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Research Article

Evaluation of the Role of Arginase1 Enzyme in Type 2 Diabetics with and without Retinopathy

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Abstract

Background: Oxidative stress plays a major role in the pathogenesis of diabetes mellitus by damaging cellular organelles and enzymes in blood such as arginase1, insulin and glutathione s-transferase; increasing lipid peroxidation such as malondialdehyde and increasing insulin resistance which can lead to diabetic complications such as diabetic retinopathy.

Objectives: To explore the relationship of oxidative stress to the development of diabetic retinopathy by measuring the levels of Arginase1, the activity of glutathione s-transferase enzyme, and the levels of malondialdehyde as a secondary product of lipid peroxidation (biomarker for oxidative stress).

Methods This study was conducted from November 2022 to January 2023 at the Ibn Al-Haitham Teaching Eye Hospital in Baghdad, the University of Baghdad / Department of Chemistry and the National Diabetes Centre for Treatment and Research at Al-Mustansyrriah University. This study was conducted on 120 subjects distributed as follows: 40 non-diabetic obese controls, 40 type 2 diabetics with no retinopathy, and 40 type 2 diabetic retinopathy patients, between 30 and 65 years of age. All groups were subjected to tests: measuring fasting blood glucose (FBG), HbA1c, lipid profile (cholesterol, triglycerides, HDL- cholesterol, LDL- cholesterol, and VLDL cholesterol), serum total arginase1, malondialdehyde glutathione s -transferase, body mass index (BMI), and waist-to-hip ratio.

Results: Mean arginase1 levels were significantly higher in diabetic patients than in diabetic retinopathy and control groups. The mean oxidative stress marker malondialdehyde concentration was significantly higher in diabetic retinopathy patients than in type 2 diabetics and the control group. The mean glutathione s-transferase activity in diabetic retinopathy patients was significantly higher than in the control group and type 2 diabetics.

Conclusion: There is a relationship between oxidative stress and the development of diabetic retinopathy, where the levels of arginase1 and malondialdehyde increased and the activity of glutathione s –transferase enzyme increased as a result of oxidative stress and inflammation associated with complications of type 2 diabetes.

Keywords: Arginase1; Diabetic Retinopathy; Type 2 Diabetes mellitus; Oxidative Stress; Lipid Profile

Introduction

Diabetes mellitus (DM) is one of the most common chronic metabolic diseases marked by high blood sugar (hyperglycemia) which may lead to life-threatening, debilitating, and expensive consequences and to a lower life expectancy (1). Type 2 diabetes mellitus (T2DM), makes up over 90% of all instances of the disease and is characterized by insulin resistance (IR) and β-cell dysfunction at the beginning of the disease. DM and its consequences have been linked to oxidative stress, and inflammatory responses (2), which lead to damages, malfunctions, and failure in different systems. DM patients develop long-term health problems in the kidneys, blood vessels, nerves, heart, and eyes (diabetic retinopathy) (3). Cellular damage, oxidative stress, and reactive oxygen species (ROS) caused by hyperglycemia contribute to diabetes complications; one of which is retinopathy4 Diabetic retinopathy (DR) is a neurovascular condition that is generally asymptomatic, but ophthalmoscopic examination shows microaneurysms and leakage of microscopic arteries, which may cause the retina to expand and to cause vision loss (5). An important factor in the development of DM is oxidative stress, because of glucose oxidation, nonenzymatic protein glycation, and the oxidative breakdown of glycated proteins that follow, and an overabundance of free radicals. The significant increases in the formation of free radicals may be assessed indirectly by the presence of products of lipid peroxidation, mainly malondialdehyde (MDA) (6), which is frequently used as a biomarker for evaluating oxidative stress, making elevated circulating MDA levels a risk factor in patients with diabetic retinopathy (7). Additionally, due to oxidative stress, Glutathione S-Transferase

