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Estimation of Plasma Triglyceride Level among Patients with Diabetes Mellitus, Wad Medani, Gezira State, Sudan, in 2022

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ABSTRACT

Background: In Sudan and around the world, Diabetes Mellitus is a growing health concern. It is a serious, ongoing condition. The Middle East and North Africa area (MENA) area, which includes Sudan, has the world's highest prevalence of diabetes. It was predicted to be about 25%. More concerning is the prediction that by 2030.

Patients and Methods: This is a case control study conducted in Aldaraga Health Center for Diabetes Care and Wad Medani Pediatric Teaching Hospital, Wad Medani, Gezira State, Sudan to estimate the plasma triglyceride level among diabetic patients. A total of 160 participants were included in the study, ninety patients were case group (Diabetic patients), their mean age was (40.90±24.00) years and seventy were control group (Healthy individuals) their mean age was (45.78±22.38) years. Among case, 37 (41%) were males while 53 (59%) were females. Data were collected by using questionnaire and analyzed by computer program SPSS (Version 20). After fasting (8-12) hours, 2 ml of heparinized plasma and 1.5 ml EDTA whole blood was collected for estimation of triglyceride and HbA1c respectively and then plasma was stored at -200C till assay was done by Cobas C 311.

Results: It revealed high rate of poor glycemic control in Sudanese diabetic patients (81%). There were significance differences in plasma triglyceride between diabetic patients and control group (P value =0.002), age groups (P value =0.000), and gender (P value =0.019). However, there were no statistically significant differences when compared plasma triglyceride levels with glycosylated hemoglobin and duration of the disease (P values = 0.514 and 0.096 respectively).

Conclusion: Diabetes, age, and gender, but not glycosylated hemoglobin or disease duration, were found to have an impact on triglyceride levels in this study.

1.0 Inroduction

Diabetes mellitus is a chronic, lifelong disease resulting from a defect in insulin secretion, insulin resistance, or both (1). In Sudan, diabetes mellitus is a serious health issue. Its prevalence is estimated to be 19% in urban areas and 2.6% in rural areas (2). The Middle East and North Africa (MENA) area, which includes Sudan, has the world's highest prevalence of diabetes. It was predicted to be about 25%. More concerning is the prediction that by 2030, there will be 28 million people living in Africa who are affected by DM, rising from 14 million. In north Sudan's regions, diabetes affects 19% of the population. and 8.3% among members of the Danagla tribe who reside in Northern Sudan. In rural areas in north Sudan, the incidence of undiagnosed diabetes was 2.6% (3). Type 1 Diabetes, which affects the production of insulin (a hormone that controls blood glucose), and Type 2 Diabetes, which affects the body's ability to utilize the insulin that is produced, are both serious, chronic diseases. Nearly 90% of the disease's burden is caused by type 2 diabetes mellitus, and the remaining 10% is caused by type 1 diabetes or gestational diabetes (4).The glycosylated hemoglobin (HbA1c) test is frequently used to determine glycemic status. Intensive glycemic control is achieved through frequent exercise, diet, medication use, and insulin injections to keep

blood glucose levels within or close to the normal range (4).

The American Diabetes Association defined glycemic control status for HbA1c level. When an adult's HbA1c level of 7% or less indicates adequate glycemic control and when an adult's HbA1c level of more than 7% indicates poor glycemic control (5).Poor glycemic control has been linked to diabetes problems, which can be prevented by maintaining adequate diabetic control. In different settings, it has been documented that varying rates and different factors (age, gender, obesity, education, and exercise) are linked to poor glycemic control. While there are a lot of published material on glycemic control and its related variables in the various African nations. Few published studies on glycemic control in Sudan exist. According to the American Diabetes Association (ADA), each 1% increase in HbA1c increases the risk of diabetes-related death by 25%. Additionally, it has been calculated that each percentage point increase in HbA1c is associated with a 35% increase in the risk of micro vascular problems and an 18% increase in the risk of major vascular complications (6).A variety of metabolic dysfunctions are brought on by uncontrolled diabetes mellitus. Poor glycemic control, which predisposes to micro- and macrovascular complications, is the main concern faced by this disease. Neuropathy, retinopathy, and nephropathy are examples of micro vascular consequences. Coronary artery disease and peripheral artery disease are macro vascular problems (7). According to recent studies, Sudan had a serious health problem with diabetes and its associated problems (5). Low levels of very low-density lipoprotein cholesterol (VLDL-C), excess levels of low density lipoprotein cholesterol (LDL-C), and elevated triglyceride levels are all of dyslipidemia (8).Because key enzymes and metabolic pathways involved in lipid metabolism are impacted by insulin resistance or deficiency, lipid abnormalities are common in diabetes mellitus. The production of Apo-proteins, control of lipoprotein lipase, action of cholesterol ester, transfer proteins, and hepatic and peripheral actions of insulin are specifically impacted. Furthermore, it has been suggested that diabetic dyslipidemia's lipid particle makeup is more atherogenic than that of other forms of dyslipidemia (8). There is a relationship between hyperglycemia and hypertriglyceridemia and an increased risk of cardiovascular disease (9). The two basic categories of hypertriglyceridemia (HTG) will be covered: "mild to moderate," defined as triglyceride levels between 150 and 499 mg/dL, and "severe HTG," defined as triglyceride levels ≥ 500 mg/dL. other HTG patients, it is crucial to consider additional risk factors such as lipodystrophy, obesity, alcoholism, renal disease, drugs (such as steroids, Beta-blockers, retinoid, oral estrogens, tamoxifen, protease inhibitors, and bile acid sequestrants), and pregnancy (10). The objective of present study was to estimate the plasma triglyceride level among diabetic patients.

