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Correlation between Glycated Hemoglobin and Triglyceride Levels in Type-2 Diabetes Mellitus at Khartoum State

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Abstract

Background: *Patients with type 2 diabetes mellitus have an increased prevalence of triglyceride abnormalities. Glycated hemoglobin (HbA1c) is the indicator of glycemic status over long term. This study was over signed to evaluate the correlation between levels of HbA1c and triglycerides.*

Methods: *This is a case control study aimed to evaluate the plasma levels of triglyceride and HbA1c of (50) patients with type 2 diabetes mellitus and (50) apparently healthy (non-diabetic) volunteers as a control group, the patient were chosen from Zeenam specialized center, age and sex of the test group were matched with control group. The plasma levels of triglyceride were measured using a spectrophotometer (bio system company reagent). HbA1c levels were measured using reagent and instrument from I-chrome Company. Data was analyzed using SPSS (version 20).*

Results *showed a significant increase in the mean of the plasma levels of triglyceride of the diabetic group when compared with the control group (p.value <0.05) whereas HbA1c were increased in diabetic patients (type 2) compared to the control group (p.value >0.05). There was a strong positive correlation between plasma levels of triglyceride and HbA1c levels in diabetic patients. Plasma levels of triglyceride have a strong positive correlation with HbA1c levels, so results revealed that uncontrolled diabetic patients are at higher risk of hypertriglyceridemia compared to controlled patients.*

Key words: glycated hemoglobin (HbA1c), triglyceride, type 2 diabetes mellitus, I-chrome and statistical package for social science.

1. INTRODUCTION

Diabetes mellitus is a major health problem worldwide. Diabetes is one of the leading causes of morbidity and mortality throughout the world. Diabetes mellitus is a major health problem worldwide. About 2.2% to 3% of the world`s population suffer from type 2 diabetes mellitus[1]

Diabetes mellitus (DM)is a chronic metabolic disorder that can lead to severe cardiovascular, retinal, neurological and rental complications[2, 3]. It is a serious debilitating and deadly disease that has now reached epidemic proportion and the prevalence rates are expected to go even higher in the future.

The proportion of people with T2DM is increasing in most countries.3 nearly 80% of people with the disease live in low- and middle-income countries[4].

In the ancient Sanskrit literature, diabetes mellitus was described as "honey-urine disease," associated with gross emaciation and wasting. Diabetes Mellitus (DM) comprises a group of common metabolic disorders that share the phenotype of hyperglycemia. It is a global endemic with rapidly increasing prevalence in both developing and developed countries [5].

Although the prevalence of both type 1 and type 2 DM is going to increase, type 2 DM is expected to rise more rapidly in future because of increased obesity and reduced activity levels.

The chronic complications of DM affect many organ systems and are responsible for the majority of morbidity and mortality associated with the disease.

The risk of chronic complications increases as a function of the duration of hyperglycemia; they usually become apparent in the second decade of hyperglycemia.

Diabetic patients may reach End Stage Renal Disease (ESRD) if diabetes mellitus is not adequately controlled. In most countries diabetic nephropathy has become the single most frequent causes of ESRD[2, 3].

The Glycosylated hemoglobin (HbA1c) is widely accepted and used as the most reliable test for assessment of chronic glycaemia][6].The HbA1c reflects the overall blood glucose levels over a period of 2-3 months and the major use of the HbA1c assay is to assess changes in metabolic control that follow an alteration in treatment][7].

The nephropathy is common in diabetic patients and usually associated with vascular complications. The long-term complications of diabetes have major consequences for individual and healthcare providers.

The blood glucose was considered as a prime test for optimizing treatment of diabetes mellitus. But the HbA1c determination is the new better method to monitor the long term glucose control irrespective of glucose measurement for patient management. It would prevent or delay the further diabetic complications. Diabetic patients with oral hypoglycemic therapy should go for HbA1c test as recommended by the American diabetes association][8].

Dyslipidemias is one of the modifiable risk factors for coronary artery disease in type 2 diabetes. Atherogenic or diabetic dyslipidemia is defined by a profile of low- and high-density lipoprotein and high triglycerides. It is an independent predictor of coronary artery disease or silent myocardial ischemia. High triglycerides can be dictated by many factors including genetic or acquired.

To rule out other causes, we only include patients without any familial dyslipidemia or history of alcohol intake. As these two factors also play a role in increasing triglycerides as compared to polygenic etiologies like obesity, insulin resistance or diabetes mellitus[9].

