Hyperlipidemia among Patients with type 2 Diabetes Mellitus in Al-Nasiriya City

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Abstract

Diabetes mellitus is a set of metabolic disorders that result in persistent diseases characterised by excessive blood sugar because of the lack of manufacturing of insulin, a hormone responsible for regulating sugar levels. This study became carried out on 42 (24 female, 18 male) non-insulin-dependent diabetics without a control group for comparison. The information had been obtained from November 2021 to February 2022 from the clinical data of the Diabetes Center in the Nasiriyah city. The exclusion criteria had been patients with type 1 diabetes who have been already taking lipid-decreasing drugs. Patients had been categorized into two groups based on glycated hemoglobin, the good glycemic control group having less than 7.0% and the poor glycemic control group having more than 7.0%. Data have been analyzed in the use of the (SPSS) program (p-value ≤0.05) and the superiority of dyslipidemia in diabetic patients was 43% amongst men and 57% amongst females. This study evaluated the relationship amongst glycemic control and lipid profile amongst diabetic patients. Evaluation of data by kind shows gender that there may be no significant difference in blood sugar parameters in addition to lipid level amongst males and females except for HDL values that are higher in females.

Keywords: Diabetes Mellitus (DM), Diabetic Dyslipidemia, HbA1c, FBS, TC, HDL, LDL, TG, VLDL.

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INTRODUCTION

Diabetes mellitus (DM) is described as a set of metabolic problems of more than one etiology that cause chronic diseases characterised by hyperglycemia because of inadequate action and/or manufacturing of insulin, a hormone this is responsible to regulate the levels of sugar [1]. The most important subtypes of DM are Type 1 diabetes mellitus (T1DM) and Type II Diabetes mellitus (T2DM). T1DM previously referred to as "insulin-dependent diabetes mellitus" (IDDM) or "juvenile diabetes", can develop at any age, though it frequently seems during childhood or adolescence. Although T2DM was once called 'non-insulin dependent diabetes mellitus' (DNID) or 'early-onset diabetes', it is the idea of impact on middle-aged and older adults (more common in people over 40). Who've extended hyperglycemia because of poor life-style and nutritional choices. Although the prevalence of each type 1 and type II DM goes to increase, type II DM is expected to rise greater rapidly in the future due to elevated weight problems and decreased activity levels [2]. Type 2 diabetes, with alteration in lipid profile, is likewise associated with atherosclerosis [2]. Type II diabetes is one in all the foremost common persistent diseases within the world [3].

Diabetic dyslipidemia is one of the most important danger factors for cardiovascular disorder which has a large mortality rate during the world. Early detection and treatment of dyslipidemia can keep away from danger for cardiovascular disease in diabetic patients. "About 1. 4 million Iraqis suffer from diabetes. The reported incidence of DM2 in Iraq ranges from 8,513.9% [4].

A local study involving more than 5,400 people in the city of Basra in southern Iraq showed an age-adjusted incidence of diabetes of 19.7% in people aged 19 to 94 years. [5].Gradually increasing fast socioeconomic development and associated life-style modifications has been causing an increase in the prevalence of dyslipidemia dramatically during the last decade worldwide [6]. Though identifying and screening dyslipidemia in each country to prevent the prevalence and development of cardiovascular illnesses could be very important, there aren't any right and correct data at the popularity of dyslipidemia and its determinants in lots of nations [6].

Hyperlipidemia as a metabolic abnormality is often related to diabetes mellitus. Dyslipidemia is a common problem withinside the Iraqi population. A study performed on diabetic patients in the Kurdistan area of Iraq mentioned that hyperlipidemia became greater dominant amongst diabetic patients with retinopathy [7]. This observe changed into performed to decide the prevalence of and pattern of dyslipidemia in diabetic patients in Nasiriyah city, Iraq.

MATERIALS AND METHODS

This study was carried out in Nasiriyah city, Iraq and Department of Medical Laboratory Technology in Mazaya College University, Nasiriyah (Southern of Iraq), throughout the period of November 2021 to February 2022.