2.0 Patients and Methods

This is a case control study conducted in Gezira State among Known diabetic patients Attending Aldaraga Health Center for Diabetic Care and Wad Medani Pediatric Teaching Hospital. 160 participants were enrolled in the study, 90 were diabetics as case group, their mean age was (40.90±24.00) years and 70 healthy individual as control group their mean age was (45.78±22.38) years. 73 (71%) uncontrolled (HbA1c ≥ 7%) and 17(29%) controlled (HbA1c ≤ 7%) they were recruited by trained field workers and gave their written consent voluntarily. Fasting diabetic Sudanese patients who consented for participation, were included in the study. Newly diagnosed diabetic patients, smokers, obese, pregnant, and lactating women, patient with other illness (Renal failure, hypertension, liver disease, cancer, thyroid disorder), and patients using the following drugs (e.g., steroids, β blockers, retinoid, oral estrogens, tamoxifen, protease inhibitors, and bile acid sequestrants), were excluded from the study. Ethical approval was obtained from the Ministry of Health, Gezira State. Ethical permission was also obtained from the Manager of Aldaraga Health Center for Diabetic Care and the Manager of Wad Medani Pediatric Teaching Hospital. The specimens and information were collected from the individuals in privacy and strict confidentiality was followed and the data was not used for any purposes other than this study. The data was collected by using questionnaire that was designed to include personal, clinical information, and laboratory results. Venous blood sample collection was obtained through clean venipuncture technique under aseptic conditions and 3.5 ml of venous blood was obtained from patients following an overnight fast (8-12 hours). A non-allergenic adhesive spot placed over the venipuncture site. The blood sample was divided in to two blood containers tubes, one containing K3EDTA for HbA1c estimation by colorimetric method by Cobas C311. The other tube contained lithium heparin for TG estimation the tubes were labeled and centrifuged at 5000 rpm for 5 minutes to separate the plasma. After centrifugation, laboratory analysis was immediately performed or the plasma separated and stored in a labeled Eppendorf tube at -20C until it analyzed by enzymatic colorimetric test by Cobas C311. The diagnostic criteria used for the parameters were as follows: HbA1c in Non-diabetic ≤6% Control diabetic = ≤7%, Uncontrolled Diabetic = more than 7% (5) Triglyceride normal rang was (<1.70mmol/L = <150mg/dL). Hypertriglyceridemia (HTG) was discussed under two broad categories: "mild to moderate, "in which the triglycerides are between 150 to 499 mg/dL, and "severe HTG" when the triglyceride levels are ≥500 mg/dL (10). Data were analyzing by using Statistical Package for Social Sciences (SPSS) computer program (Version 20). Descriptive statistics were calculated for the data in the form of mean and standard deviation (SD±) using student T test for quantitative data and frequency and distribution for qualitative data.

3.0 Results:

This study was carried out on 160 participants including 90 diabetic patients and 70 healthy individuals at the mean age (40.90±24.00) years, (45.78±22.38) years respectively. 41% of the participants were men, while 59% were women. Regarding the duration of diabetes, 44% of patients had diabetes for less than 5 years, 47% had diabetes for 6 – 10 years, and 9% had diabetes for more than 10 years. 56% of patients were from rural areas, while 44% were from urban areas. 84% of patients had a family history of diabetes (Table 1). The mean level of triglyceride was significant between diabetic group case and control (Table 2). The distribution of participants by HbA1c level revealed that the majority of

diabetic patients were uncontrolled 81% (HbA1c ≥ 7%), (Table 3). In terms of triglyceride level with glycemic control and disease duration, the results did not indicate any statistically significant differences (Table 4 and Table 7), respectively. However, differences in triglyceride levels associated carried out on 160 (Table 5 and Table 6), respectively were statistically significant.

