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Impact of Risk Factors on Diabetic Retinopathy Among A sample of Patients with type 2 Diabetes

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Abstract:
Background: Diabetic retinopathy (DR) is the most common long-term complication of diabetes mellitus (DM) and the most common cause of vision loss in the adult population. Diabetic retinopathy affects one in every three DM and so requires extensive research for both prevention and therapy. People at risk of vision loss are predicted to double by the year 2030, along with the increasing rate of the diabetes epidemic. The aim of this study is to assess the impact of risk factors that could be associated with DR among type2 D.M patients in Iraq. The risk factors include age, gender, duration of D.M., Body Mass Index and laboratory investigations [Fasting blood sugar, HbA1c, lipid profile. Methods: A case control study was done with 120 participants from ophthalmic clinics divided into three groups 40 control (healthy without disease),40 patients with type 2D.M without D.R and 40 patients with type 2D.M with D.R. Results: Age, duration ,high body mass index , high F.B.S, high HbA1C, High cholesterol and triglycerides, very low density lipoprotein cholesterol and low high density lipoprotein cholesterol were highly significant associated with DR (P =0.0001, 0.0001, 0.0001, 0.0001,0.0001,0.023,0.0001,0.0001, 0.0001) respectively while gender and low density lipoprotein cholesterol was not significant (0.061, 0.213.Controlling these risk factors might help in preventing D.R.
Keywords*: Diabetes Mellitus, Diabetic retinopathy, Type 2 Diabetes Mellitus, Lipid profile.*

INTRODUCTION:

The prevalence of Diabetes mellitus (DM) is rapidly rising globally at a threatening rate. According to the world health organization, 346 million individuals globally were diagnosed with diabetes, among which 90% of individuals have T2DM. This value is expected to rise to 380 million individuals by the year 2025 [(1)]
There is a globally agreed target to halt the rise in diabetes and obesity by 2025. [(2)]Diabetes mellitus (DM) is a group of chronic metabolic diseases caused by genetic, environmental, and autoimmune diseases. Long-term metabolic disorders can lead to microvascular and macrovascular diseases, neurological complications [(3)]Diabetic retinopathy (DR) is the most common long-term complication of diabetes mellitus and the most common cause of vision loss in the adult population [(4)]DR affects one in every three DM and so requires extensive research for both prevention and therapy [(5)]Vascular autoregulation is affected by diabetes mellitus also damages the microvascular system, especially in the retina and optic nerve. [(6)]There are two types of diabetic retinopathy (DR): nonproliferative (NPDR) and proliferative (PDR) [(7)]People at risk of vision loss are predicted to double by the year 2030, along with the increasing rate of the diabetes epidemic [(8)]Despite advances in optimal management of hyperglycemia and hypertension, regarded as systemic risk factors for DR, the prevalence of DR is still high in diabetic patients. [(9)]Although many preventive measures and treatment methods have been used, DR has remained to be the leading cause of blindness in the 21st century [(10)]The aim of this study is to assess the impact of risk factors for D.M on diabetic DR which include age, gender, duration of D.M, BMI, laboratory tests which include Fasting blood sugar, HbA1c, Lipid profile tests

which include Cholesterol, Triglycerides, High-Density Lipoprotein Cholesterol, Low-Density Lipoprotein Cholesterol, Very Low-Density Lipoprotein Cholesterol.

Material and Methods:

