



Lipid Profile and Vitamin B 12 levels in Women Having Gestational Diabetes Mellitus: A Case Control Study

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Aim: To assess the lipid profile and vitamin B12 levels in women having gestational diabetes mellitus.

Study Design: Case Control study.

Place and Duration: Department of Biochemistry and Gynecology/Obstetrics LUMHS Hospital Jamshoro total 1 year duration from January 2018 to December 2018.

Methodology: A sample of 291 pregnant women was grouped as; 216 diagnosed gestational diabetes mellitus (GDM) and 75 non gestational diabetes mellitus were selected according to criteria. Sera were evaluated for glucose (hexokinase method), blood lipids and Vitamin B12 (ECLIA assay method) by Cobas chemistry analyzer. Triglyceride/high density lipoprotein (TAGs/HDLc) ratio was calculated as log of transformed TAGs to HDLc. TAGs/HDLc ratio was

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labelled as low risk (0.3 – 0.1), medium risk (0.1 – 0.24) and high risk (>0.24). Statistical SPSS software 21.0 (IBM, Inc USA) was used to analyze the research variables at 95% CI ($P \leq 0.05$).

Results: Age of cases was 37.9 ± 5.19 years ($P=0.051$). Fasting and random blood glucose levels were elevated significantly ($P=0.0001$). Vitamin B12 in cases was low noted as 155.6 ± 71.3 ng/mL compared to 251.5 ± 33.1 in control ($P=0.0001$). Any type of vitamin B12 deficiency was present in 153 (70.51%) GDM cases compared to 37 (49.4%) control ($P=0.0001$). Low, medium and high atherogenicity risk was found in 56.01%, 37.5% and 6.4% GDM cases and 50.5%, 36.6% and 0% in control respectively ($P=0.0001$).

Conclusion: It was found in the present study that triglyceride to HDLc ratio was found elevated in Gestational Diabetes mellitus women with vitamin B12 deficiency.

Keywords: Triglycerides; high density lipoprotein; gestational diabetes; vitamin B12 deficiency.

1. INTRODUCTION

Gestational diabetes mellitus (GDM) is a metabolic disorder of high blood glucose levels first time diagnosed during pregnancy. It is a state of glucose intolerance noted during pregnancy without prior history of diabetes mellitus (DM) [1]. Pregnant women may develop hyperglycemia and glycosuria during initial period of gestation. True prevalence of GDM is unknown in developing countries including Pakistan because of lack of hospital registries and incomplete records. Global prevalence of GDM is reported as 1 – 14 % [2]. Geographical variations of GDM prevalence have been evidently related to ethnicity, dietary habits, racial factors, environmental factors and pollution. Approximately 7% of pregnant women develop some degree of glucose intolerance that may be severe enough to develop GDM. Global burden of GDM was proposed as >200,000 cases [2].

Risk of maternal morbidity and mortality is increased by GDM beside risk to the fetus of developing congenital malformation and macrosomia [2,3]. Currently, urbanization is on rise and similar rise of risk of developing GDM has been observed in modern community. This may be because of sedentary life style, modern life style, gourmet habits, obesity and intake of carbohydrate rich foods. Contaminated food, water and pollutants have put the community members at increased risk of DM and GDM.

Normally, pregnancy involves change in metabolism, hormones and altered internal milieu. Increase in anti – insulin hormones levels are associated with the chances of increase in insulin resistance. Insulin resistance and carbohydrate intolerance has been observed at the beginning of gestation weeks of 24–28 and then increase progressively [1-3]. GDM patients show altered primarily metabolic defect of glucose and

secondarily the lipid metabolism in major. Pregnant women may develop enough insulin resistance resulting in hyperglycemia, hyperlipidemia, and dyslipidemia which increase the tendency of atherosclerosis [4, 5].

Vitamins are essential for normal glucose and lipid metabolism and prevent complications brought about by hyperglycemia and hyperlipidemia. Vitamin B12 deficiency [6] has been linked to insulin resistance, glucose intolerance, hyperglycemia, hyperlipidemia, dyslipidemia, etc. Vitamin B12 maintains normal lipid metabolism and endothelial function. Dyslipidemia [4, 5] is serious complication of diabetes mellitus that is linked to many morbidities, hence there is need to analyze blood lipid abnormalities in gestational diabetes mellitus patients.

The present prospective research study analyzed the triglyceride and high density lipoprotein levels in Gestational Diabetes mellitus patients having vitamin B12 deficiency.