Table 1: Frequency and percentage of Socio-demographic data in the diabetic group

Demographic/clinical variables		Frequency	Percent (%)
Category	**Sub-category**		
Gender	**Male**	40	41
	Female	50	59
Age group	**Less than 17 years**	38	42
	17 – 50 years	23	26
	More than 50 years	29	32
Disease duration/ year	**Less than 60 years?**	40	44
	6 – 10 years	42	47
	More than 10 years	8	9
Residence	**Rural**	50	56
	Urban	40	44
Family history	**Yes**	76	84
	No	14	16

Table 2: The mean ~~of~~ Triglyceride levels in the diabetic and control groups

	N	Mean	STD	P value
Case (Diabetic group)	90	109.32	65.92	**0.020**
Control	70	135.00	79.00	

Table 3: Frequency and percentage of Triglyceride in Controlled and uncontrolled diabetic groups

	Frequency	Percent
Triglyceride level		
Normal (<150mg/dL)	**72**	**80**
Moderate (150 to 499 mg/dL)	**18**	**20**
HbA1c level		
Controlled (HbA1c ≤ 7%)	**17**	**19**
Uncontrolled (HbA1c ≥ 7%)	**73**	**81**

Table 4: The mean ~~of~~ triglyceride level at different glycemic control.

	HbA1c	N	Mean (mg/dl)	STD	P value
Triglyceride	**Controlled**	17	118.59	85.52	0.514
	Uncontrolled	73	106.89	61.14	

Table 5: The mean of triglyceride level according to Age groups.

Age	N	Mean(mg/dl)	STD	P value
Less than 17 Years	**38**	**71.84**	**29.24**	**0.000**
17 – 50 Years	**23**	**117.83**	**69.03**	
More than 50 Years	**29**	**151.00**	**72.24**	
Total	**90**	**109.1**	**66.03**	

Table 6: The mean of triglyceride level according to gender:

	Gender	N	Mean(mg/dl)	STD	P value
Triglyceride	**Male**	**37**	**90.86**	**50.476**	**0.019**
	Female	**53**	**121.83**	**72.773**	

Table 7: The mean of triglyceride level according to disease duration.

Triglyceride	N	Mean(mg/dl)	STD	P value
Less than 6 Years	**40**	**92.65**	**62.02**	**0.096**
6 – 10 Years	**42**	**120.48**	**67.06**	
More than 10 Years	**8**	**131.63**	**68.95**	
Total	**90**	**109.10**	**66.03**	

4.0 Discussion:

In this study, the distribution of patients by HbA1c level revealed that 81% of diabetic patients are uncontrolled (HbA1c $\geq$ 7%) . This proportion was nearly identical to or equivalent to those of numerous African nations, including Uganda (79.2%), Botswana (82%), Nigeria (62%) and Congo (68) (11).Oman, Saudi Arabia, the United Arab Emirates, and Bahrain all had higher than average rates of controlled diabetes in the Gulf region: 35%, 32.3%, 21.2%, 41%, and 21.8%, respectively (11). So, like other Gulf region nations, Sudan has a similar proportion of uncontrolled diabetes. However, it was projected that 52.5% of Americans and 49.1% of Koreans had controlled diabetes (11). These findings show that glycemic control represents a major challenge not just in African nations but also in Western and Asian nations (11).In a prior study, Rania and et al. (write a reference).found that levels of total CHOL, TRI, HDL, and LDL varied amongst three groups (normal weight, overweight, and obese) but that the differences were not statistically significant. High amounts of total CHOL and LDL were found in the overweight group, but high levels of TRI and HDL were seen in the obese group. Increased quantities of fat in the cells block the effects of insulin, resulting in insulin resistance and the eventual emergence of type 2 DM. The rising prevalence of obesity has been largely related to dietary practices, such as consuming a lot of fatty and sugary foods and dates and getting little exercise. Very low density lipoprotein (VLDL) secretion from the liver may be enhanced and delayed as a potential cause of hypertriglyceridemia (12). According to the study's findings, there was no statistically significant difference in the triglyceride levels in individuals with various levels of

glycemic control and disease duration (P value = 0.514 and 0.096). This finding is consistent with research conducted by Omer and colleagues (2019) in Gadarif State, Eastern Sudan, to evaluate glycemic control among adult patients with type 2 diabetes (12). They found that triglycerides and the duration of the disease were not related to poor glycemic control (P value = 0.170 and 0.085 respectively). This however, conflicts with the findings of several studies that examined the relationship between triglycerides and glycosylated hemoglobin and were conducted in different countries around the world (write a reference). It differs with the findings of studies carried out by Azad and colleagues in Saudi Arabia in 2017 (P value = 0.036) (13), as well as studies carried out by Mullugeta and colleagues in India in 2012 (P value = 0.050) (14), Vinod Mahato in Nepal in 2011 (P value = 0.030) (15) , and Ismail in Iraq in 2017 (P value = 0.042) (6).The results of this study showed that there was statistical significance difference in triglyceride in between the diabetic group and control (P value = 0.020) also with patients age and gender (P value = 0.007) (P value = 0.019) respectively. Our findings agree with the results of all studies mentioned above in and outside Sudan. There may be differences in ethnicity, lifestyle, patient fasting length, and sample size between t our study and the studies conducted in other countries.

5.0 Conclusion:

In this study, it is revealed that triglyceride levels were influenced by diabetes, age, and gender but not by HbA1c or the duration of the disease. According to the distribution of patients by HbA1c level, 81% of diabetic patients have uncontrolled diabetes.

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