A case control study was done with 120 participants from ophthalmic clinic at Alkindy hospital in Baghdad city in Iraq during the period from November 2019 till April 2020, which is classified into three groups : first group which includes 40 participants who were healthy without history of any disease, second group includes 40 with type 2 D.M without diabetic retinopathy and last group which includes 40 participants with type 2 D.M with diabetic retinopathy. The classification is done according to ophthalmic examination, including best corrected visual acuity (BCVA; measured with the Snellen chart), biomicroscopic evaluation, intraocular pressure measurement with Goldmann applanation tonometry, and biomicroscopic fundoscopy with a 90-D lens. Spectral-domain optical coherence tomography (SD-OCT) and fundus fluorescein angiography (FFA) were performed after the ophthalmic examination. FFA images were recorded with a digital fundus camera system (Zeiss Visucam 500). After pharmacologic pupil dilation with tropicamide 1% drops, 5 mL of 10% fluorescein sterile dye (Novartis Pharma, Bern, Switzerland) was injected intravenously into the antecubital vein.The minimum criterion for the diagnosis of DR was the presence of at least one definite microaneurysm in any field photographed [11,12]All the participants were nonsmokers and without history of hypertension or history of hypertension in the last year with controlled hypertension with blood pressure below130\80, the participants were assessed for many risk factors which include duration of T2 D.M, Body Mass Index (BMI), fasting blood sugar (FBS), Hemoglobin A1C(HbA1C), Cholesterol, Triglycerides(TG),High-Density Lipoprotein Cholesterol(HDL-C), Low-Density Lipoprotein Cholesterol(LDL),Very Low-Density Lipoprotein Cholesterol (VDRL). Criteria for the diagnosis of diabetes is HbA1C≥ 6.5% (≥48 mmol\mol) or FPG≥ 126mg\dL (≥7.0mmol\Fasting is defined as no caloric intake for at least hours) [13]Hypertension is defined as an average systolic blood pressure (SBP) of ≥140 mmHg and/or an average diastolic blood pressure (DBP)of≥90mmHg. [14]A normal level of total cholesterol in blood is defined as total blood cholesterol below 5.18 mmol/l. Body mass index (BMI) was calculated as the ratio of weight to height squared (kg/m2). According to standard criteria in adults, participants with a BMI ≥24 [15]Duration of DM—Duration of DM was defined as the time between the age at diagnosis and the time of examination. They were categorized into the following groups: Group 1 <5 years, Group 2 5–10 years, Group 311–15 years, and Group 4 >15 years [16]

Results:

Table (1): Association between Socio-demographic characteristics, duration of type 2 D.M and BMI and D.R of the study sample

		Diabetic retinopathy		T2DM		Controls		P value
		No.	%	No.	%	No.	%	
Age (years)	40-49	2	5.0	9	22.5	20	50.0	0.0001*
	50-59	16	40.0	13	32.5	15	37.5	
	60-69	22	55.0	18	45.0	5	12.5	
	Mean±SD (Range)	60.7±6.2 (49-69)		56.7±8.1 (43-69)		50.6±7.4 (40-69)		0.0001^
Gender	Male	24	60.0	14	35.0	22	55.0	0.061
	Female	16	40.0	26	65.0	18	45.0	
	1-<5	-	-	13	32.5	-	-	0.0001*

Duration of T2DM (years)	5-10	3	7.5	19	47.5	-	-	
	11-15	8	20.0	8	20.0	-	-	
	>15years	29	72.5	-	-	-	-	
	Mean±SD (Range)	15.5±3.5 (8-22)		6.6±3.4 (1-14)		-		0.0001#
BMI (Kg/m2)	Normal (18.5-24.9)	6	15.0	4	10.0	4	10.0	0.0001*
	Overweight (25-29.9)	13	32.5	10	25.0	31	77.5	
	Mean±SD (Range)	32.1±6.5 (20.8-41.7)		32.7±5.7 (21.9-40.9)		27.6±2.5 (22.3-34.5)		
	Obese (=>30)	21	52.5	26	65.0	5	12.5	
*Significant difference between percentages using Pearson Chi-square test (χ^2-test) at 0.05 level.								
#Significant difference between two independent means using Students-t-test at 0.05 level.								
^Significant difference among more than two independent means using ANOVA-test at 0.05 level.								