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(GST) activity increases in DM, and this enzyme is significantly associated with the detoxification. It is primarily involved in the neutralization of reactive oxygen species (ROS) by enzymatic conjugation with the scavenger peptide glutathione (GSH)(8). Arginase and GST are involved in hormone synthesis, intracellular transport, and oxidative stress resistance (9). DM disrupts the majority of the body's enzyme functions as well as other essential elements involved in diabetic complications. Arginase is a key enzyme whose activity rises with DM, causing retinal tissue damage because it affects the synthesis of nitric oxide, which is essential for endothelial function (10). An enzyme called arginase hydrolyzes arginine to produce urea and ornithine. It is present in every cell and tissue and is crucial for the early onset of vascular problems and diabetic retinopathy in T2DM, which is now among the main causes of blindness and death (11). Diabetes causes a decrease in retinal blood flow, which is thought to be implicated in the development of diabetic retinopathy. The purpose of the study is to measure the levels of arginase1, MDA, and GST activity to determine the relationship between arginase1 and oxidative stress in T2DM patients with retinopathy as well as the function of arginase1 in the development of inflammation that causes diabetic complications.

Patients and Methods

This study was conducted between November 2022 to January 2023 at the Ibn Al-Haitham Teaching Eye Hospital in Baghdad, the Department of Chemistry, College of Science for Women, University of Baghdad, and the National Diabetes Centre for Treatment and Research at Al-Mustansyrriah University. This study was conducted on 120 subjects distributed as follows: 40 non-diabetic obese controls, 40 type 2 diabetics with no retinopathy, and 40 type 2 diabetic retinopathy patients, between 30 and 65 years of age. The diagnosis of DR is based on the symptoms of blurred vision, floaters and flashes, and loss of vision. Additionally, a physical examination of the fundus pictures and a computer diagnostic method were used in the diagnosis. Patients with chronic liver, kidney, heart failure, type 1 diabetes, and gestational diabetes were excluded. They were excluded as the current study was designed to include T2DM patients only, with those having DR as a complication of the disease, to show the effect of high blood glucose on the retina and the enzymes specified in the study. Patients with T2DM, with and without retinopathy were included. Each participant (patient and control) had 10 mL of venous blood taken with a disposable needle. The blood was divided into two tubes: The first was a gel tube to collect serum (when the blood clotted, it was spun at 3000 rpm for 10 minutes at room temperature), and the second was an ethylene diamine tetra acetic acid (EDTA) tube and tested for HbA1c. The total quantity of Arginase and Malondialdehyde in human blood was measured using an enzyme-linked immunoassay (ELISA) kit from Elabscience-USA. The FUJIFILM NX600 was used to determine fasting blood glucose (FBG) after a minimum of eight hours of fasting and lipid profile (cholesterol, triglycerides, HDL-cholesterol, LDL-cholesterol, and VLDL-cholesterol). HbA1c was determined using the Finecare HbA1c rapid quantitative test. The spectrophotometer was used to measure the activity of GST manually by measuring the conjugation of 1-Chloro2,4 dinitro benzene (CDNB) with Glutathione (GSH). The 1 ml assay mixture contained 0.5 mM CDNB, 1 mM Reduced (GSH), and 100 mM potassium phosphate buffer, pH 6.5. The rate of increase in absorbance at 340 nm was measured for 5 mm at 37°C against a blank containing the reaction mixture without enzyme (13). Body Mass Index (BMI) was calculated from the equation [weight in kilograms/ height in square meters] and waist-to-hip ratio (waist centimeter hip centimeter) was also measured. The data was analyzed using the Statistical Packages for Social Sciences (SPSS Version 26) (14). The correlation coefficient (r), the ANOVA test for differences between three independent variables and estimates via analysis of the linear regression between the values were used. The data was shown as mean± SE. Statistically, significance was at (P-value < 0.05).

Results

Table 1 shows that diabetics with retinopathy had higher mean levels of HbA1C, TG, and VLDL-C than the other two groups. As for other biochemical parameters, there were no consistent differences between the three groups. Significant differences between the three groups were found in cholesterol and HDL-C, while highly significant differences were found in FBS, HbA1C, and LDL-C. Non-significant differences in TG and VLDL were found.

