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ORIGINAL ARTICLE

Lipid Profile Disorders in Type 2 Diabetic Patients among Adult Patients in Tur Sinai District

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ABSTRACT

Background: Type 2 diabetes mellitus (T2DM) is a notable disease in developing and/or developed countries associated with a high risk of morbidity form cardiac disease. It has been proposed that the composition of lipid particles in diabetic dyslipidemia is more atherogenic than other types of dyslipidemia. The aim of our study was to identify the relation between T2DM and the lipid profile disorders and identify the factors associated with increasing the risk of dyslipidemia in patients with T2DM. **Methods:** We conducted an epidemiological cross-sectional study in DM Clinic in comprehensive health insurance clinic Tur Sinai District in Egypt. We included patients with T2DM, patient age from 18 to 60 years old, and apparently uncomplicated. **Results:** We enrolled 94 patients with T2DM with mean age of 49.5 ± 9.12 years. Of whom, 42 (44.7%) were male and 52 (55.3%) were females. About 55% of the studied patients had dyslipidemia. On assessing each item in lipid profile, (53.2%) of the studied patients had abnormally high triglycerides level, 46.9% of them had hypercholesterolemia, 45.9% had abnormal LDL-cholesterol level and 25.5% of them had low HDL level. Fasting blood glucose and glycosylated hemoglobin were significantly higher among DM patients with dyslipidemia. **Conclusions:** This study highlighted high prevalence of dyslipidemia associated with DM. The present study also highlights the importance of strict control of DM in prevention and treatment of dyslipidemia as dyslipidemia is more frequent in uncontrolled diabetic patients and decreasing BMI and absence of hypertension can protect against the risk of dyslipidemia

Keywords: Lipid Profile; Type 2 diabetes mellitus; Dyslipidemia

INTRODUCTION

Diabetes mellitus (DM) is an endocrinal disorder in which blood glucose levels are elevated. This chronic disease is responsible for significant morbidity, mortality, and cost. DM is the most common set of disorders of carbohydrate metabolism 1.

About 382 million adults were diagnosed with DM worldwide in 2013. This number is expected to grow to 592 million in 2035. In addition, around 11% of total health care expenditures worldwide are spent on DM.

However, in Egypt, there was around 7.8 million diabetic patients in 2015, ranking 8th worldwide; and expected to be 15.1 million on 2040, and ranking 7th worldwide. Around 14.9% was the national prevalence for the ages 20-79 and about 78,184 were deaths recorded in 2015 1.

DM is the leading cause of renal failure, the most common cause of nontraumatic amputations, and the foremost cause of new blindness in adult's ages 20 to 74 years. Diabetic neuropathy occurs in about 60-70% of people with DM. Most DM-related deaths, however, are related to the increased risk of developing atherosclerotic disease. People with DM are at least two to four times more likely to have heart disease and cerebrovascular disease than those without DM. Fortunately, in recent years, associated with better glycemic and blood pressure control, use of angiotensin converting enzymes inhibitors or angiotensin receptor blockers for renoprotection, use of statin drugs to lower LDL-cholesterol, and better foot care, complication rates have been falling 2.

Different methods are the main factors for the development of dyslipidemia in patients with DM. Defects in insulin and hyperglycemia may lead to dyslipidemia in patients with DM. In the case of T2DM, the obesity that is at the basis of the development of this disease can lead to dyslipidemia independent to the hyperglycemia 3. In uncontrolled T2DM, hypertriglyceridemia and reduced HDL are occurred, however in most of cases insulin treatment in these patients correct these abnormalities. This type is not fully corrected with glycemic control, confirming that insulin resistance and not hyperglycemia are associated with this dyslipidemia in T2DM 4.

Therefore, the aim of our study was to identify the relation between T2DM and the lipid profile disorders and identify the factors associated with increasing the risk of dyslipidemia in patients with T2DM.

METHODS

We followed Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement guidelines when reporting this manuscript. The present study was approved by the ethics committee of Zagazig university

Study Design, Study Setting, and Study Participants

We conducted an epidemiological cross-sectional study in DM Clinic in comprehensive health insurance clinic Tur Sinai District in Egypt. We included patients with T2DM, patient age from 18 to 60 years old, and apparently uncomplicated. Exclusion criteria were; patients having hepatic, renal or metabolic disorders or other comorbidities, and patients who refused to participate in this study.