2. METHODOLOGY

The present case control study was planned to determine the triglyceride (TAG), high density lipoprotein (HDL) and vitamin B12 levels in Gestational Diabetes mellitus women. The patients were selected from the Department of Gynecology/Obstetrics of the institute. A total of 291 pregnant women were grouped as follows; 216 diagnosed GDM pregnant women and 75 pregnant controls who had no GDM. Women were included according to the non-probability purposive technique. Diagnosis of GDM was carried out according to the standard criteria and confirmed by a consultant gynecologist. Diagnosed GDM patients were interviewed for voluntary inclusion in the study protocol. Patients were examined of biodata, physical examination,

and laboratory findings to confirm the diagnosis and fulfill the inclusion and exclusion criteria. Inclusion criteria were pregnant women, diagnosed GDM, 20 – 40 years of age, looking healthy without systemic disease, and ultrasound revealing viable fetus of 2nd and/or 3rd trimester. Type 2 DM pregnant women, postpartum women, concomitant systemic diseases, insulin resistance cases, polycystic ovarian syndrome (PCOS) and those having family history of diabetes mellitus were excluded from the study. GDM diagnosed cases were examined physically by a consultant gynecologist and obstetrician of the institute. The volunteers were informed the study will help future management of GDM cases for their better health, so the consent was taken purely on humanitarian grounds. Volunteers were asked for blood sampling. Study protocol strictly followed the “Helsinki’s Declaration” of human handling for research purpose. Patient’s data was secured in a pre – structured proforma and saved in lockers. Blood samples were collected and centrifuged (at x3000 rpm for 15 minutes) to get sera for biochemical analyses. Hemolyzed, lipemic and icteric samples were discarded. Sera were stored at – 20 °C. ELISA assay kit was used to measure serum vitamin B12 levels (Abcam, USA) at 450nm “absorbance”. Vitamin B12 deficiency was defined as value less than 160 pg/mL (118 pmol/L) [7]. Patients showing serum total cholesterol \geq 200 mg/dL, TAGs \geq 150 mg/dL, LDLc \geq 100 mg/dL and HDLc \leq 50 mg/dl were considered as suffering from dyslipidemia [8]. TAGs/HDLc ratio was calculated as log of triglyceride to HDLc [5]. TAGs/HDLc ratio was labelled as low risk (0.3 – 0.1), medium risk (0.1 – 0.24) and high risk (>0.24) [5]. Biochemical analyses were performed on Cobas chemistry analyzer at laboratory. Data variables were

analyzed on SPSS 21.0 using Student’s t-test for continuous data and results presented as mean \pm SD. Categorical data variables were analyzed by Chi- square (χ^2) test and results were presented as frequency and %. Statistical significance of results of data variables was considered significant at 95% CI (P \leq 0.05).

3. RESULTS

Table 1 shows the demographic and biochemical findings of cases and control. Age of cases was 37.9 \pm 5.19 years (P=0.051). Fasting and random blood glucose levels were elevated significantly (P=0.0001). Vitamin B12 in cases was low noted as 155.6 \pm 71.3 ng/mL compared to 251.5 \pm 33.1 in control (P=0.0001). Blood lipids were found elevated in GDM cases compared to control cases (P=0.0001).

Any type of vitamin B12 deficiency was present in 153 (70.51%) GDM cases compared to 37 (49.4%) in control cases (P=0.0001) (Table 2). Dyslipidemia was found in 59 (27.3%) GDM cases compared to 9 (12.0%) control ($\chi^2=351.0$) (P=0.0001). Table 3 shows the TAGs/HDLc ratio. Low, medium and high atherogenicity risk was found in 56.01%, 37.5% and 6.4% GDM cases and 50.5%, 36.6% and 0% in control respectively (P=0.0001). Correlation (Pearson’s analysis) proved negative correlation of vitamin B12 with cholesterol (r= -0.12, P=0.02), TAGs (r= -0.11, P=0.01), LDLc (r= -0.19, P=0.03), TAGs/HDLc ratio (r= -0.67, P=0.0001) and positive correlation with HDLc (r= 0.77, P=0.0001). Scatter plots A – E showed the correlation of cholesterol, TAGs, LDLc, HDLc, TAGs/HDLc ratio with vitamin B12 levels.