Table (1): Mean ± SE of biochemical parameters in the study groups

Parameters	Study Groups - Mean ± SE - (Median)			P-value
	Control	Diabetes mellitus	Retinopathy Diabetics	
FBS (mg/dL)	98.4±1.44 [a] (100.5)	216.9±12.89 [b] (205)	199.4±13.65 [b] (180)	**0.0001
HbA1c%	5.2±0.07 [a] (5.25)	8.1±0.22 [ab] (8.15)	9.8±1.62 [b] (8.4)	**0.004
Cholesterol (mg/dL)	196.4±3.86 [b] (200)	174.8±8.26 [a] (165)	191.6±6.20 [ab] (189.5)	*0.045
TG (mg/dL)	190.1±9.85 [a] (196)	178.5±13.10 [a] (169.5)	201.0±18.04 [a] (176.5)	0.530
HDL-C (mg/dL)	36.7±0.95 [a] (36.05)	42.0±1.60 [b] (39.5)	37.3±1.55 [a] (35)	* 0.016
LDL-C (mg/dL)	121.4±3.99 [a] (124)	94.9±5.99 [b] (97.5)	113.5±5.43 [a] (113.5)	**0.002
VLDL-C (mg/dL)	37.6±2.06 [a] (39)	35.2±3.72 [a] (30.5)	39.9±3.61 [a] (34.1)	0.587

* Statistically significant, ** statistically highly significant

The arginase1 levels ng/mL show statistically highly significant differences between the groups. Arginase level in the DM and retinopathy groups compared to the control (*p*-value ≤0.05). Table 2 shows highly significant differences between the three groups in the (mean± SE) of arginase 1, MDA and GST. Those with DR had a higher mean Arginase 1 than the controls but lower than the other diabetics, while they had the highest means of MDA and GST than the two other groups.

Table (2): Arginase1, MDA levels and GST activity in patients and control groups

Biochemical Parameters	Study Groups – Mean ± SE - (Median)			P-value
	Control	Diabetes mellitus	Retinopathy Diabetics	
Arginase1 (ng/ml)	41.8±1.66 [a] (38.56)	113.8±4.12 [b] (112.6)	85.0±4.90 [c] (82.19)	**0.0001
Malondialdehyde (ng/ml)	366.7±13.24 [a] (387.40)	581.7±16.53 [b] (605.96)	627.2±22.71 [b] (585.93)	**0.0001
GST activity (IU/L)	7.7±0.94 [a] (6.25)	6.5±0.75 [a] (4.95)	17.0±2.69 [b] (8.8)	**0.0001

** Statistically highly significant

Correlation of Arginase1 and Other Clinical Variables: The correlation coefficient of arginase1 levels with various anthropometric and biochemical variables for the three study groups are shown in Table 3. There was a negative correlation between arginase1 and weight, height and a positive correlation between arginase1 and cholesterol in the control group and a negative correlation between arginase1 and MDA in the retinopathy group.

Table (3): Correlation between Total arginase1 and Study Parameters

Parameters	Correlation of Arginase1 (ng/ml) in the study groups					
	Control		Diabetes mellitus patients		Retinopathy Diabetes patients	
	R	P	R	P	R	P
Age (years)	0.166	0.306	-0.163	0.316	0.136	0.402
Weight (kg)	-0.360*	0.022	0.092	0.571	-0.195	0.228
Height (cm)	-0.327*	0.039	-0.044	0.788	0.064	0.697
BMI (Kg/m2)	-0.192	0.235	0.095	0.560	-0.301	0.059
W/H ratio	-0.104	0.523	-0.111	0.495	-0.244	0.129
FBS (mg/dL)	-0.261	0.103	-0.118	0.470	0.103	0.527
HbA1C %	0.077	0.636	0.301	0.059	-0.009	0.954
Cholesterol (mg/dL)	0.342*	0.031	-0.139	0.391	0.286	0.074
TG (mg/dL)	0.105	0.519	-0.151	0.352	0.046	0.779
HDL-C (mg/dL)	-0.019	0.907	0.075	0.647	0.056	0.729
LDL-C (mg/dL)	0.288	0.071	-0.064	0.694	0.296	0.063
VLDL-C (mg/dL)	0.121	0.456	-0.066	0.686	0.047	0.775
Malondialdehyde (ng/ml)	0.103	0.525	-0.266	0.098	-0.336*	0.034
GST activity (IU/L)	0.270	0.093	0.162	0.318	-0.037	0.822

* Correlation is significant, **Correlation is highly significant P= p-value, R= Regression

ROC analysis for Arginase1: The arginase1 ROC analysis yielded an excellent result with an area under the curve of (0.948), indicating a flawless ROC test. Table (4 and Figure 1) show the area under the curve for arginase1 in T2DM retinopathy patients.