Study Assessments and Data Collection

For each eligible patient, we reported the following data: written informed consent, detailed history including medical, surgical history, history of drug intake and family history, history of endocrine disease, history of previous operations. General examination includes Blood pressure, pulse examination, temperature and respiratory rate, upper, lower limbs and head and neck examination with, comment on lymph node. Local examination of different systems for; Cardiac examination, chest examination, thorough Abdominal examination, thorough neurological examination.

Medication adherence was assessed using Morisky medication adherence scale (MMAS-8). The MMAS-8 is eight items produced to measure medication adherence. It is composed of seven (Yes-No) questions. The eighth question uses a 5-point of Likert scale [5]. The translation was carried out according to standard forward and backward method. In the forward translation process

the scale was translated into Arabic by language experts.

Laboratory tests

Five ml of venous blood were taken from each patient and then divided into fluoride oxalate, ethylene diamine acetate and test tubes. All biochemical methods were made using automated chemistry analyzer according to the standardized protocols. Fasting blood glucose level was measured by glucose oxidase-peroxidase method HDL was assessed by phosphotungstate precipitation method. TC and TG were measured by cholesterol oxidase-peroxidase and glycerol phosphate kinase methods, respectively. LDL was calculated using Friedwald formula. Non-HDL was measured by subtracting HDL from TC. ApoB was estimated using the following equation; ApoB=0.65×TC-0.5 9×HDL-C+0.01×TG when, TG<270 mg/dl and ApoB =25.6+0.58×TC-0.38×HDL-C-0.6×TG when TG>270mg/dl. HbA1c was measured by ion-exchange resin method.

Statistical Analysis

Sample size calculation was measured using Epi info 7 to be 94 cases with confidence level 95% and power of 80% after assuming prevalence of T2DM with dyslipidemia as total number of patients with T2DM attending to DM Clinic in comprehensive health insurance clinic Tur Sinai District was 140 patients and prevalence of DM is 25%.

Central Data processing and a Statistical Analysis Plan (SAP) before the study began. Continuous data were described by their mean, standard deviation, quartile, median, minimum and maximum. Categorical data were described by frequency and percentage. Comparative analysis and inferential statistics were performed using paired-t-test, Wilcoxon signed- rank, McNamara test for continuous variables. Chi-square test was used in case of categorical variables. For all statistical tests, P-value ≤ 0.05 was considered statistically significant. Multivariate logistic regression analyses were performed to find the predictive factors. Odds ratio (OR) was presented with its 95% CI. All statistical analysis was performed using IBM-SPSS program version 25.

RESULTS

The present study included 94 patients with T2DM with mean age of 49.5 ± 9.12 years. Of whom, 42 (44.7%) were male and 52 (55.3%) were females. The largest percentage of the studied patients was female and non-smokers. The baseline characteristics were reported Table 1.

About 55% of the studied patients had dyslipidemia. On assessing each item in lipid profile, (53.2%) of the studied patients had abnormally high triglycerides level, 46.9% of them had hypercholesterolemia, 45.9% had abnormal LDL-cholesterol level and 25.5% of them had low HDL level as seen in Table 2. There is statistically significant difference between the studied groups regarding fasting blood glucose and glycosylated hemoglobin (All were significantly higher among diabetic patients with dyslipidemia) as seen in Table 3.

Correlation analysis showed the following: There is statistically significant positive correlation between HBA1c and all of disease duration, total cholesterol, triglycerides, LDL and cholesterol levels while there is significant negative correlation between it and HDL cholesterol level. Furthermore, there is statistically non-significant positive correlation between disease duration, and all of total cholesterol, and LDL cholesterol levels while there is non- significant negative correlation between it and HDL cholesterol level. There is statistically non-significant positive correlation between disease duration, and triglycerides level. Most of patients with dyslipidemia reported low medication adherence. About 91.5% of patients had

lower adherence to their anti-diabetic medication. There is statistically significant difference between the studied groups regarding medication adherence (All patients with dyslipidemia reported low medication adherence, p=0.001).