Table 1. Findings in cases and control (n=291)

	GDM Cases n=216	Control n=75	P-value
Age (years)	37.2 \pm 9.3	37.9 \pm 5.19	0.78
Fasting Glucose (mg/dl)	135.1 \pm 19.3	79.5 \pm 11.5	0.0001
Random Glucose (mg/dl)	234.5 \pm 36.5	149.1 \pm 11.3	0.0001
Cholesterol (mg/dl)	234.7 \pm 39.3	123.4 \pm 16.3	0.0001
Triglycerides (mg/dl)	539.5 \pm 57.3	497.2 \pm 23.5	0.0003
LDL cholesterol (mg/dl)	139.7 \pm 12.3	90.9 \pm 11.5	0.0001
HDL cholesterol (mg/dl)	31.3 \pm 6.1	39.5 \pm 3.6	0.0002
Vitamin B ₁₂ level (ng/mL)	155.6 \pm 71.3	251.5 \pm 33.1	0.0001

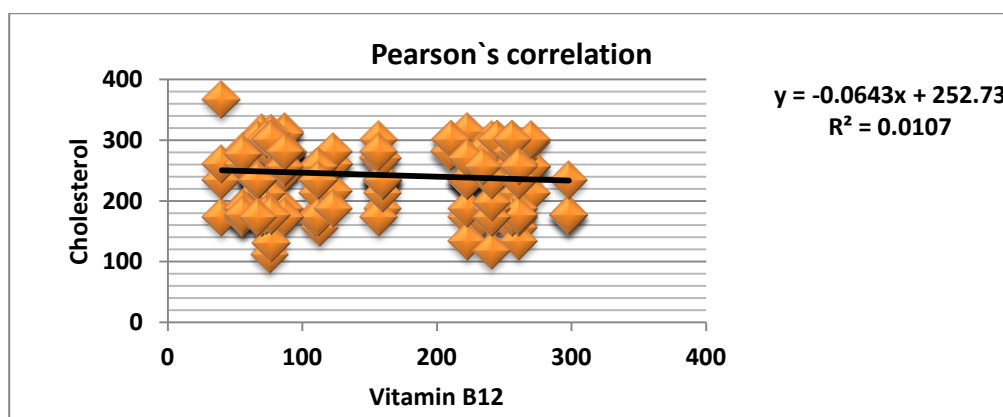
GDM – Gestational Diabetes Mellitus

Table 2. Cross tabulation of vitamin B₁₂ in cases and control

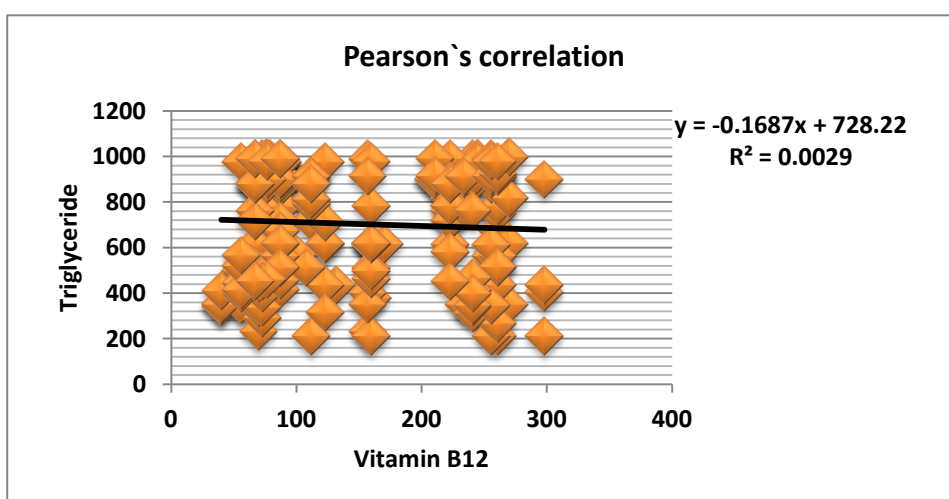
	Cases Number	%	Control Number	%	P-value
Vit. B ₁₂ – Normal	63	29.1	38	50.5	0.0001
Vit. B ₁₂ – Borderline	37	16.9	26	36.6	
Vit. B ₁₂ – Deficiency	31	13.9	08	10.6	
Vit. B ₁₂ – Severe	85	39.7	03	3.9	
Total	216	100	75	100	

