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Original Research Paper

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THE ROLE OF TRIGLYCERIDE GLUCOSE INDEX AS PREDICTOR OF GLYCEMIC CONTROL IN PATIENTS WITH TYPE 2 DIABETES MELLITUS

Dr. Charchit Mehta*	M.B.B.S, 3RD year Post graduate, Department of General Medicine, Sri Devaraj Urs Medical College, SDUAHER, KOLAR.*Corresponding Author
Dr. Vidyasagar C R	M.B.B.S, M.D, Professor, Department of General Medicine, Sri Devaraj Urs Medical College, SDUAHER, KOLAR.
Dr Raveesha A	M.B.B.S, M.D Professor And HOD, Department of General Medicine, Sri Devaraj Urs Medical College, SDUAHER, KOLAR.

ABSTRACT **Objectives-** To explore the association of Triglyceride Glucose index with HbA_1c and To evaluate their potential role as predictors of glycemic control in patients with type 2 diabetes mellitus. **Design: observational study Setting:** Conducted in the Department of General Medicine at Sri Devaraj Urs medical college, Kolar, Karnataka. Subjects: 98 diabetic subjects were studied and were evaluated for predicting glycemic control using triglyceride glucose index. **Results:** Among subjects with good glycaemic control (HbA1c <7%) mean Triglyceride was 136 $\pm$ 21.78 mg/dl and Among subjects with poor glycaemic control (HbA1c $\geq$7%) mean Triglyceride was 190.35 $\pm$ 62.94 mg/dl. there was a statistically significant difference found between Triglyceride and HbA1c. Among subjects with good glycaemic control (HbA1c <7%) mean Triglyceride glucose index was 9275.06 $\pm$ 2154.22 mg/dl and Among subjects with poor glycaemic control (HbA1c $\geq$7%) mean Triglyceride glucose index was 24223.63$\pm$ 15794.73mg/dl. there was a statistically significant difference found between Triglyceride glucose index and HbA1c **Conclusion:** We can use Triglyceride glucose index in predicting glycaemic control in type 2 DM which is inexpensive and cost effective.

KEYWORDS : Triglyceride Glucose Index, Type 2 Diabetes Mellitus, Predictor Of Glycemic Control

INTRODUCTION-

Diabetes mellitus is an "Iceberg disease". Diabetes mellitus is accepted as a worldwide epidemic with an estimated increase in prevalence from 2.8% in 2000 to 4.4% by 2030[1].

Diabetes mellitus is the leading cause of blindness between the ages of 20 and 74. Blindness in Diabetes is primarily the result of progressive diabetic retinopathy and clinically significant macular edema. While it has been well established that intensive blood glucose control can lower the risk of microvascular complications from diabetes, the pathophysiology of retinopathy progression is not completely understood.[2-4]

The number of premature deaths caused by diabetic macro- and micro-vascular complications is rising. Glycated hemoglobin A1c (HbA1c) is the gold standard of glycemic control that reflects average blood glucose in patients over approximately 3 months. Achieving HbA1c target value less than 7% has been shown to reduce diabetic vascular complication.

In diabetic patients, for each 1% increase in absolute HbA1c value estimated risk of cardiovascular diseases (CVD) increases by 18%. Another risk factor for CVD in patients with DM2 is diabetic dyslipidemia. It consists of increased triglycerides (TG), reduced high density lipoprotein cholesterol (HDL-C), and postprandial lipemia.

TRIGLYCERIDE GLUCOSE INDEX (TyG) index is calculated as formula:

TyG index =fasting triglycerides (mg/dL) × fasting plasma glucose (mg/dL) / 2

The role of triglyceride glucose index and its correlation with Hba1c as a predictor of diabetic control in diabetes patient is assessed in the study.

OBJECTIVES:-

1. To explore the association of Triglyceride Glucose index with HbA_1c
2. To evaluate their potential role as predictors of glycemic control in patients with type 2 diabetes mellitus.

MATERIALS& METHODS

Study setting: - A study was conducted in the Department of General Medicine at Sri Devaraj Urs medical college, Kolar, Karnataka.

