

Original article

## Correlation between HbA1c and lipid profile in patients with Type2 diabetes mellitus

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### Abstract:

- **Background:** Diabetes mellitus is one of the greatest health threats of recent times for global population, T2DM is associated with two to four excess risk of cardiovascular disease, Serum lipids are frequently abnormal and are likely to contribute to the risk of coronary artery disease, and there an 18% increased risk of cardiovascular disease for each 1% increase of HbA1c in diabetic population,
- **Method and patient:** this is across sectional study which was carried out on 100 diabetic patients ,62 male and 38 female with age from 38-75years, after fasting of at least 8 hours, fasting blood sugar, HbA1C and lipid profile were measured.
- **Result:** patients were divided into two groups; the controlled group with HbA1c of 7% or less, and uncontrolled group with HbA1c of more than 7% ,the controlled group include 28% of the patients while the uncontrolled group include 72% of the patients with mean age of  $50.50 \pm 12.60$  and  $53.94 \pm 7.99$  respectively, with no significant difference(p-value=0.187), while there was significant difference in lipid profile between the two groups.
- **Conclusions:** most diabetic patients are uncontrolled and dyslipidemia, and HbA1c is used as a dual marker for dyslipidemia and diabetic control.
- **Keywords:** Type 2 DM, HbA1c, Dyslipidemia

## INTRODUCTION

American Diabetes Association (ADA) proposed the use of HbA1c in the definition of diabetes and the category of increased diabetes risk (which also includes impaired fasting glucose and impaired glucose tolerance <sup>(1)</sup>. Diabetes is one of the biggest health threats of recent times for the global population, rich and poor alike. It was estimated that, in the year 2017, more than 425 million people globally were suffering from diabetes.

The burden is increasing, predominantly in low- and middle-income countries, where about 80% of total diabetes deaths in the world occur <sup>(2)</sup>. T2DM is associated with significant long-term complications, particularly vascular disease. It has been reported that T2DM is associated with a two-to fourfold excess risk of cardiovascular disease (CVD) <sup>(3)</sup>. 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 <sup>(4)</sup>. Serum lipids are frequently abnormal and are likely to contribute to the risk of coronary artery disease, worsening of glycemic control deteriorates lipid and lipoprotein abnormalities and particularly of diabetes mellitus. The American Diabetes study (ADA) has designated HbA1c level of <7% as a goal of optimal blood glucose control and the American Association of Clinical Endocrinologist has further recommended HbA1c level of <6.5% . Criteria for abnormal lipid profiles were based on the ADA criteria, Hypercholesterolemia refers to a total cholesterol level  $\geq 200$  mg/dl, Hypertriglyceridemia refers to a level is  $\geq 150$  mg/dl, HDL was considered low when the level is < 40 mg/dl in males and < 50 mg/dl in females, LDL was considered high when the level is  $\geq 100$  mg/dl. Dyslipidemia was defined as the presence of one or more of the previous abnormalities in serum lipids <sup>(5)</sup>. The higher prevalence of lipid abnormalities in diabetes mellitus has been attributed to insulin resistance or deficiency that affects key enzymes and pathways in lipid metabolism, So, hyperglycemia, dyslipidemia and coronary artery disease relate well with each other in type 2 diabetes and it has been proposed that higher prevalence of cardiovascular disease in type 2 diabetes is due to chronic uncontrolled hyperglycemia and hence strict control of hyperglycemia and dyslipidemia can be preventive <sup>(6)</sup>. Patients with diabetes can have a reasonably normal lifestyle if they are well educated and motivated concerning the disease, Intensive treatment strategies have been demonstrated to reduce complications in diabetics <sup>(7)</sup>. there is an 18% increased risk of CVD for each 1% rise in absolute HbA1c levels in the diabetic population. This positive correlation between HbA1c and CVD has been demonstrated in nondiabetic cases, even within the normal range of HbA1c <sup>(8)</sup>. The aim of this cross-sectional study is to know the relation of HbA1c to lipid abnormalities in patient with T2DM.

## **PATIENT and METHOD**

This is across sectional study in which a total of one hundred patients , 62 male and 38 female were included, and was carried out in K-1 hospital, north oil company, Kirkuk city in Iraq, with age from 38 to 75year,in the period from June to September 2021, after fasting of at least 8hours, fasting blood sugar, HbA1C, Cholesterol ,Triglyceride, LDL and HDL were measured, patients were diagnosed as type 2 diabetic as per American Diabetes Association guidelines 2022 or already taking treatment for type 2 diabetes, dyslipidemia was defined by presence of one or more than one abnormal serum lipid value, Controlled diabetes mellitus is considered as HbA1c =7%or less and uncontrolled diabetes HbA1c of more than 7%, Criteria for abnormal lipid profiles were based on the ADA criteria, S.LDL was measured by Friedewald Equation;(LDL=Total cholesterol-Triglyceride/5-HDL).