Glycated hemoglobin HbA1c was initially identified as an “unusual” hemoglobin in patients with diabetes over 40 years ago[10]. After that discovery, numerous small studies were conducted correlating it to glucose measurements resulting in the idea that HbA1c could be used as an objective measure of glycemic control. The A1C-Derived Average Glucose (ADAG) study included 643 participants representing a range of A1C levels. It established a validated relationship between A1C and average glucose across a range of diabetes types and patient populations[11]. HbA1c was introduced into clinical use in the 1980s and subsequently has become a cornerstone of clinical practice [12]

2.0. MATERIALS AND METHODS:

2.1. Study design:
Analytical, Case control study

2.2. Study area:
The study was done Zeenam specialized center in Khartoum state.

2.3. Study period:
The study was carried during the period from March to august 2019.

2.4. Study population:
The main target population of this study was Sudanese patients with type 2 diabetes mellitus at age (40 -67) years; 25 females and 25 males, attending to Zeenam specialized center and 25 females, 25 males of healthy people as control.

2.4.1. Inclusion criteria:
Test group: Sudanese diabetic patients, type 2diabetes mellitus.
Control group: Healthy volunteers.

2.4.2. Exclusion criteria:
Patients take triglyceride supplementation, non-fasting, hypertension, renal impairment and coronary heart diseases, thyroid disease and alcohol consumption.

2.5 Sample size and technique:
Fifty diabetic patients as (test group), and 50 normal healthy (non-diabetic) as control group.

2.6 Ethical consideration;
Permission of this study was obtained from the local authorities in the area of the study. The objectives of the study were explained to all individuals participating in the study. An informed consent was obtained from each participant in the study. Health education considering diabetes mellitus and its complications was provided to all participants.

2.7 Data collection:
Interview and questionnaire:
Interviews with a test group and the control group were done to obtain the clinical data and provide health education. Questionnaire designed specifically to obtain information which help in either including or excluding certain individuals in or from the study.

Blood sampling:
After informed consent, about 5 ml of venous blood were collected by standard procedure from each participants under complete a septic

conditions, the blood withdrawal was followed national requirements. 2.5ml were placed in lithium heparin container.

Plasma was clear by low speed centrifugation, after separation the plasma samples were stored tightly closed at 2 – 8 ˚C and then used for triglyceride analysis.

The other 2.5 ml were placed in heparin container and used for HbA1c analysis.

*(Icteric, lipemic, hemolyzed or bacterially contaminated sample was not used).

2.8 Statistical analysis:

All data were analyzed using statistical package for social sciences (SPSS) software version version 20, Mean and standard deviation of hemoglobin A1C and triglyceride was calculated.

2.9 Biomedical analysis:

Measurement of hemoglobin A1C is used sandwich immune detection method (I Chrome) while the measurement of triglyceride used spectrophotometric method (Biosystem instrument version 420).

Principle of hemoglobin A1C:

The test uses a sandwich immune-detection method; the detector antibody in buffer binds to antigen in sample, forming antigen-antibody complexes, and migrates onto nitrocellulose matrix to be captured by the other immobilized-antibody on test strip.

The more antigen in sample forms the more antigen-antibody complexes and leads to strong intensity of fluorescence signal on detector antibody. Instrument for I chrome tests displays the content of glycated hemoglobin in terms of percent of total hemoglobin in blood.

Clinical hemoglobin A1c range:

NGSP (%): 4.5-6.5%

Principle of triglyceride:

Triglycerides in the sample originates, by means of the coupled reactions described below a colored complex that can be measured by spectrophotometry (420nm).

Clinical triglyceride range:

-up to 150mg/dl.

3. RESULTS:

Fifty patients with type 2-diabetes mellitus as a test group and fifty apparently health Sudanese volunteers as a control group were involved in this study. Both groups were matched by age and gender.

Table 3.1. This result shows that the minimum age is 38, the maximum age is 70 and mean 49.4 with standard deviation (6.72).

	N	minimum	Maximum	Mean	St. Deviation
Age/years	100	38	70	49.4	6.72

Table 3.2. This results seems that 51 male (51%) and 49 female (49%) from diabetic patient and control group.

	Frequency	Percent
Male	51	51%
Female	49	49%
Total	100	100%

Table 3.3. This result shows that male 26 (52%) and female 24 (48%) from the type 2-diabetic patients.

	Frequency	Percent
Male	26	52%
Female	24	48%
Total	50	100%

Table 3.4. This result shows that the male 25(50%) and female 25(50%) from the control groups.

	Frequency	Percent
Male	25	50%
Female	25	50%
Total	50	100%

Table 3.5. This result shows that the 50 (50%) from type 2-diabetic patients and 50 (50%) from the control group.

	Frequency	Percent
Case	50	50%
Control	50	50%
Total	100	100%

Table 3.6. This result shows that the mean of HBA1C is 9.76 with standard deviation 2.31(p.value:0.00) and the mean of triglyceride is 5.43 with standard deviation 0.471(p.value:0.00).