Logistic regressions for variables independently predict presence of dyslipidemia in the studied diabetic patients showed that body weight and increasing HBA1c significantly increase the risk of dyslipidemia in diabetic patients by about 1.106 and 1.721 folds respectively. Increasing fasting blood glucose, disease duration non-significantly increase that risk by 1 and 1.112 folds respectively. Low medication adherence indefinitely predicts dyslipidemia. On the other hand, decreasing BMI and absence of hypertension protect against that risk by about 0.1 and 0.7 respectively (OR 0.893 and 0.487 respectively) as seen in Table 4.

Table 1. Distribution of the studied patients according to demographic characteristics and special habits

	Mean ± SD	Range
Age	49.5 ± 9.12	24 - 60
Weight (kg)	89.34 ± 14.36	55 - 118
Height (m)	1.7 ± 0.11	1.5 – 1.92
BMI (kg/m^2)	32.42 ± 7.07	16.34 – 47.61
Disease duration	6.95 ± 3.89	1 - 25
HBA1c (%)	8.46 ± 2.71	4.51 – 15.9
Fasting blood glucose (mg/dL)	183.91 ± 63.71	100 - 442
Total cholesterol (mg/dL)	195.34 ± 50.92	105 – 288
Triglycerides (mg/dL)	158.96 ± 66.18	5 – 299
HDL (mg/dL)	45.56 ± 7.84	30 - 65
LDL (mg/dL)	122.27 ± 43.66	32 - 197
	N	%
Gender:		
Male	42	44.7
Female	52	55.3
Education:		
None	7	7.4
Primary	10	10.6
Secondary	48	51.1
Tertiary	29	30.9
Smoking:		
No	58	61.7
Yes	36	38.3

BMI, body mass index, HDL, high density lipoprotein; LDL, low density lipoprotein, HbA1c, glycated hemoglobin A1c

Table 2. Distribution of the studied patients according to dyslipidemia

	N	%	Reference values
Dyslipidemia:			
Absent	42	44.7	
Present	52	55.3	
Cholesterol level:			
Normal	50	53.2	< 200 mg/d
Borderline to high	20	21.3	200 to 239 mg/dl
High	24	25.5	>240 mg/dl
Triglycerides level:			
Normal	44	46.8	<150 mg/dL
Borderline to high	28	29.8	150-199 mg/dL
High to very high	22	23.4	>200 mg/dL
LDL cholesterol:			
Normal	51	54.3	<129 mg/dL
Borderline to high	19	20.2	130-159 mg/dL
High to very high	24	25.5	>160 mg/dL
HDL cholesterol:			
Normal	70	74.5	40-50 mg/dL for men and 50-59 mg/dl for women
Low	24	25.5	<40 mg/dL for men and <50 mg/dL for women.
HDL, high density lipoprotein; LDL, low density lipoprotein			

Table 3. Relation between dyslipidemia in the studied patients and other data.

	Absent	Present	t	p
	Mean ± SD	**Mean ± SD**		
Age	50.31±8.53	48.85±9.59	0.772	0.442
Weight	84.31± 13.06	93.4 ± 14.19	-3.2	0.002*
Height	1.7 ± 0.1	1.7 ± 0.12	-0.318	0.751
BMI	29.65±5.97	32.84±7.61	-2.281	0.025*
Disease duration	5.84±3.94	7.85±3.63	3.568	<0.001**
Fasting blood glucose	157.76±50.54	204.54±65.84	-3.758	<0.001**
HBA1c	6.92 ± 1.78	9.69 ± 2.71	-5.951	<0.001**
	N (%)	**N (%)**	**X^2**	**p**
Gender:				
Male	23 (54.8)	23 (44.2)	0.01	0.922
Female	19 (45.2)	29 (55.8)		
Education level:				
Illiterate	3 (7.1)	4 (7.7)		
Primary	4 (9.5)	6 11.5)	0.429	0.934
Secondary	23 (54.8)	25 (48.1)		
Tertiary	12 (28.6)	17 (32.7)		
Smoking:				
No	27 (64.3)	31 (59.6)	0.214	0.643
Yes	15 (35.7)	21 (40.4)		

*p<0.05 is statistically significant, **p≤0.001 is statistically highly significant
BMI, body mass index, HbA1c, glycated hemoglobin A1c

Table 4. logistic regressions for variables independently predict presence of dyslipidemia in the studied diabetic patients