Descriptive statistics were reported using mean with standard deviation (SD) for numerical data, and relative frequencies (percentages) for categorical data, the statistical data were analyzed by SPSS version 26, a p-value of less than 0.05 was regarded as significant.

## **RESULTS**

This study included 100 patients with type 2 diabetes ,72 male and 28 female with age from 38 to 75 yrs,In which( table -1) illustrate two groups of patients, the controlled group with HbA1c of 7% or less, and the uncontrolled group with HbA1c of more than 7%,the controlled group include 28% of the patients while the uncontrolled group include 72% of the patients, the mean age of controlled group was  $50.50 \pm 12.60$ ,while the mean age of uncontrolled group was  $53.94 \pm 7.99$  ,with no significant difference between the two groups(p-value=0.187), while there was significant difference in fasting blood sugar, Cholesterol, Triglyceride, LDL, HDL and Cholesterol/HDL-C ratio between controlled and uncontrolled group **Table 1**.

**Table 1. Illustrates parameters in controlled and uncontrolled diabetic groups.**

Parameter	HbA1c =7%or less	HbA1c >7%	P-value
Age (Years)	50.50±12.60	53.94±7.99	0.187
Fasting Sugar (FBS)	144.39±59.75	185.11±82.34	0.007 *
S. cholesterol	179.89±24.71	202.74±55.45	0.006 *
S. triglyceride	162.66±39.77	216.43±153.50	0.007 *
S.LDL	94.92±29.68	118.14±42.28	0.003 *
S.HDL	41.88±9.74	34.90±6.11	0.001*
Cholesterol/HDL	4.58±1.41	5.50±2.28	0.018 *

\* Significant  $P < 0.05$

## DISCUSSION

HbA1C is the main indicator of diabetes control in the previous 6-8 weeks, in addition there is significant correlation between diabetic control and lipid profile in T2DM, and HbA1C as well as lipid profile are significantly correlated with cardiovascular complications of Type 2 DM, so HbA1C can be used as a dual marker of diabetic control and dyslipidemia in type 2 diabetes mellitus<sup>(9)</sup>. Dyslipidemia is prevalent in diabetes mellitus because insulin resistance or deficiency affects key enzymes as well as pathways in lipid metabolism, and the following processes are affected: apoprotein production, regulation of enzyme lipase, action of cholesterol ester, the transfer proteins and the hepatic and peripheral actions of insulin .Even more, it has been proposed that composition of the lipid particles in diabetic dyslipidemia is more atherogenic than other forms of dyslipidemia, this means that even normal lipid concentrations could be more atherogenic in diabetic than nondiabetic people. In our study there was no significant difference in mean age of controlled and uncontrolled group, while the values of FBS and lipid concentrations in controlled diabetic was significantly less than those in uncontrolled group, in addition, in our study 72% of patients had dyslipidemia, these findings are correlated with other studies:

Gligor Romana, et all study showed that HbA1c is a good predictor of triglyceride, cholesterol, LDL and HDL, and that HDL cholesterol is inversely, and non HDL cholesterol directly, correlated with coronary heart disease (CHD) risk in diabetes mellitus<sup>(11)</sup>.

In studies from Saudi Arabia, Jordan, and Kuwait 73%, 65.1%, and 66.7% of patients respectively had poor diabetic control. Similar figures had noted in studies conducted in UK, and dyslipidemia is more frequent in poorly controlled diabetes compared to diabetes with good glyceamic control <sup>(12)</sup>.

Kameran Hassan Ismail demonstrated that there is significant difference of total cholesterol, triglycerides, and LDL cholesterol between controlled and uncontrolled diabetes mellitus <sup>(13)</sup>. Emina Panjeta, et al study showed that dyslipidemia is correlated with atherosclerosis, and up to 97% of diabetic patients are dyslipidemia and the severity of dyslipidemia increases in patients of higher HbA1c value <sup>(14)</sup>.

It was observed that main lipid predictor of vascular events was mean TC/HDL-C ratio with the aim to use this ratio as a guide for treatment of diabetic patients with dyslipidemia and it is worth to state that apo-B containing particles and small LDL-C particles are significantly increased in diabetes and these metabolic markers are indirectly reflected by TC/HDL-C ratio more than LDL-C alone. The significant association between HbA1c with TC/HDL-C ratio suggests that improved lipid status reflects good diabetic control <sup>(15)</sup>.

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Nil.

#### **Conflicts of interest:**

There are no conflicts of interest.

#### **CONCLUSION**

Most diabetic patients are uncontrolled and are dyslipidemia, HbA1C is used as a dual marker for glyceamic control as well as dyslipidemia, which both are main causes of cardiovascular complications of diabetes, and good glyceamic control lead to improved lipid state and less diabetic complications.

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