	Group	Number	Mean	St. Deviation	p. value
HBA1C	Case	50	9.76	2.31	
	Control	50	5.43	0.471	0.00
TRIGLY	Case	50	193.88	44.09	
	Control	50	102.68	16.20	0.00

Table 3.7. This result shows that the correlation significant between HBA1C (1) and triglyceride (0.897)

		HBA1c	Triglyceride	Age/year
	Personal correlation	1	0.897**	0.061
HBA1c	Sig.(2-tailed		0.000	0.545
	Number	100	100	100
	Personal correlation	0.897**	1	0.227*
Triglyceride	Sig.(2-tailed	0.000		0.023
	number	100	100	100
	Personal correlation	0.061	0.227*	1
Age/year	Sig.(2-tailed	0.545	0.023	
	number	100	100	100

** Correlation is significant at the 0.01 level

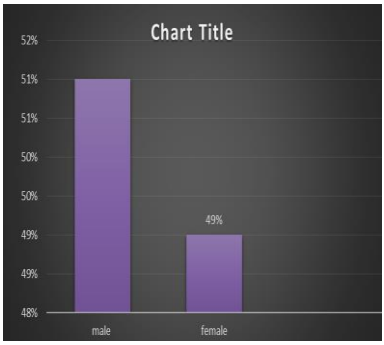
*Correlation is significant at the 0.05 level.

Table 3.8. This result shows that the correlation between mean of good control is 6.216 with standard deviation 0.499 (p.value:0.000) and the mean of bad control is 10.245 with standard deviation 2.016 (p.value:0.000) from the type 2-diabetic patients.

	Groups	Number	Mean	St. Deviation	p. value
HBA1C	<7%Good control	6	6.216	0.499	
	>7%bad control	44	10.245	2.016	0.000

Table 3.9. This result determine that the correlation between mean of good control triglyceride is 122.6 with standard deviation 19.05 and the mean of bad control triglyceride is 203.6 with standard deviation 37.01 (p.value 0.00) from type 2 diabetic patients

	Groups	Number	Mean	St. deviation	p.value
Triglyceride	<150 mg/dl	6	122.6	19.05431	
	>150 mg/dl	44	203.6	37.01057	0.000



Figures 3-1. Gender of both type 2 diabetic patients and control group as volunteer.

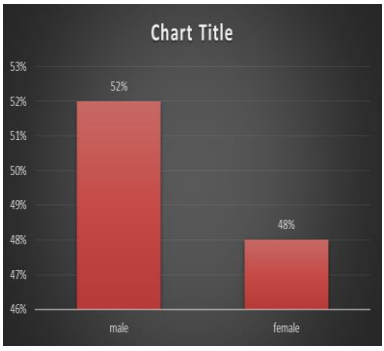


Figure 3-2: Gender of patients with type-2 diabetes mellitus

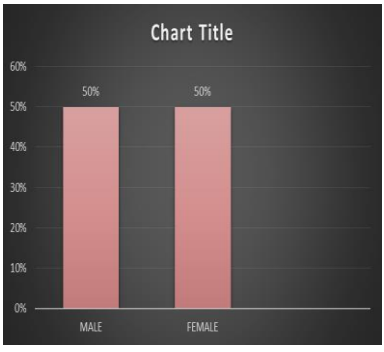


Figure 3-3: Gender of healthy people as volunteer group

4. DISCUSSION:

This study aimed to evaluate the plasma levels of triglyceride and Hba1c in Sudanese patients with type 2 diabetes mellitus.

This study includes 50 Sudanese patients with type 2 diabetes mellitus, their plasma triglyceride and Hba1c levels were measures and compared with 50 non diabetic subjects as a control.

Many studies done in the western countries show that the mean of plasma triglyceride levels are higher in patients with type 2 diabetes mellitus than in general population.

In Sudan very few data is available considering the plasma triglyceride levels in diabetic patients.

The results of this study showed a significant increase in the mean of the plasma levels of triglyceride of the test group compared to the control group, this agrees with the previous studies [13],[9].

Gender wise evaluation of the data shows that there is no significant difference in glycemic parameters as well as triglyceride parameter between males and females.

This warrants the need for more critical monitoring of triglyceride in diabetic males and females so as to prevent cardiovascular complications in them.

5. CONCLUSION:

The results of this study have shown significant change of triglyceride in type 2 diabetic patients.

The level of serum triglyceride was increased in case of uncontrolled type 2-diabetic patient than healthy individual, while the level of serum triglyceride was normal in case of controlled type 2-diabetic patient and also healthy individuals.

There was no difference in the glycemic status of males and females as measured by HbA1c, HbA1c showed positive correlation with triglyceride and this findings suggest that HbA1c level can be used as good parameter for predicting the triglyceride of both male and female diabetic patients.

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