	β	OR	95% CI		p
			Lower	Upper	
Weight	0.101	1.106	1.021	1.199	0.013*
BMI	-0.114	0.893	0.770	1.035	0.133
Duration	0.106	1.112	0.954	1.295	0.175
Hypertension (No)	-0.720	0.487	0.487	1.506	0.211
FBG	0.001	1.001	0.988	1.014	0.863
HBA1C	0.543	1.721	1.152	2.572	0.008*

*p<0.05 is statistically significant, **p≤0.001 is statistically highly significant
BMI, body mass index, HbA1c, glycated hemoglobin A1c, FBG, Fasting blood glucose, OR odds ratio, CI confidence interval,

DISCUSSION

Both dyslipidemia and DM have been shown to be the predictors for associated comorbidities as HTN, and heart diseases. Fats play a role in the pathogenesis of DM. Dyslipidemia is frequently associated with DM. Abnormalities in fat metabolism have been reported in patients

with DM accompanied by the risk of cardiovascular arteriosclerosis [3].

This cross-sectional study was conducted on patients with T2DM. This study aimed to identify the relation between type 2 DM and the lipid profile disorders and reduce the complications associated with lipid dyslipidemia in patients with T2DM in Tur Sinai District. The study was conducted DM Clinic in comprehensive health insurance clinic Tur Sinai District and included 94 subjects with T2DM (more than 6 months duration). Study subjects were asked to complete questionnaires that contained demographic information including past and/or present medical history, and to return after fasting for more than 8 hours for blood sample. In the present study, there were more females (55.3%) than males (44.7%) with T2DM Most patients were secondary education and only 7.4% were none educated (table 3). The high percentage of females in this study may be due to the nature of population admitting to this hospital during morning clinic hours and to the tough living environment in Sinai.

In this study 61.7% of patients were non-smokers. This was promising as smoking is associated with increased risk of DM and dyslipidemia. Also, Smoking is an important risk factors of heart diseases. Its effects on vascular diseases act not by worsening control of blood pressure, glucose metabolism, and lipid metabolism. In patients with DM, it causes microangiopathy and diabetic microangiopathy [6]. In addition, all effects of smoking on metabolic diseases are not unclear. But stop smoking improves glucose and metabolism and decrease risk of impaired glucose tolerance, and diabetic microangiopathy. All patients with metabolic diseases must quit smoking for control of diseases and prevention of arteriosclerotic disease as soon as possible [6]. However, in our study percentage of smokers were low but there was no significant difference between the studied patients with and without dyslipidemia and smoking.

This study also, showed that most diabetic patients had high LDL, cholesterol and TAG levels (Table 7). However, there was a significant decline in mean concentration of HDL level. Hypertriacylglycerolemia (53.2%) was the major lipid parameter disorder in our study. This finding is in concord with previous studies who reported similar ratios in Hyderabad (60%) and Sudan (48.8%) [4, 13].

Our study showed that 44.2% of patients with dyslipidemia were males and 55.3 % were females. Also there was high TAG, LDL and low HDL cholesterol levels in DM patients. This result is similar to Asian Pacific Cohort Studies Collaboration [9]. The previous studies showed that LDL cholesterol may higher than our finding in T2DM patients [10].

Further study showed that there was no significant difference in serum TC and LDL cholesterol in patients with DM compared to control group [11]. On the other hand, dyslipidemia in DM patient type 2 is higher in previous studies in Haiderabid (70%), Nepail (22%), Sudan (94%) and Ghania (26.5%). This variation is due to differences in life style, genes, and DM management [12].

Glycemic control is one of the most important factors for diabetic patient's complications. Highlighting the factors associated with boor control of the blood glucose help health care providers in the areas that decrease the risks of diabetic complications. In the present study, most patients with dyslipidemia reported low medication adherence. About 91.5% of patients had lower adherence to their anti-diabetic medication. Also, the mean HbA1c was (8.46 ± 2.71) and this is closely related to the high percentage of people not

adherent to their anti-diabetic medication. Reasons for poor glycemic control is multi factorial. A previous study in type 2 DM found that more than 70% of patients poorly controlled their DM HbA1c >8% [13].