Table 2: Association between Lab. Investigations and D.R of the participants

	Diabetic retinopathy	**T2DM**	**Controls**	**P value**
FBS (mg/dL)	227.6±62.1 (135-372)	213.7±57.7 (140-320)	89.1±8.0 (70-99)	0.0001^
HbA1C (%)	9.2±1.5 (6.4-11.9)	8.1±1.5 (6.0-11.5)	5.1±0.3 (4.4-5.6)	0.0001^
Cholesterol (mg/dL)	194.3±40.7 (127-272)	179.8±43.6 (120-270)	171.9±19.9 (117-192)	0.023^
TG (mg/dL)	215.3±55.7 (153-340)	172.1±48.7 (100-342)	117.0±21.7 (73-148)	0.0001^
HDL-C (mg/dL)	31.7±3.6 (25-39)	35.8±5.2 (27-49)	41.1±2.6 (38-46)	0.0001^
LDL-C (mg/dL)	118.9±39.0 (49.2-193)	107.6±39.9 (56.0-192)	107.4±19.9 (48.2-133.6)	0.213
VLDL (mg/dL)	44.6±14.8 (30.6-88.8)	34.9±11.9 (20.0-89.4)	23.3±4.5 (13.4-29.6)	0.0001^
#Significant difference between two independent means using Students-t-test at 0.05 level.				
^Significant difference among more than two independent means using ANOVA-test at 0.05 level.				

Table (3) Association between two independent groups and among the three groups.

	ALL	DM Retinop x Control	T2DM x Control	DM Retinop x T2DM
FBS (mg/dL)	0.0001^	0.0001#	0.0001#	0.303
HbA1C (%)	0.0001^	0.0001#	0.0001#	0.003#
Cholesterol (mg/dL)	0.023^	0.003#	0.300	0.130
TG (mg/dL)	0.0001^	0.0001#	0.0001#	0.0001#

HDL-C (mg/dL)	0.0001^	0.0001#	0.0001#	0.0001#
LDL-C (mg/dL)	0.213	0.101	0.977	0.204
VLDL (mg/dL)	0.0001^	0.0001#	0.0001#	0.002#
#Significant difference between two independent means using Students-t-test at 0.05 level.				
^Significant difference among more than two independent means using ANOVA-test at 0.05 level.				