The included NIDDM patients were 42 (24 females, 18 males), without a control group for comparison. The age of the patients was 10-65 years. This study was conducted to determine the prevalence of and pattern of dyslipidemia in diabetic patients in Nasiriyah city, Iraq. This study also was conducted to determine if sex has an influence on hyperlipidemia in diabetic patients and detect the risky age group for developing hyperlipidemia in the diabetic patients. The patients lived in various localities including urban and rural areas of Nasiriyah city.

Inclusion Criteria

- Patients with Type 2 Diabetes.
- Demographic features: Age, Gender, Marital condition, Education level, Smoking, Living, Weight, & Height.
- Biochemical markers: FBS. HbA1c, TC, TG, HDL, LDL, & VLDL.

Exclusion Criteria

- Patients with a known diagnosis of type-1 DM.
- Hypothyroidism.
- Chronic renal failure, Nephrotic syndrome.
- Familial hypercholesteremic syndromes.
- Patients already on lipid-lowering drugs.
- Patients with hypertension and/or using beta blockers or thiazide diuretics.
- Patients already on oral contraceptives (women).

Samples Collection

About 5 mL of blood was collected from the cubital vein by applying alcohol and rubbery tape and the blood was placed in a disposable syringe in the morning for the serum lipid profile and fasting blood sugar and dispensed to basic test tubes (EDTA & Gel Tube). After the blood had clotted in a gel tube, centrifuged at 3000 rpm for 10 min to obtain clear, transparent sera that have been moved to another labeled tube to measurement these tests: Random Blood Sugar (RBS), Glycated hemoglobin (HbA1c), Total Cholesterol (TC), Triglycerides (TG), High-density lipoprotein (HDL), Low-density lipoprotein (LDL), & Very Low-density lipoprotein (VLDL). All tests were performed on all the patients in accordance with the research protocol.

METHOD

Estimation of Blood Sugar: Endpoint, BIOLABO France).

Estimation of Glycated hemoglobin (HbA_1c): Ion Exchange Resin method Principle.

Estimation of Total cholesterol: Enzymatic Colorimetric Kit method, BIOLABO (France)

Estimation of Serum Triglycerides: Enzymatic Colorimetric Kit method, BIOLABO (France).

Estimation of HDL: CHOD-POD kit method, BIOLABO (France).

Estimation of LDL: concentration was determined by the traditional Friedewald's formula: $LDL = TC - (HDL + \frac{TG}{5})$.

Estimation of VLDL: concentration was determined by the traditional Friedewald's formula, which is assumes the triglyceride/cholesterol ratio in VLDL to be 5:1[8].

Lipid profile and sugar tests measurement by mg/dl unit, while HbA1c was percentage.

Estimation of Body mass index (BMI) was calculated from the formula: $BMI = \frac{Weight\ (kg)}{(Height\ (m))^2}$. According to world health organization (WHO), Criteria patients were taken as:

1. Normal weight: BMI=18.5-25
2. Overweight: BMI= 25-30
3. Obesity: BMI=30-40
4. Morbid Obesity: BMI=>40

The patients were classified into two groups depending on their glycated hemoglobin (HbA1c); the Good Glycemic Control (GGC) group having HbA1c less than 7.0% and the Poor Glycemic Control (PGC) group having HbA1c more than 7.0%. For serum lipid reference level, National Cholesterol Education Programmed (NCEP) Adult Treatment Panel III (ATP III) guideline was referred [9].

According to NCEP-ATP III guidelines, hypercholesterolemia is defined as TC >200 mg/dl, high LDL when value >130 mg/dl, hypertriglyceridemia as TG > 150 mg/dl and low HDL when value < 60 mg/dl. Dyslipidemia was defined by the presence of one or more than one abnormal serum lipid concentration[10,11].

Statistical analysis

The data were analyzed using Statistical Package for Social Sciences (SPSS IBM-version 26.0) software. Descriptive statistics were presented as mean ± SD (standard deviation) and frequencies were expressed as percentages. Chi-square for categorical variables and t-test were used to compare between two means. The level of significance (p-value) was set at ≤ 0.05.

RESULTS AND DISCUSSION

Table (1) Distribution of the Patients by their demographic characteristics.