Table (4): Area under the curve of arginase1 between DR and control group

Area Under the Curve - Test Result Variable(s): Arginase1							
Area	Std. Error[a]	Asymptotic Sig.[b]	Cut-Off Point	Sensitivity	1 – Specificity	Asymptotic 95% Confidence Interval	
						Lower Bound	Upper Bound
.948	.028	.000	60.40	.850	.050	.893	1.000
a. Under the nonparametric assumption							
b. Null hypothesis: true area = 0.5							

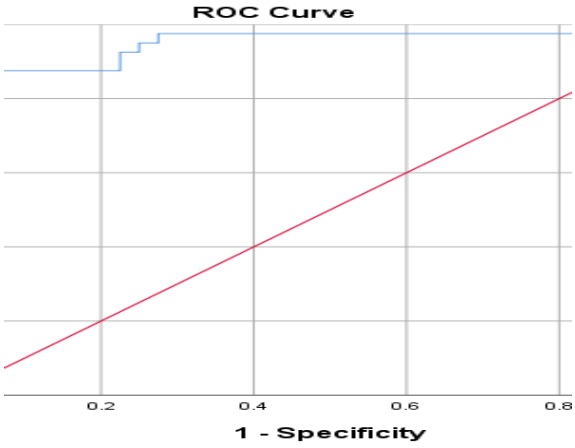

Figure 1 ROC analysis of arginase1 - DR and control

Correlation of Malondialdehyde enzyme levels and other clinical variables: The correlation coefficient of malondialdehyde levels with various anthropometric and biochemical variables for the three study groups are shown in Table (5). A positive correlation was found between height and MDA and a negative correlation was found between MDA and BMI in DM group. A positive correlation was found between MDA and cholesterol in the control group. A negative correlation was found between MDA and arginase1 in the DR group.

Table 5: Correlation between MDA and Study Parameters

Parameters	Malondialdehyde (ng/ml)					
	Control Group		Diabetes mellitus patients Group		Retinopathy Diabetes patients Group	
	R	P	R	P	R	P
Age (years)	0.099	0.544	-0.043	0.791	0.001	0.993
Weight (kg)	-0.097	0.553	-0.129	0.428	0.092	0.572
Height (cm)	-0.049	0.766	0.341*	0.031	0.043	0.793
BMI (Kg/m2)	-0.056	0.732	-0.329*	0.038	0.110	0.498
W/H ratio	0.123	0.450	0.287	0.073	-0.013	0.934
FBS (mg/dL)	0.230	0.153	-0.009	0.956	0.046	0.779
HbA1C %	-0.027	0.868	-0.014	0.932	-0.092	0.572
Cholesterol (mg/dL)	0.325*	0.040	-0.187	0.247	0.008	0.961
TG (mg/dL)	0.033	0.839	-0.091	0.578	-0.008	0.963
HDL-C (mg/dL)	0.281	0.080	-0.262	0.103	0.078	0.631
LDL-C (mg/dL)	0.259	0.107	-0.027	0.871	-0.014	0.932
VLDL-C (mg/dL)	0.036	0.826	0.174	0.282	-0.007	0.967
Arginase1 (ng/ml)	0.103	0.525	-0.266	0.098	-0.336*	0.034
GST activity (IU/L)	-0.060	0.714	0.241	0.134	-0.074	0.650

*Correlation is significant at the 0.05 level. **Correlation is significant at the 0.01 level.
P = p value, R= Regression

Correlation of GST Activity and other Clinical Variables: The correlation coefficients between Glutathione S-Transferase and various anthropometric and biochemical variables for the three study groups are shown in table (6). A positive correlation was found between GST and height and a negative correlation was found between BMI and GST in the DM group and a positive correlation was found between GST and cholesterol in the control group and a negative correlation was found between Arginine 1 and GST in the DR group.