Source of data: - Type 2 Diabetic patient attending OPD and those admitted in R. L. Jalappa hospital, Kolar.
Study design: - observational study.
Sample size: - 98 subjects
Study duration: - 9 months.

Method of collecting data

Patients attending R.L.JALAPPA hospital who fulfil the inclusion/exclusion criteria was taken in to study after obtaining a written informed consent.

INCLUSION CRITERIA-

1. Diabetic patients older than 18 years of age.

EXCLUSION CRITERIA-

1. Patient younger than 18 years.
2. Subjects who had any condition known to affect lipid metabolism.
3. Taking any drugs known to cause disturbance of lipid metabolism.

Patients attending R.L.JALAPPA hospital who fulfil the inclusion/exclusion criteria were taken in to study after obtaining a written informed consent. Demographic data, history, clinical examination and details of investigation were recorded in study performa. and under aseptic condition 10 ml of blood drawn from the brachial vein and subjected to the investigations like, fbs ,hba1c and fasting tryglyceride level.

STATISTICAL ANALYSIS:

Data was entered into Microsoft excel data sheet and was analysed using SPSS 22 version software. Categorical data was represented in the form of Frequencies and proportions. Chi-square test or Fischer's exact test (for 2x2 tables only) was used as test of significance for qualitative data. Continuous data was represented as mean and standard deviation.

Independent t test was used as test of significance to identify the mean difference between two quantitative variables. Correlations were performed with spearman Correlation coefficient. Receiver operating characteristic (ROC) was constructed for triglyceride glucose index in predicting glycaemic controls. A test that predicts an outcome no better than chance has an area under the ROC curve of 0.5. An area under the ROC curve above 0.8 indicated fairly good prediction. P value (Probability that the result is true) of <0.05 was considered as statistically significant after assuming all the rules of statistical tests.

Statistical software:
MS Excel, SPSS version 22 (IBM SPSS Statistics, Somers NY, USA) was used to analyse data.

RESULTS.

In our study we have included 98 diabetic patients. Among 98 subjects 52(53.06%) subjects were female and 46(46.94%) subjects were male. Minimum age was 35yrs and maximum was 87yrs with mean age was 58.38 + 12.79yrs.

In our study out of 98 subjects good glycaemic control (HbA1c <7%) was present in 16(16.33%) subjects and remaining 82(83.67%) subjects had poor glycaemic control (HbA1c >7%).

Table 1:- Distribution of subjects according to sex and HbA1c.

	HbA1c <7%	HbA1c ≥7%	Total
Female	9	43	52
	56.3%	52.4%	53.1%
Male	7	39	46
	43.8%	47.6%	46.9%
Total	16	82	98
	100.0%	100.0%	100.0%

Among subjects with good glycaemic control (HbA1c <7%) 56.3% were female and 43.8% were male. Among subjects with poor glycaemic control (HbA1c >7%) 52.4% were female and 47.6% were male. P value 0.780, there was no statistically significant difference found between sex and glycaemic control.

Among subjects with good glycaemic control (HbA1c <7%) mean age was 42.06 + 5.4yr and among subjects with poor glycaemic control (HbA1c >7%) mean age was 61.56 + 11.34yr.

P value <0.001, there was a statistically significant difference found between age and HbA1c.

Table 2:- Comparison of Triglyceride, fasting blood sugar according to HbA1c

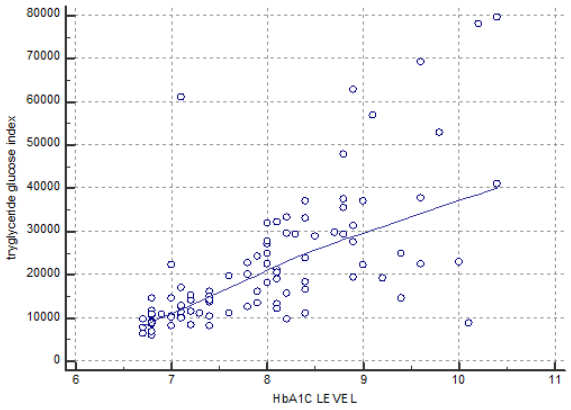
	HbA1c <7%		HbA1c ≥7%		P value
	Mean	SD	Mean	SD	
Triglyceride (mg/dl)	136.00	21.78	190.35	62.94	<0.001
Fasting Blood Sugar (mg/dl)	139.13	38.47	234.77	86.29	<0.001
Triglyceride glucose index	9275.06	2154.22	24223.63	15794.73	<0.001