Variables	Characteristics	Frequency	Percentage
Age	<20yrs	8	19%
	20-40yrs	5	12%
	40-60yrs	21	50%
	>60yrs	8	19%
	Total	42	100%
Gender	Male	18	43%
	Female	24	57%
	Total	42	100%
Marital	Divorced	1	2%
	Married	30	72%
	Single	9	21%
	Widowed	2	5%
	Total	42	100%
Education	None	7	17%
	Primary	22	52%
	Middle School	6	14%
	High School	3	7%
	University	4	10%
	Total	42	100%
Smoking	Smoking	5	12%
	Non smoking	37	88%
	Total	42	100%
Living	Rural	12	29%
	Urban	30	71%
	Total	42	100%
BMI	Normal weight	13	31%
	Overweight	14	33%
	Obesity	12	29%
	Morbid Obesity	3	7%
	Total	42	100%

In the table above, the results show the Distribution of the Patients by their demographic characteristics: (Age, Gender, Marital, Education level, Smoking, Living, and BMI).

Table (2) Distribution of data according on Gender & Age of current study

		Gender			
		Female	**Male**	**Total**	**Percent**
Age	<20yrs	4	4	8	19%
	20-40yrs	2	3	5	12%
	40-60yrs	13	8	2	50%
	>60yrs	5	3	8	19%
	Total	24	18	42	100%
	Percent	57%	43%	100%	

In the Table above, the results show the frequency of data depending on Gender and Age of patients in this study. The results showed the higher percentage of patients was females who they are 40-60 years old.

Table (3) Frequency of data in this study according to parameters categories.

Variables	Characteristics	Frequency	Percentage
FBS	Less than 80 (mg/dl)	14	33%
	80-120 (mg/dl)	8	19%
	More than 120 (mg/dl)	20	48%
	Total	42	100%
HbA_1c	less than 7%	12	29%
	More than 7%	30	71%
	Total	42	100%
T. Ch	Less than 200 (mg/dl)	10	24%
	More than 200 (mg/dl)	32	76%
	Total	42	100%
TG	Less than 150 (mg/dl)	9	21%
	More than 150 (mg/dl)	33	79%
	Total	42	100%
HDL	More than 60 (mg/dl)	15	36%
	less than 60 (mg/dl)	27	64%
	Total	42	100%
LDL	less than 130 (mg/dl)	12	29%
	More than 130 (mg/dl)	30	71%
	Total	42	100%
VLDL	less than 30 (mg/dl)	16	38%
	More than 30 (mg/dl)	26	62%
	Total	42	100%

In the table above, the results show the Distribution of patients according on parameters level to Normal and abnormal value by frequency and percentage of each tests.

Table (4) Male and female lipid parameters result of Male and Female type 2 Diabetic patients

Parameters	Total (n=42)	Females (n=24)	Male (n=18)	P-value
FBG (mg/dl)	120.94±36.51	130.65±30.81	126.94±30.51	0.521 (N.S.)
HbA_1c (%)	7.50±1.64	7.53±1.43	7.32±1.54	0.402 (N.S.)
TC (mg/dl)	153.91±33.08	156.37±33.40	150.91±35.08	0.067 (N.S.)
TG (mg/dl)	154.81±59.59	145.33±52.33	153.81 ± 59.59	0.064 (N.S.)
HDL (mg/dl)	51.75±7.232	40.79±4.32	55.34±3.33	0.0023 (S.)
LDL (mg/dl)	71.30±31.05	68.89±35.64	72.41±28.78	0.067 (N.S.)
VLDL (mg/dl)	35.56±10.92	25.87±10.97	33.09±12.24	0.072 (N.S.)

In the table above, in this study, among total 42 type 2 diabetic individuals included, 18 were male and 24 were female. The mean age ± SD of male and female subjects were 52.14±6.40 and 51.46 ± 5.62 years respectively. The mean value of HbA1c, FBG, and TC were slightly higher in females in comparison to male patients, but the differences were not significant. There was no statistically significant difference in Total cholesterol, Serum Triglyceride, LDL or VLDL levels

among both the genders though HDL levels in females were significantly more than males.

*The P-Value (≤0.05) was significant.