Table (6): Correlation between GST and Study Parameters

Parameters	Glutathione S-Transferase					
	Control Group		Diabetes Mellitus Patients Group		Retinopathy Diabetes patients Group	
	R	P	R	P	R	P
Age (years)	0.099	0.544	-0.043	0.791	0.001	0.993
Weight (kg)	-0.097	0.553	-0.129	0.428	0.092	0.572
Height (cm)	-0.049	0.766	0.341*	0.031	0.043	0.793
BMI (Kg/m2)	-0.056	0.732	-0.329*	0.038	0.110	0.498
W/H ratio	0.123	0.450	0.287	0.073	-0.013	0.934
FBS (mg/dL)	0.230	0.153	-0.009	0.956	0.046	0.779
HbA1C %	-0.027	0.868	-0.014	0.932	-0.092	0.572
Cholesterol (mg/dL)	0.325*	0.040	-0.187	0.247	0.008	0.961
TG (mg/dL)	0.033	0.839	-0.091	0.578	-0.008	0.963
HDL-C (mg/dL)	0.281	0.080	-0.262	0.103	0.078	0.631
LDL-C (mg/dL)	0.259	0.107	-0.027	0.871	-0.014	0.932
VLDL-C (mg/dL)	0.036	0.826	0.174	0.282	-0.007	0.967
Arginase1 (ng/ml)	0.103	0.525	-0.266	0.098	-0.336*	0.034
GST activity (IU/L)	-0.060	0.714	0.241	0.134	-0.074	0.650

*Correlation is significant at the 0.05 level. **Correlation is significant at the 0.01 level. P = p value, R= Regression

Discussion

DM results from the insufficient amount or activity of insulin produced by the pancreas which leads to elevated blood glucose levels. Insulin resistance and insufficiency is associated with an increased risk of microvascular damage (15). For the glycemia-associated risks of microvascular and macrovascular consequences of diabetes mellitus, the glycated hemoglobin HbA1c is regarded as the gold standard (16). The levels of HbA1c and the duration of (DM) are significant risk factors for diabetic retinopathy (17). Overweight or obesity increases the chance of developing T2DM and insulin resistance. We included obese individuals in the control group to determine arginase1 levels in all groups and its relationship to oxidative stress and inflammation by measuring the effectiveness of GST as an antioxidant enzyme and malondialdehyde as products of lipid peroxidation in this group of patients. The data show that, except for lower the HDL levels. Patients have hyperlipidemia in terms of lipid features. The lipid profile of obese controls was abnormal, and the patients' groups had high levels of VLDL because hyper-insulinemia and that agree with other study they said hyperglycemia enhance the liver's synthesis of VLDL-C. Plasma VLDL-C particle turnover may increase plasma VLDL-C concentrations have while plasma HDL-C concentrations dropped (18). Diabetes eye complications have become one of the leading causes of blindness due to an increased risk of microvascular illness, among other complications including retinopathy, neuropathy and nephropathy all of which can lead to disability, dependency, accelerating morbidity, and mortality. Diabetes causes disruptions in most of the body's enzyme activities and other vital factors that are involved in diabetes complications, one of which is arginase1 its activity increases with diabetes mellitus, leading to retinal problems because it has an effect on the production of nitric oxide, which is crucial for endothelial function (19). Moreover, arginase1 levels rise when obesity-related BMI rises influencing how T2DM condition develops (20). T2DM patients with problems like retinopathy had considerably higher MDA levels than those without problems. MDA, being the most major risk factor, might be used in combination with antioxidants to assess oxidative stress in T2DM patients (21). Individuals with T2DM with retinopathy had higher levels of serum GST activity, indicating a significant presence of oxidative stress in those patients and that agree with the other study that say implying that GST is an important biochemical instrument that could provide significant insight into the oxidative stress prevalent in a variety of diseases (22). A possible explanation is the DM group had higher arginase1 activity than the control group. Arginase1 may contribute to the development of DM and its repercussions because of its regulatory role in β-cell functioning and vascular dysfunction by influencing L-arginine metabolism, inflammatory responses, and oxidative stress (23). A key mechanism in the development of microangiopathy is the enhanced lipid peroxidation and peroxyl radical production brought on by hyperglycemia and dyslipidemia in DM (24). In this study malondialdehyde levels were high in diabetic retinopathy patients due to oxidative stress, which was assessed by lipid peroxidation marker, antioxidant enzyme status, and type 2 diabetes mellitus patients with and without retinopathy and compared with a control non-diabetic group. In this study also Arginase1 increases in obesity and aging that agree with another study that say the obesity increases the quantity of arginase1 in the vascular wall, which is directly correlated with the degree of vascular wall remodeling (25). Like another study that found a relationship between arginase and cholesterol. In cases where increased levels of the enzyme arginase serve as a useful indicator of a