Among subjects with good glycaemic control (HbA1c <7%) mean Triglyceride was 136 ± 21.78 mg/dl and Among subjects with poor glycaemic control (HbA1c ≥7%) mean Triglyceride was 190.35 ± 62.94 mg/dl. there was a statistically significant difference found between Triglyceride and HbA1c.

Among subjects with good glycaemic control (HbA1c <7%) mean Fasting Blood Sugar was 139.13 ± 38.47 mg/dl and Among subjects with poor glycaemic control (HbA1c ≥7%) mean Fasting Blood Sugar was 234.7 ± 86.29 mg/dl. there was a statistically significant difference found between Fasting Blood Sugar and HbA1c.

Among subjects with good glycaemic control (HbA1c <7%) mean Triglyceride glucose index was 9275.06 ± 2154.22 mg/dl and Among subjects with poor glycaemic control (HbA1c ≥7%) mean Triglyceride glucose index was 24223.63± 15794.73mg/dl. there was a statistically significant difference found between Triglyceride glucose index and HbA1c

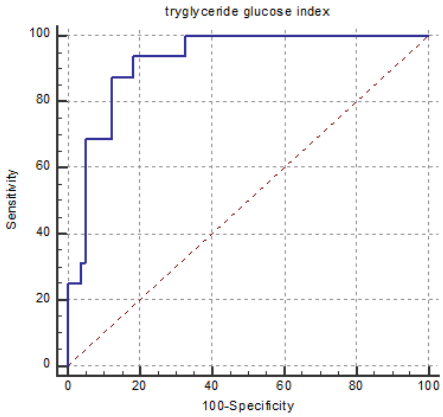
Figure 1:- Scattered diagram showing relationship between triglyceride glucose index and HbA1c.



There was a strong positive correlation between triglyceride glucose index and HbA1c which was statistically significant.

Spearman's rho Correlation Coefficient for triglyceride glucose index and HbA1c was 0.747 with P value <0.001.

Figure 2:- ROC Curve for triglyceride glucose index in predicting glycaemic control.



Area under the ROC curve for triglyceride glucose index in predicting glycaemic control was 0.925 (95% Confidence interval lower bound 0.853 , upper bound 0.968) which was statistically significant with P value <0.001.

DISCUSSION

The effect of glycaemic control on different parameters was evaluated by categorizing all the patients into two categories on the basis of HbA_1c levels < 7% good glycaemic control, ≥ 7 % poor glycemic control. The selection of these cut-off values of HbA_1c was based on earlier studies [8].

In our study there was no statistically significant difference found between sex and HbA1c. Similar to our study finding in a study done by Babic N et al [9] there was no statistically significant difference found between sex and HbA1c.

In our study mean age among subjects with HbA1c <7% was 42.06 ± 5.4yr and mean age among subjects with HbA1c ≥7% was 61.56 ± 11.34yr. There was a statistically significant difference found between age and HbA1c.

Whereas in studies done by Babic N et al [9] and in study done by Hameed EK et al [10] there was no statistically significant difference found between Age and HbA1c.

In our study we have evaluated TyG index correlate with long term glycemic control in term of HbA1c in type 2 diabetic patients and their possible use as surrogate markers of glycemic control.

In our study there was a strong positive correlation between triglyceride glucose index and HbA1c which was statistically significant.

In study done by Babic N et al [9] there was weak positive correlation between triglyceride glucose index and HbA1c.

Several possible mechanisms have been suggested to explain the correlation between TyG index and glycemic control. Increased triglyceride levels can lead to increased free fatty acids and, thus, increased flux of free fatty acids from adipose to nonadipose tissue, which may affect the glycemic control [11]. Many studies have confirmed that higher levels of triglycerides in the liver and muscle may affect glucose metabolism in each target organ[12,13].