Table 3. Cross tabulation of TAGs/HDLc ratio in cases and control

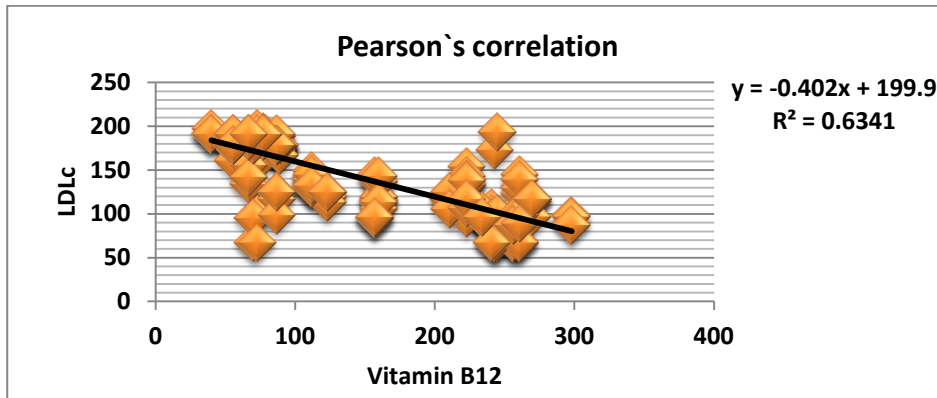
Risk categories	Cases Number	%	Control No.	%	P-value
No (<-0.3)	0	0	51	50.5	0.0001
Low (-0.3 – 0.1)	121	56.01	23	50.5	
Medium (0.1 – 0.24)	81	37.5	01	36.6	
High (>0.24)	14	6.4	0	0	
Total	216	100	75	100	



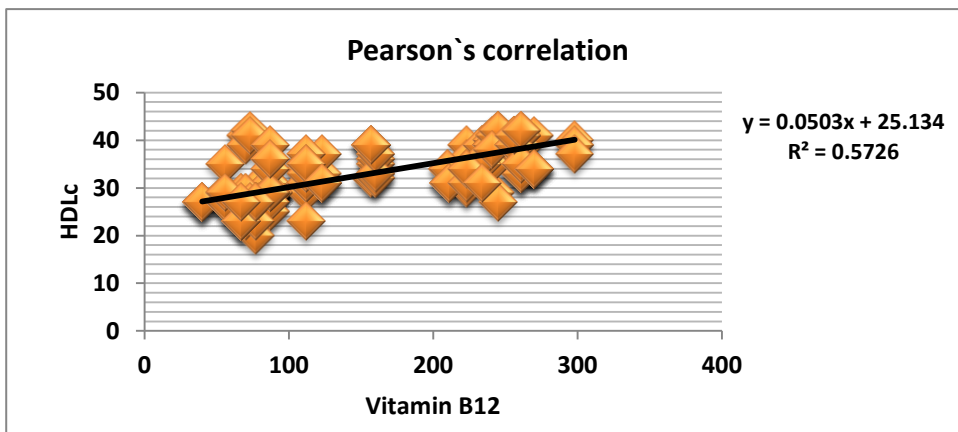
Graph A. Scatter plot showing –ve correlation of cholesterol and vitamin B₁₂



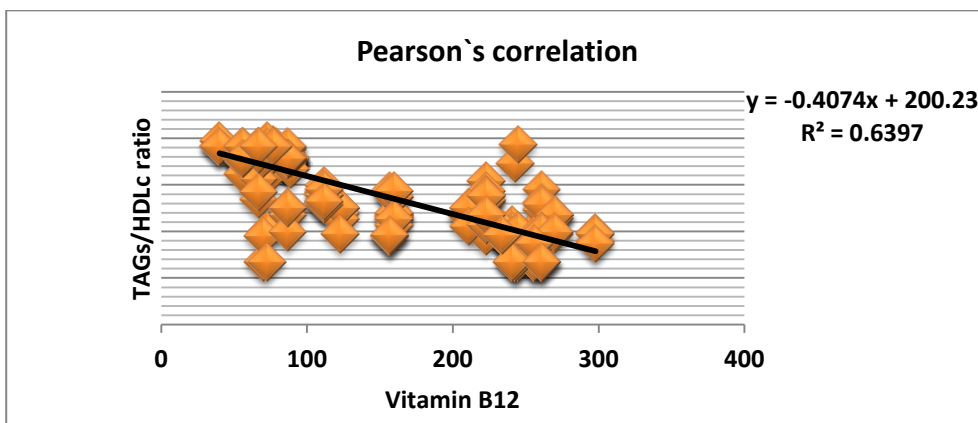
Graph B. Scatter plot shows –ve correlation of triglycerides and vitamin B₁₂