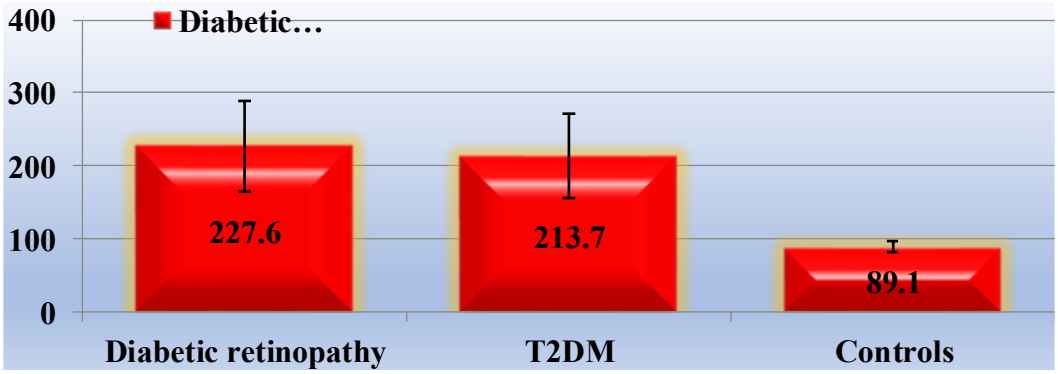

Figure (1) showed mean F.B.S in the three groups

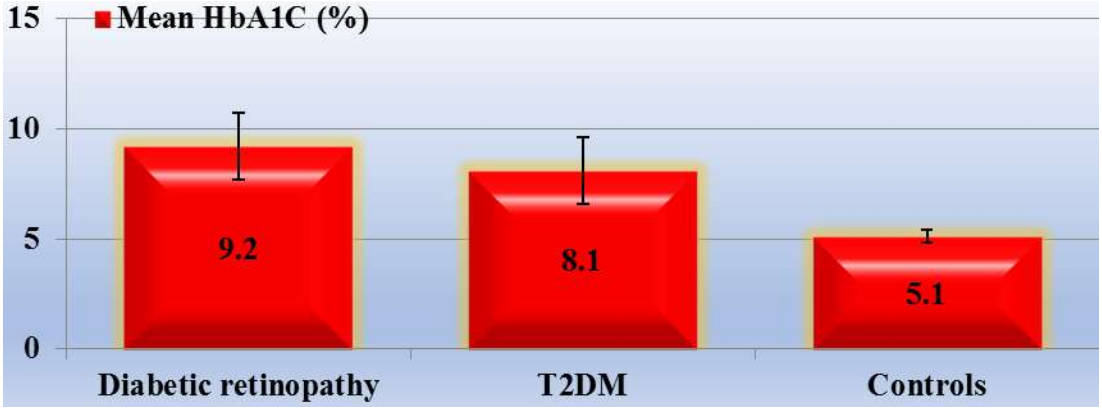

Figure (2) showed mean HbA1c% in the three groups

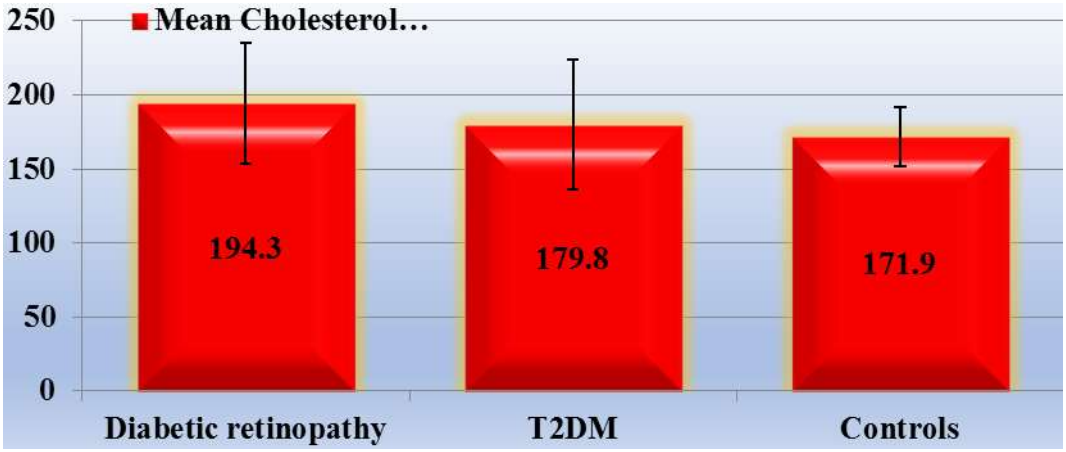

Figure (3) showed mean cholesterol in the three groups

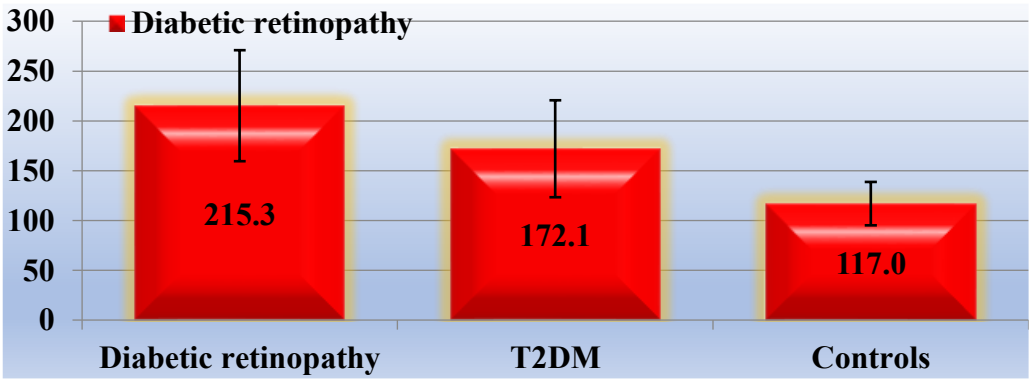

Figure (4) showed mean Triglycerides in the three groups

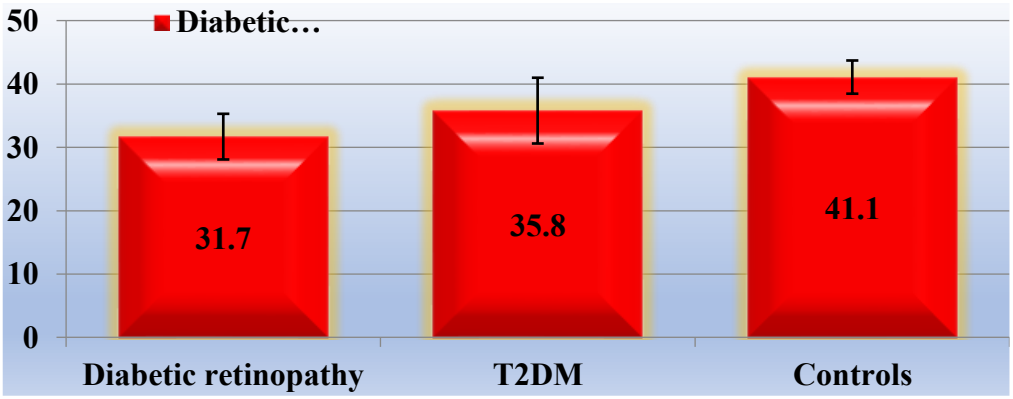

Figure (5) showed mean HDL-Cholesterol(mg\dL) in the three groups

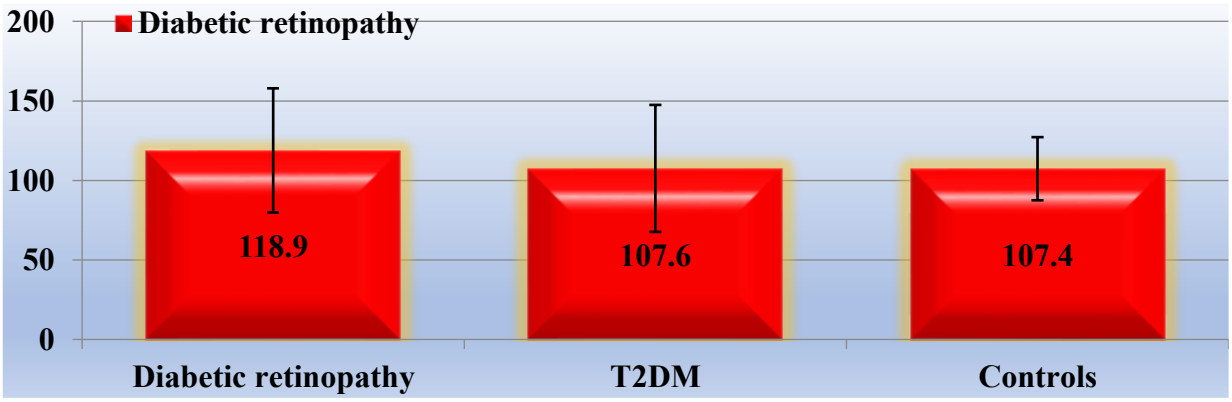

Figure (6) showed mean LDL-Cholesterol(mg\dL) in the three groups

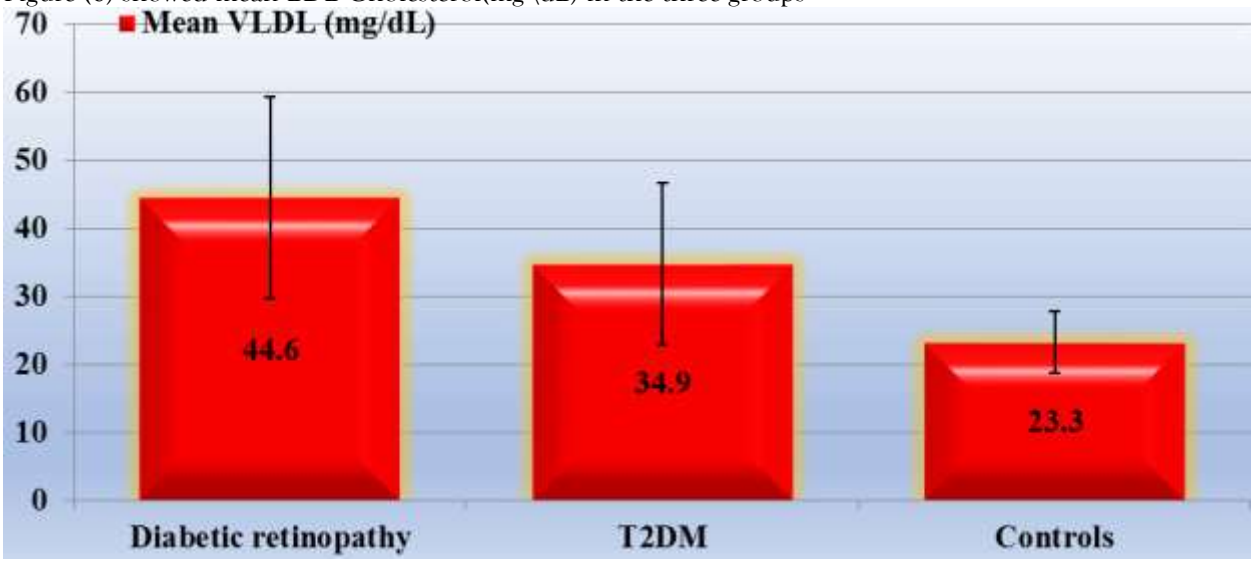

Figure (7) showed mean VLDL (mg\dL) in the three groups

DISCUSSION:

Diabetes is a chronic illness which needs both medical care and the patient's self-management education to prevent acute complication and reduce the risk of long term complication

Diabetic retinopathy patients tend to be more in old age, with the highest percentage (55%) in the 60–69 age group. There is a higher significant association between D.R patients and old age compared to controls (P = 0.0001) which goes with Al-Amer, R. etal study [16]

There was no significant association between gender and D.R which is not matched with Cherchi, S etal study [17] with a significant higher prevalence in men as compared to women (22.0% vs. 19.3% p < 0.0001)