person's propensity for cardiac abnormalities, blood total cholesterol has a positive and significant relationship with cardiovascular disease (CVD) (26). This is a positive accurate result confirming that arginase has a good relationship with T2DM patients with retinopathy that agreement with other studies that found the increased Arginase activity in diabetes a key pathogenic factor, is associated the ROC curve is used in those studies to distinguish between individuals with type 2 diabetes and those with the development of obesity-related type2 diabetes and associated vascular disease (27). In this study the high MDA levels in diabetic patients who suffer from obesity (BMI>30) and the higher plasma lipid peroxidation marker, MDA, indicate that the obese and centrally obese T2D had more oxidative stress. This study agrees with another study that says the oxidative stress increased MDA in T2D patients who are obese or centrally obese supports "reductive stress" induction (28). Cholesterol and BMI were strongly correlated, that agree with other study that explained by residual cholesterol inducing atherosclerosis in the overweight and obese groups by accumulating in the artery wall (29). The high BMI group had significantly higher MDA levels, and there was a positive correlation between MDA levels and BMI, this result agree with other study which found a high MDA levels is linked to higher atherogenic lipid profiles and enhanced oxidative stress30. In this study, the levels of MDA and arginase1 were high in a diabetic retinopathy group and that related with oxidative stress in diabetic complications. This study found the MDA levels were higher in DR patients than in DM patients who did not have DR this agrees with another study that says as a byproduct of lipid peroxidation, malondialdehyde (MDA) is one of the most extensively used biomarkers for assessing oxidative stress 31. Arginase induces premature senescence it induces endothelial dysfunction and increases oxidative stress (32). The expression of glutathione S-transferases in type 2 diabetes patients showed extremely significant alterations when compared to diabetic and control groups this agree with the other study that found the increases in free radicals are a result of abnormalities in cellular metabolism in diabetes when these free radicals interact with other vital biological elements, they can lead to diabetic retinopathy (DR), a side consequence of diabetes33. In diabetics, a higher triglyceride index (TG) is related to the prevalence of retinopathy and might be utilized to evaluate metabolic state in clinical settings in another study (34). In this study, GST activity increased in diabetic retinopathy indicating marked oxidative stress in these patients that agree with other study said the hyperglycemia-induced hyperproduction of reactive oxygen species causes microvascular problems in diabetes mellitus. Glutathione S-transferases have key detoxifying and antioxidant properties (35). In this research, T2DM patients saw an increase in small HDL particles. That agree with other numerous investigations demonstrate that HDL's capacity to inhibit inflammatory signals is dramatically diminished in this patient population (36). In this study, the DR group had elevated VLDL levels that similar with other study that explain the changes in lipid profile have a major impact on micro-vascular risk in T2DM. These indices can serve as new indicators for spotting micro-vascular problems linked to diabetes. Thus, to control on DR, examination of these indicators can be included to the evaluation of lipid profile (37).

Conclusion

There is a relationship between oxidative stress and the development of diabetic retinopathy, where the levels of arginase1 and malondialdehyde increased and the activity of glutathione s –transferase enzyme increased as a result of oxidative stress and inflammation associated with complications of type 2 diabetes.

Authors' declaration:

Conflicts of Interest: The authors declare no conflict of interest.

We confirm that all the Figures and Tables in the manuscript belong to the current study. Besides, the Figures and images, which do not belong to the current study, have been given permission for re-publication attached to the manuscript. Authors sign on ethical consideration's **Ethical Clearance:** Ibn Al-Haitham Teaching Eye Hospital, the Department of Chemistry, College of Science for Women, University of Baghdad and the National Diabetes Centre for Treatment and Research at Al-Mustansyrriah University in 22/11/2022 according to the code number (158347).

