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Study on Viral Infection and Related Parameters in A Sample of Diabetes Mellitus Type 2

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ABSTRACT

Background: High levels of blood glucose brought on by insulin resistance or deficiency characterize diabetes mellitus type 2, a metabolic condition. One of the main factors contributing to diabetes is viral infection. One of the viruses connected to T2DM is the cytomegalovirus (CMV). Analysis of viral infection and associated factors in a type 2 diabetes sample.

Objective: The aim of this study is to measure levels of anti-CMV virus IgG in serum of Iraqi patients with Type 2 diabetes mellitus disease and measure the levels of some markers including age, gender, FBS, HbA1c, s. creatinine, blood urea and lipid profile (cholesterol, triglyceride, HLD, LDL, and VLDL).

Materials and Methods: This study involved 100 T2DM patients (52 males and 48 females) who visited Al-Karamah Teaching Hospital and Baghdad Teaching Hospital, and 52 healthy Iraqi subjects (control) (26 males and 26 females).
In addition to the measures used in this investigation, which also included the lipid profile, HbA1c, FBS, serum creatinine, and blood urea, Anti-CMV IgG was also measured for 48 patients and 40 controls.

Results: In comparison with the control group, B. urea, S. creatinine, Anti-CMV IgG, and lipid profile (excluding HDL) were considerably higher in the patient group. While there was no statistically significant difference between groups in terms of age and HDL levels, there was a difference.

Conclusion: As indicators and cofactors for type 2 diabetes mellitus, particular laboratory tests and Anti-CMV viral IgG might be utilized.

Keywords: Type 2 diabetes mellitus, Cytomegalovirus.

INTRODUCTION

One of the most widespread metabolic problems globally is Type 2 diabetes mellitus (T2D) that occurs as a consequence of a pair of critical indicators: defective insulin responsivity of tissues and hypoinsulinemia production by pancreatic islets [(1)]. Hyperglycemia, a hallmark of type 2 diabetes, is often brought on by the concomitant presence of insulin resistance and decreased beta cell function [(2)].

About 382 million individuals worldwide had diabetes mellitus in 2013, according to statistics, with type 2 diabetes accounting for 90% of all cases [(3)]. It is anticipated that the prevalence of diabetes would increase by 110 percent between 2017 and 2045, reaching 629 million worldwide in 2045 [(4)]. The risk factors for T2DM are genetic, obesity, family history for disease, sedentary lifestyle, ethnicity and other [(5)].

Age, genetic inheritance, environmental variables, lifestyle choices, infections that increase the likelihood of developing T2DM, and others make up the likely etiology. Since viruses and T2D may coexist in an individual through direct or indirect viral-mediated pathways, viral infections appear to be highly related with non-autoimmune diabetes [(6-7)].

Numerous viral illnesses, such as rubella, mumps, Epstein-Barr, and CMV, have been linked to T2DM [(8)]. Human herpes virus 5 (HHV 5), often known as cytomegalovirus (CMV), is a double-stranded DNA virus that belongs to the family Herpesviridae and can cause a variety of disorders in humans [(9)]. CMV's virion structure matches that of the herpes virus, and its replication cycle consists of a fully regulated cascade of genes capable of expression [(10)]. Multiple findings suggest that chronic CMV infection may have a role in the development of type 2 diabetes. CMV may expedite immunosenescence by promoting the development of late-differentiated CD4+ and CD8+ T-cells that generate pro-inflammatory cytokines and hence create a more pro-inflammatory environment [(11)].

Eye, renal, and neurological system issues are caused by diabetes. Diabetes is a leading cause of blindness, renal failure, amputation, cardiovascular disease, and stroke [(12)].

Diabetes is diagnosed using glycated hemoglobin (HbA1c), a crucial measure of long-term glycemic control that might reflect the cumulative glycemic history of the previous two to three months, which is the predicted half-life of red blood cells [(13)]. FBG is also utilized for the diagnosis of impaired fasting glucose (IFG) and diabetes. FBG 100 mg/dl is often considered normal in humans, with 126 mg/dl or more indicating diabetes [(14)]. Blood urea and serum creatinine, which are simple tests for evaluating kidney function in poorly controlled diabetics, are used to diagnose diabetes [(15)].

Moreover, increases in cholesterol, triglyceride, VLDL, and HDL levels are associated with an increased risk of type 2 diabetes in first-degree relatives [(16)].

Our study's objective is to determine the anti-Cytomegalovirus IgG levels in the blood serum of Iraqi T2DM patients as well as other parameters including

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HbA1c, FBS, B. urea, S. creatinine, cholesterol, triglyceride levels, HDL, LDL, and VLDL.

MATERIALS AND METHODS

In the current study, 100 Iraqi patients (52 males and 48 females) with T2DM disease and 50 healthy Iraqi control were included, the subjects' ages ranged from 40 to 70 years. In addition a control group included 52 healthy subjects in term of non-diabetic (26 males and 26 females), their ages ranged from 40 to 70 years. The total samples were registered during the period from October 2021 to February 2022 in Al-karamah Teaching Hospital and Baghdad Teaching Hospital.