The study found all patients who had diabetes for ≥15 years had D.R with high significant association (0.0001) which is agreed with Al-Amer, R. etal [16] which showed that the duration of the disease was strongly associated with the frequency of retinopathy,

About BMI Obesity is prevalent in the T2DM groups, with 52.5% of D.R patients and 65% of non-retinopathy T2DM patients classified as obese. The control group mostly falls into the overweight category (77.5%). There's a significant difference in BMI distribution (P = 0.0001) which goes with Qiu-Xue Yi etal [18] which showed A higher BMI was associated with elevated risk of DR.

This study showed a high Significant association between high F.B.S, Hb.A1C, with D.R which goes with T Shakthiya1u [19] that found a significant association between blood glucose, HbA1c, and the duration of diabetes in patients with NPDR and those without DR

Higher HbA1C levels are linked to health complications, so reaching and maintaining patients' goal is key to living well with diabetes. For most people with diabetes, the A1C goal is 7% or less [20].

In addition to high significant association between high results of F.B.S, HbA1C in diabetic and diabetic retinopathy patients there was also high significant association between high level of TG (mg/dL), VLDL (mg/dL), and law level of HDL-C (mg/dL),this result goes with a study done by Kajal Seema S.etal [21] which showed higher fasting blood glucose (176.79±59.13 vs 138.46±49.44 mg/dl, p<0.001) and higher HbA1c levels (8.21±1.38 vs 7.48±1.25 %, p=0.002) were significantly associated with DR, also goes with Alattas study[22] which conclude that Elevation in serum triglyceride levels showed a statistically significant association with diabetic retinopathy but not agreed with the result of a study done by Romero-Aroca etal[23] who

conclude that one of the variables that most influenced the development of DR in our study, based on significance and cumulative hazard (CH), was LDL-C cholesterol this might be related to genetic causes or life style ,also agreed with study Zhenzhen Liu [24] which concluded that Increased lipid levels were risk factors for DR

CONCLUSION

High F.B.S, Hba1C, Cholesterol, TG, V.L.D.L had impact for the development of D.R, so control of these risk factors may protect against D.R in addition to control obesity by getting normal B.M.I.

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