Table (5) Lipid profile categorized by patient's glycemic control (HbA1c)

Parameters	$HbA_1c < 7$ (GGC)	$HbA_1c > 7$ (PGC)	P value
FBG (mg/dl)	107.10 ± 21.26	145.55 ± 35.68	0.0001 (H.S.)
HbA_1c (%)	6.35 ± 0.45	8.50 ± 1.12	0.0001 (H.S.)
TC (mg/dl)	143.85 ± 27.01	159.31 ± 27.58	0.0631 (N.S.)
TG (mg/dl)	138.51 ± 44.77	165.39 ± 68.40	0.0054 (S.)
HDL (mg/dl)	55.63 ± 7.38	47.01 ± 7.5	0.0013 (H.S.)
LDL (mg/dl)	66.49 ± 20.98	76.88 ± 23.61	0.0256 (N.S.)
VLDL (mg/dl)	27.82 ± 8.15	32.08 ± 13.42	0.0057 (S.)

In the table above, in this study, among total 42 type 2 diabetic patients, 12 patients had HbA1c values less than or equal to seven (GGC) while rest of 30 patients had HbA1c values more than seven (PGC). A very strong positive correlation was observed between FBG and HbA1c as shown by pearson's correlation coefficient. Similarly, values of TC, TG, LDL & VLDL in GGC group were significantly lower than PGC group. Values of TG had Moderate positive correlation with HbA1c values while TC, LDL & VLDL values had only weak positive relationship. HDL levels were significantly high in GGC group as compared to PGC group and demonstrated a weak negative correlation.

DISCUSSION

Diabetes mellitus (DM), commonly referred to as diabetes, is defined as a group of metabolic disorders of multiple etiology that lead to chronic diseases characterized by hyperglycemia (high blood glucose levels over a prolonged period) due to insufficient action and/or production of insulin, a hormone that is accountable to regulate the levels of sugar [1].

Depending on the 10th edition of the International Diabetes Federation (IDF) Diabetes Atlas, 537 million out of 10 adults (20-79 years) live with diabetes worldwide.) are living with diabetes worldwide. This number is predicted to rise to 643 million by 2030 and 783 million by 2045. Diabetes is responsible for 6.7 million deaths in 2021 - 1 every 5 seconds. Over 3 in 4 adults with diabetes live in low- and middle-income countries. While the corresponding data in Middle East and North Africa -The highest proportion of all IDF Regions, Diabetes is responsible for 796,000 deaths in 2021, The Middle East and North Africa Region has the highest percentage (24. 5%) of diabetes-related deaths among people of working age. The number of adults with diabetes is expected to reach 95 million by 2030 and 136 million by 2045 and 796,000 deaths were caused by diabetes in 2021[12].

In this study, the prevalence of dyslipidemia among diabetics in Nasiriyah was 43% in males and 57% in females. In the other study in in Bangladesh, it was 72.9% and 70.6% for males and females respectively [6].

In this study, we assessed the correlation between glycemic control (HbA1c) and lipid profile in diabetic patients. Gender-wise evaluation of the data shows that there was no significant difference in glycemic parameters as well as lipid profile between males and females except in HDL values which are significantly higher in females, which agreed with the finding of [13]. Whereas in another study conducted in Zaria, Northwestern Nigeria [14], the prevalence of dyslipidemia in the patients with type II Diabetes mellitus in Zaria was 69.3% and there was no significant difference in the prevalence of dyslipidemia between females and males.

This warrants the need for more critical monitoring of lipid profiles in diabetic males to prevent cardiovascular complications in them [15].one of the possible explanations of this hypercholesterolemia was the loss of affinity for Apolipoprotein B (ApoB) receptors of the glycated LDL may contribute to the increase in serum cholesterol level in diabetics. Another because that could explain the high serum cholesterol in diabetic patients is that the intake of saturated fatty acid is positively associated with high serum cholesterol [16].

This study shows that quite a good number of diabetic patients have high TC (but non-significant), high TG (significant), high LDL (non-significant), and low HDL (high significant) levels which are well-established risk factors for cardiovascular diseases. This agrees with the findings of other studies [17; 6; 3; 16; 15; 18; 11), whereas in another study conducted in Kuwait isolated dyslipidemia is the second most common pattern with increased LDL-cholesterol, observed in 21% of the patients [19], and in Mosul, In the present study (TC) was in diabetic patients, which is consistent with other studies such as [20].

