met.2006.4.149.)
3. Kaaja RJ, Greer IA. Manifestations of chronic disease during pregnancy. *J Am Med Assoc.* 2005;294(21):2751-7. (doi:10.1001/jama.294.21.2751.)
4. Mesdaghinia E, Samimi M, Homaei Z, Saberi F, Moosavi S, Yaribakht M. Comparison of newborn outcomes in women with gestational diabetes mellitus treated with metformin of insulin: A randomized blinded trial. *Int J Prev Med.* 2013; 4:327-33.
5. Spaulonci C, Bernardes L, Trindade T, Zugaib M, Francisco R. Randomized trial of metformin vs insulin in the management of gestational diabetes. *Am J Obst Gynecol.* 2013;209(1):341-7. (DOI: 10.1016/j.ajog.2013.03.022)
6. Feig DS, Zinman B, Wang X, Hux JE. Risk of development of diabetes mellitus after diagnosis of gestational diabetes. *Can Med Assoc J.* 2008;179(3): 229-34. (DOI: 10.1503/cmaj.080012)
7. Rudra CB, Sorensen TK, Leisenring WM, Dashow E, Williams MA. Weight characteristics and height in relation to risk of gestational diabetes mellitus. *Am J Epidemiol.* 2007;165(3):302-8. (DOI: 10.1093/aje/kwk007.)
8. Torloni MR, Betrán AP, Horta BL, Nakamura MU, Atallah AN, Moron AF, et al., Prepregnancy BMI and the risk of gestational diabetes: a systematic review of the literature with meta-analysis. *Obes Rev.* 2009;10(2):194-203. (DOI: 10.1111/j.1467-789X.2008.00541.x.)
9. Clark CM, Qiu C, Amerman B, Porter B, Fineberg N, Aldasouqi S, et al. Gestational diabetes: should it be added to the syndrome of insulin resistance?. *Diabetes care.* 1997 May 1;20(5):867-71.
10. McGrowder D, Grant K, Irving R, Gordon L, Crawford T, Alexander-Lindo R. Lipid profile and clinical characteristics of women with gestational diabetes mellitus and preeclampsia. *JMB.* 2009;28(2):72-81. (DOI: 10.2478/v10011-009-0007-x)
11. Ghafoor S, Shaikh AW, Shaheena. Maternal Lipids in Pregnancies with Gestational Diabetes Mellitus. *Pak J Med Health Sci.* 2012; 6:81-4
12. Buschur E, Stetson B, Barbour LA. Diabetes in pregnancy. *Endotext [Internet].* 2018 Jan 17.
13. Wang J, Li Z, Lin L. Maternal lipid profiles in women with and without gestational diabetes mellitus. *Medicine (Baltimore).* 2019;98(16):e15320. (DOI: 10.1097/MD.00000000000015320.)
14. Ren Z, Zhe D, Li Z, Sun XP, Yang K, Lin L. Study on the correlation and predictive value of serum pregnancy-associated plasma protein A, triglyceride and serum 25-hydroxyvitamin D levels with gestational diabetes mellitus. *World J Clin Cases.* 2020;8(5):864-873. (DOI: 10.12998/wjcc.v8.i5.864)
15. Son GH, Kwon JAY, Kim UJ, Park YW. Maternal serum triglycerides as predictive factors for large-for-gestational age newborns in women with gestational diabetes mellitus. *Acta Obstetrica et Gynecologica.* 2010; 89:700-4. (DOI: 10.3109/00016341003605677)
16. Feingold KR, Grunfeld C. Introduction to lipids and lipoproteins.
17. Herrera Martinez A, Palomares Ortega R, Bahamondes Opazo R, Moreno-Moreno P, Molina Puerta M^J, Gálvez-Moreno MA. Hyperlipidemia during gestational diabetes and its relation with maternal and offspring complications. *Nutr Hosp.* 2018; 35(3): 698-706. (DOI: 10.21203/rs.3.rs-52856/v3)
18. Hamilton JK, Odrobina E, Yin J, Hanley AJ, Zinman B, Retnakaran R. Maternal insulin sensitivity during pregnancy predicts infant weight gain and adiposity at 1 year of age. *Obesity.* 2010;18(2):340-6. (<https://doi.org/10.1038/oby.2009.231>)
19. Quinlivan JA, Danielle L. Cholesterol Abnormalities are Common in Women with Prior Gestational Diabetes. *J Diabetes Metab.* 2013;4(4):1000255. (DOI: 10.4172/2155-6156.1000255)
20. Carr DB, Utzschneider KM, Hull RL, Tong J, Wallace TM. Gestational diabetes mellitus increases the risk of cardiovascular disease in women with a family history of type 2 diabetes. *Diabet Care.* 2006; 29:2078-83. (DOI: 10.2337/dc05-2482)
21. Kautzky-Willer A, Krssak M, Winzer C, Pacini G, Tura A. Increased intramyocellular lipid concentration identifies impaired glucose metabolism in women with previous gestational diabetes. *Diabetes.* 2003; 52:244-51. DOI: 10.2337/diabetes.52.2.244.)
22. Aziz R, Mahboob T. Lipid profile and serum insulin levels in Gestational Diabetes. *J Dow Univ Heal Sci.* 2008;2(3):102-6.
23. Amraei A, Azemati M. Metabolic Status of Women with Gestational Diabetes Mellitus Six months after Delivery. *Res J Biol Sci.* 2007;2(1):104-7. (doi=rjbsci.2007.104.107)