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Authors' Contributions:

Study conception & design: (Maha F Yaseen & Fayhaa M. Khaleel). Literature search: (Maha F Yaseen & Fayhaa M. Khaleel). Data acquisition: (Maha F Yaseen). Data analysis & interpretation: (Maha F Yaseen & Fayhaa M. Khaleel). Manuscript preparation: (Maha F Yaseen). Manuscript editing & review: (Maha F Yaseen & Fayhaa M. Khaleel).

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دور الارجنيز وبعض العلامات الحيويه في مرضى السكري من النوع الثاني الذين يعانون من اعتلال الشبكية والذين لا يعانون منه

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الخلاصة:
الخلفية: يلعب الإجهاد التأكسدي دورا رئيسيا في التسبب في مرض السكري عن طريق إتلاف العضيات الخلوية والإنزيمات في الدم مثل الأرجنيز 1 والإنسولين والكلوتاثايون اس ترانسفيريز ونتيجة لذلك ترتفع مستويات بيروكسيد الدهون مثل المالونداياليديهايد وتزداد مقاومة الإنسولين التي يمكن أن تؤدي إلى مضاعفات مرض السكر ومنها إعتلال الشبكية السكري.
الأهداف: إكتشاف علاقة الإجهاد التأكسدي بتطور إعتلال الشبكية السكري عن طريق قياس مستويات إنزيم الأرجنيز 1 ونشاط إنزيم الكلوتاثايون اس ترانسفيريز ومستويات المالونداياليديهايد كناتج ثانوي لبيروكسيد الدهون (علامة حيوية للإجهاد التأكسدي).
المرضى والمنهجية: أجريت الدراسة في الفترة من تشرين الثاني 2022 إلى كانون الثاني 2023 في مستشفى إبن الهيثم للعيون وقسم الكيمياء في جامعة بغداد كلية العلوم للبنات والمركز الوطني لعلاج وابحاث السكري في الجامعة المستنصرية وقد أجريت الدراسة على 120 شخصا موزعين على ثلاثة مجموعات: 40 في مجموعة السيطرة يعانون السمنة وليسوا مصابين بالسكري و40 في مجموعة مرضى السكري النوع الثاني غير المصابين بإعتلال الشبكية السكري و40 مريض سكري من النوع الثاني مصاب بإعتلال الشبكية السكري تتراوح أعمارهم من 30 الى 65 عاما. خضعت جميع المجموعات إلى إختبارات قياس الكلوكوز في دم الصائم، السكر التراكمي، ملف الدهون ويشمل (الدهون الثلاثية TG،الكوليسترول الحميد HDL، LDL والكوليسترول VLDL) وقياس مستويات الأرجنيز والمالونداياليديهايد وفعالية الكلوتاثايون اس ترانسفيريز، قياس مؤشر كتلة الجسم BMI ونسبة الخصر إلى الورك.
النتائج : كان متوسط مستويات الأرجنيز 1 أعلى بكثير في مرضى السكري منه في مرضى إعتلال الشبكية السكري ومجموعة السيطرة ($P<0.05$) وكان متوسط تركيز علامة الإجهاد التأكسدي المالونداياليديهايد أعلى بكثير في مرضى إعتلال الشبكية السكري منه في مرضى السكري النوع الثاني غير المصابين بإعتلال الشبكية ومجموعة السيطرة ($P<0.05$) وكان متوسط نشاط إنزيم الكلوتاثايون اس ترانسفيريز أعلى في مرضى إعتلال الشبكية السكري منه في مجموعة السيطرة ومجموعة مرضى السكري غير المصابين بإعتلال الشبكية السكري ($P<0.05$).
الاستنتاج: توجد علاقة بين الإجهاد التأكسدي وتطور إعتلال الشبكية السكري، حيث ازدادت مستويات إنزيم ألأرجنيز 1 والمالونداياليديهايد وازداد نشاط إنزيم الكلوتاثايون اس ترانسفيريز نتيجة الإجهاد التأكسدي والإلتهابات المرتبطة بمضاعفات مرض السكري من النوع الثاني.
الكلمات المفتاحية: مرض السكري من النوع الثاني، إعتلال الشبكية السكري، الأرجنيز 1، الإجهاد التأكسدي، صورة الدهون.