In our study Area under the ROC curve for triglyceride glucose index in predicting glycaemic control was 0.925 (95% Confidence interval lower bound 0.853 , upper bound 0.968) which was statistically significant.

In a study done by Hameed EK et al [10] Area under the ROC curve for triglyceride glucose index in predicting glycaemic control was 0.833 (95% Confidence interval lower bound 0.745 , upper bound 0.922).

In clinical practice TyG index which is easily measured, less cost and also reflect many cardio metabolic risk factors. Whereas HbA1c is expensive, and not available in most laboratories in rural and remote area. Thus, an alternative test that is inexpensive and routinely available is required to provide the opportunity for follow up of long term glycaemic among the individuals of rural and remote area.

CONCLUSION

We can use Triglyceride glucose index in predicting glycaemic control in type 2 Diabetes Mellitus which is inexpensive and cost effective.

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DECLARATIONS

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REFERENCES

1. Wild S,RoglicG,greenA,SicreeR,King H prevalence of diabetes mellitus estimates for year 2000 and projections for 2030.
2. Klein R, Klein BE, Moss SE. Relationship of glycemic control to diabetic microvascular complications in diabetes mellitus. *Ann Intern Med*. 1996;124:90-6.
3. UK Prospective Diabetes Study Group: Intensive blood-glucose control with sulphonylureas or insulin compared with conventional treatment and risk of complications in patients with type 2 diabetes (UKPDS 33). *Lancet*. 1998;352:837-53.
4. The ACCORD Study Group and ACCORD Eye Study Group. Effects of medical therapies on retinopathy progression in type 2 diabetes. *N Engl J Med* 2010;363:233-44.
5. Tanaka Y, Fukui M, Tanaka M, Fukuda Y, Mitsuhashi K, Okada H, Yamazaki M, Hasegawa G, Yoshioka K, Nakamura N. The inter-arm difference in systolic blood pressure is a novel risk marker for subclinical atherosclerosis in patients with type 2 diabetes. Hypertension Research. 2014 Jun;37(6):548.
6. Clark CE, Greaves CJ, Evans PH, Dickens A, Campbell JL. Inter-arm blood pressure difference in type 2 diabetes: a barrier to effective management?. Br J Gen Pract. 2009 Jun 1;59(563):428-32.
7. Clark CE, Steele AM, Taylor RS, Shore AC, Ukoumunne OC, Campbell JL. Interarm blood pressure difference in people with diabetes: measurement and vascular and mortality implications: a cohort study. Diabetes care. 2014 Mar.
8. Amir Qaseem, , Timothy J. Wilt, , Devan Kansagara, , Carrie Horwitch, , Michael J. Barry, Mary Ann Forciea. Hemoglobin A_{1c} Targets for Glycemic Control With Pharmacologic Therapy for Nonpregnant Adults With Type 2 Diabetes Mellitus: A Guidance Statement Update From the American College of Physicians.Ann Intern Med.2018:168(8):569-576.
9. Babic N, Valjevac A, Zaciragic A, Avdagic N, Zukic S, Hasic S. The Triglyceride/HDL ratio and triglyceride glucose index as predictors of glycemic control in patients with diabetes mellitus type 2. Medical archives. 2019 Jun;73(3):163.
10. Hameed EK. TyG index a promising biomarker for glycemic control in type 2 diabetes mellitus. Diabetes Metab Syndr. 2019 Jan 1;13(1):560-3.
11. Parhofer KG. Interaction between glucose and lipid metabolism: more than diabetic dyslipidemia. Diab Metab J. 2015;39(5):353–62.
12. Kelley DE, Goodpaster BH. Skeletal muscle triglyceride an aspect of regional adiposity and insulin resistance. Diabetes Care. 2001;24(5):933–41
13. Nagle CA, Klett EL, Coleman RA. Hepatic triacylglycerol accumulation and insulin resistance. J Lipid Res. 2009;50(Supplement):S74–9