Graph C. Scatter plot showing -ve correlation of LDLc and vitamin B12



Graph D. Scatter plot showing +ve correlation of HDLc and vitamin B₁₂



Graph E. Scatter plot showing -ve correlation of TAGs/HDLc ratio and vitamin B₁₂

4. DISCUSSION

The present study is the first case control study in our region probing into the problem of dyslipidemia and vitamin B12 deficiency in GDM women. GDM occurs as a result of imbalance of gestational hormones in women of particular ethnicity. The study is the first to determine the

triglyceride to HDLc ratio (TAGs/HDLc) in Gestational Diabetes mellitus with vitamin B12 deficiency from our institute. We found any type of vitamin B12 deficiency was present in 153 (70.51%) GDM cases compared to 37 (49.4%) in control (P=0.0001). High frequency of vitamin B12 deficiency is consistent with previous studies [9,10] Previous studies [11,12] showed high

prevalence of vitamin B12 deficiency in general population of Pakistan. Prevalent vitamin B12 deficiency has negative impact on the health of both pregnant mothers and their babies [11,13]. Dyslipidemia was found in 59 (27.3%) GDM cases compared to 9 (12.0%) control ($P=0.0001$). Low, medium and high atherogenicity risk was found in 56.01%, 37.5% and 6.4% GDM cases and 50.5%, 36.6% and 0% in control respectively ($P=0.0001$). The above findings in the present study are in agreement with previous studies [14, 15].

Findings of present study points to the gravity of health problem of GDM female suffering from the concomitant vitamin B12 deficiency leading to atherogenicity, related complications and danger to the fetus. The findings of the present study are supported by previous studies [16,17]. Vitamin B12 deficiency in GDM cases has been reported by other previous studies [18,19]. A previous study¹⁹ reported pregnant women suffering from vitamin B12 deficiency were at high risk of insulin resistance and adiposity, and it was concluded that the risk of GDM is increased twice in pregnant women with vitamin B12 deficiency. Findings of above study supports the observations of the present study. Vitamin B12 deficiency was noted in 70.9% of study sample is consistent with a previous study [20] that reported 70.6% vitamin B12 deficiency in pregnant women. Previous studies [11,12] had reported high prevalence of vitamin B12 deficiency with a conclusion of nutritional deficiencies are prevalent in the country. Vitamin B12 deficiency has also been reported in pregnant women of western countries [21]. Dyslipidemia was very high in GDM cases found as 59 (27.3%) when compared to 9 (12.0%) in control ($P=0.0001$). Low, medium and high TAGs/HDLc atherogenicity risk was found in 56.01%, 37.5% and 6.4% GDM cases and 50.5%, 36.6% and 0% in control cases respectively ($P=0.0001$) in the present study.

The present study noted inverse correlation of vitamin B12 with cholesterol ($r= -0.12$, $P=0.02$), TAGs ($r= -0.11$, $P=0.01$), LDLc ($r= -0.19$, $P=0.03$), TAGs/HDLc ratio ($r= -0.67$, $P=0.0001$) and positively with HDLc ($r= 0.77$, $P=0.0001$). The finding is supported by a previous studies [21,22]. Another previous study [23] from UK reported that vitamin B12 deficiency is common in pregnant women with increasing the risk of GDM by 2.59 times in vitamin B12 deficient women. In light of evidence based findings of elevated TAGs/HDLc ratio in vitamin B12

deficient pregnant women, it is worth to report the association of atherogenic tendency and vitamin deficiency in gestational diabetes mellitus pregnant women.

Timely screening of blood lipids, TAGs/HDLc ratio and vitamin B12 may prevent maternal and fetal complications of dyslipidemia and atherogenicity. Confounding factor of prevalent nutritional and vitamin deficiencies cannot be ruled out. The findings of present study cannot be generalized to other settings as this study participants belonged to peculiar ethnicity with small sample size of different dietary resources.

5. CONCLUSION

The present study finds triglyceride to HDLc ratio was found elevated in Gestational Diabetes mellitus with vitamin B12 deficiency. Any type of vitamin B12 deficiency was present in 153 (70.51%) in GDM cases compared to 37 (49.4%) in control. Dyslipidemia was found in 59 (27.3%) GDM cases compared to 9 (12.0%) control. It is concluded, that the elevated TAGs/HDLc ratio may be corrected by vitamin B12 supplement to improve maternal and fetal outcome in gestational diabetes mellitus pregnant women. Further studies with large sample size are recommended to analyze the triglyceride to HDLc ratio in vitamin B12 deficient GDM pregnant women.

DISCLAIMER

The products used for this research are commonly and predominantly used products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

ETHICAL APPROVAL AND CONSENT

The study was approved by the ethics committee of institute. The duration of study was from January 2018 to December 2018. Place of study setting was the Department of Biochemistry Liaquat University of Medical and Health Sciences, Jamshoro. Informed consent was taken from the study participants. Permission

was taken from the ethical review committee of the LUMHS University.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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