In our study there was a reflection of uncontrolled blood glucose. This means that we need to educate T2DM patients about regular follow-up of their blood glucose and the best glycemic control. In this study, we also tried to correlate lipid profiles with various clinical and anthropometric variables. It is observed that there is statistically significant difference between the studied groups regarding body weight, BMI and disease duration which were significantly higher among diabetic patients with dyslipidemia. This study had some limitation. Selection bias might be there since study participants were selected by consecutive sampling technique. Moreover, the study was cross-sectional and the relationship between the measured parameters may not be truly associated.

CONCLUSIONS

This study highlighted high prevalence of dyslipidemia associated with DM. The present study also highlights the importance of strict control of DM in prevention and treatment of dyslipidemia as dyslipidemia is more frequent in uncontrolled diabetic patients and decreasing BMI and absence of hypertension can protect against the risk of dyslipidemia.

Results suggest a high prevalence of dyslipidemia, which might be playing a major role in the development of cardiovascular diseases and cerebrovascular accidents among diabetic patients. Selection bias might be there since study participants were selected by consecutive sampling technique. Moreover, the study was cross-sectional and the relationship between the measured parameters may not be truly associated.

Declaration of interest
The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.
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REFERENCES

1. **Al-qaicy AGS**. Lipid Profile Alteration and Atherogenic Indices in Patients with DMII. International Journal of Multidisciplinary and Current Research. 2015; 3(Sept/Oct): 1003–1006.
2. **Biadgo B, Abebe SM, Baynes HW, Yesuf M, Alemu A, and Abebe M**. Correlation between Serum Lipid Profile with Anthropometric and Clinical Variables in Patients with Type 2 Diabetes Mellitus. Ethiopian Journal of Health Sciences. 2017; 27(3): 215–226.
3. **Dahal S, Baral BK, Baral S, Shrestha R, and Khanal M**. Study of fasting serum lipid and lipoproteins profile in type-II diabetic patients attending NMCTH. Nepal Medical College Journal : NMCJ. 2013; 15(1): 18–22.
4. **Elnasri HA, and Ahmed AM**. Patterns of lipid changes among type 2 diabetes patients in Sudan. Eastern Mediterranean Health Journal. 2008 14(2): 314–324.
5. **Gregg EW, Li Y, Wang J, Burrows NR, Ali MK, Rolka D, et al**. Changes in diabetes-related complications in the United States, 1990-2010. The New England Journal of Medicine. 2014; 370(16): 1514–1523.
6. **Jan SS, Rehman A, Ahmad R, Khan TM, Ahmad A, and Abrar A**. Evaluation of Pattern of Dyslipidemia in Type 2 Diabetics in Swat. Gomal Journal of Medical Sciences. 2011; 9(2): 243–246.
7. **Kengne AP, Patel A, Barzi F, Jamrozik K, Lam TH, Ueshima H, et al**. Cholesterol, diabetes and major cardiovascular diseases in the Asia-Pacific region. Diabetologia. 2007; 50(11): 2289–2297.
8. **Krauss RM**. Lipids and lipoproteins in patients with type 2 diabetes. Diabetes Care. 2004; 27(6): 1496–1504.
9. **Morisky DE, Green LW, and Levine DM**. Concurrent and predictive validity of a self-reported measure of medication adherence. Medical Care. 1986; 24(1): 67–74.
10. **Mullugeta Y, Chawla R, Kebede T, and Worku Y**. Dyslipidemia Associated with Poor

Glycemic Control in Type 2 Diabetes Mellitus and the Protective Effect of Metformin Supplementation. Indian Journal of Clinical Biochemistry. 2012; 27(4): 363–369.

11. **Ogurtsova K, da Rocha Fernandes JD, Huang Y, Linnenkamp U, Guariguata L, Cho NH, et al**. IDF Diabetes Atlas: Global estimates for the prevalence of diabetes for 2015 and 2040. Diabetes Research and Clinical Practice. 2017; 128: 40–50.
12. **Saito K and Sone H.** Effect of smoking on diabetes mellitus and dyslipidemia (effect of smoking on glucose and lipid metabolism. Nihon Rinsho. Japanese Journal of Clinical Medicine. 2013; 71(3): 443–448.
13. **Shaikh MA Kumar S and Ghouri RA**. Type 2 diabetes mellitus and lipid abnormalities. Journal of the Liaquat University of Medical and Health Sciences. 2010; 9(3): 145–147.

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