In the present study, a positive correlation between HbA1c and dyslipidemia was observed.A positive correlation of HbA_1c level with TC and TG in diabetic patients has also been reported in the past [21]. Khan et al., also reported that the severity of dyslipidemia increases in patients with higher HbA1c value [22].

In other study in Mosul by [20], serum triglycerides (TG), HDL, and VLDLC are increased in diabetic patients which is obvious in the present study, and their levels are significantly increasing with the duration of disease, which is consistent with other studies [23], while they are inconsistent with other studies [24]. This variation could be due to differences in geographical, cultural economic, social conditions, dietary habits, and genetic makeup [20]. High serum LDL-C was noted to be significantly increased with the duration of the disease. This agrees with the findings of other studies [20;

25].

In diabetes, many factors can affect blood lipid levels, since carbohydrate and lipid metabolism are relatedeach other if there is any disorder in carbohydrate metabolism it also leads to disorder in lipid metabolism so there is a high concentration of cholesterol and triglycerides and due to this there is the reduction in HDL cholesterol levels [17;26; 27].

The most prevalent lipid abnormality in this study was high TG (79%), high TC (76%), high LDL (71 %), low HDL (64%), followed by high VLDL (62%), whereas in another study conducted in Kuwait isolated dyslipidemia is the second most common pattern with increased LDL-cholesterol, observed in 21% of the patients [19].In other study in Mosul by [20], the prevalence of high TC, high TG, hyper LDL, and low HDL among type II Diabetes according to the recommendation of British Hyperlipidemia Association was 69.6%, 36.2%, 68.8%, and 64% respectively[28]. conducted a study in Hyderabad (India) showing that the prevalence of dyslipidemia was 86%, while high total cholesterol was 41%, LDL was 64%, triglycerides were 47% and low HDL was 71%. From a study in Nishtar Hospital, Multan (Pakistan), it was found that 21% of patients with diabetes had raised serum cholesterol and 34.2% had raised serum triglyceride level [29], while in another study from Pakistan (2011), 14% of diabetic patients had raised cholesterol level while 31% patients had raised TG level [30]. In another study in Bangladesh, high cholesterol level was found in 35.42% of patients, and serum TG was found in 41.97% of diabetic patients. Different values of serum cholesterol may be due to different dietary habits of people in different cities of the country [6].

Blood sugar control can significantly reduce the risk of cardiovascular events in people with diabetes. Khaw et al have reported that reducing the HbA1c level by 0.2% could lower mortality by 10% [31].Thus, present study suggests the importance of glycemic control in the prevention of cardiovascular diseases in type 2 diabetics [15]. It is a well-known fact that low HDL-C is common in type 2 and maybe a strong factor for coronary heart disease (CHD). Which agrees with our result that low HDL-C is evident in both types compared with the control group. High serum LDL-C is noted in both types. It could be explained that patients have an increased level of small dense LDL-C and reduced clearance due to glycosylation of ligand proteins [16]. Serum Tri and VLDL-C have always been increased in diabetic patients [16]. most common lipid abnormality in DM is hypertriglyceridemia which is known to be an independent risk factor of CHD. It is due to an increase in VLDL-C synthesis and impaired VLDL-C catabolism [32]. However, this phenomenon is less evident in type 1 with different mechanisms which are because in type 1 DM the reduced chylomicron and VLDL catabolism occur as a direct consequence of reduced lipoprotein lipase activity due to insulin deficiency Since the enzyme activity requires insulin for activation [33].

Conclusion & Recommendations

The study concluded that HbA1c value is associated with the level of lipid profile in diabetic patients except that for TC & LDL. There was no difference in the glycemic status of men and women as measured by fasting glucose and HbA1c levels.HbA1c showed positive correlations with TG, HDL VLDL, & FBS, and negative correlations were found between HbA1c and TC, LDL levels. Lipid profiling for all persons with type II DM should be a routine test. All persons with type II Diabetes must be started on primary prevention by encouraging healthy lifestyle diets to reduce the risk of CHD and atherosclerosis. Increased levels of cholesterol, triglycerides, VLDL and LDL-C showed that diabetic patients may present a high risk of atherosclerosis and vascular complications of diabetes mellitus.

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