The measurement of CMV IgG class of Ab was performed in the serum of 48 volunteers of diabetic group included (25 males and 23 females) and serum of 40 healthy individuals included (19 males and 21 females). The detection of CMV IgG in human serum is relied on the technique of ELISA according to manufacturer' company human Germany. Age demographic data of both subject groups were attached**.** Laboratory tests were performed to all samples to assess disease activity including FBS, S. creatinine, Blood urea, HbA1c and lipid profile (cholesterol, triglyceride, HDL, LDL and VLDL) by using the automated method C111 (Roche, Germany).

Ethics approval:

This work was approved by the Academic and Ethical Committee of the University of Baghdad. Each patient provided informed consent. This study was done in line with the Declaration of Helsinki, which is the code of ethics for studies on humans that has been approved by the World Medical Association.

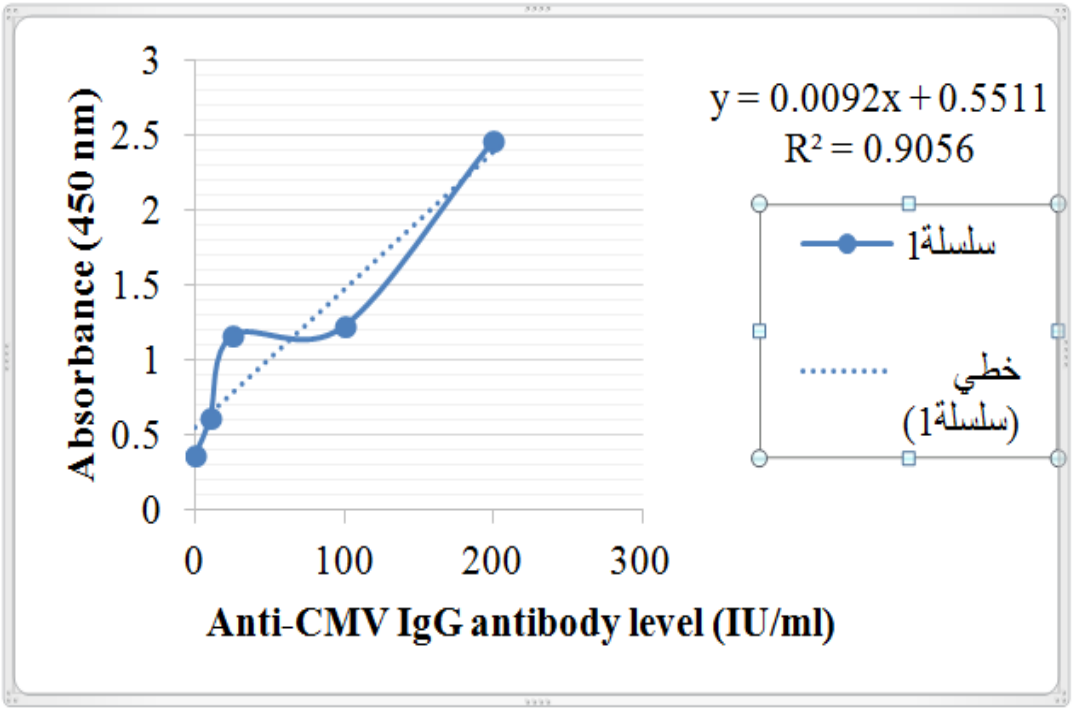

Figure 1: Standard curve of anti- CMV IgG antibody concentration (IU/ml)

Statistical Analysis

IBM SPSS Version 28.0 was used to calculate the mean and standard error for parametric data, the ANOVA table, and the probability using the independent T-test. In non-parametric data, the probability is calculated using Pearson's chi-square. When P was ≤ 0.05, it was significant.

RESULTS

Table (1) revealed that the age difference between the studied groups was not statistically significant (P>0.05). The mean age of male patients was 58.04 ± 1.42 versus 5.19 ± 1.73 in the control group, while the mean age of female patients was 56.42 ± 1.40 versus 57.27 ± 1.79 in the control group. Table (1) also showed that the males' percentage with type 2 diabetes mellitus was 52% while females' percentage was 48% in the patients group.

Table (1): The age of studied groups according to demographical data

Gender	Age mean ± SE (Years)				Probability
	Patients (100)		Control (52)		
Males	52	58.04 ± 1.42	26	5.19 ± 1.73	0.230
Females	48	56.42 ± 1.40	26	57.27 ± 1.79	0.714
Total	100	57.26 ± 1.0	52	56.23 ± 1.24	0.533
Probability		0.420		0.409	

As shown in table (2), there was a statistically significant difference (P<0.05) in the concentration of FBS (230.26 ± 9.57 in patients group vs 102.64 ± 1.40 in control group). Also, there was significant differences in HbA1c% between studied groups. Table (2) also revealed a statistically significant difference (P0.05) in B. urea (60.47 ± 4.78 patients group vs 30.24 ± 2.08 in control group) and S. creatinine (1.15 ± 0.12 in patients' group vs 0.73 ± 0.04 in control group).

Table (2): Laboratory diagnosis in the studied groups

Parameters	Mean ± SE		Probability
	Patients	Control	
FBS (mg/dl)	230.26 ± 9.57	102.64 ± 1.40	3.13×10^{-17}
HbA1C (%)	7.74 ± 0.12	5.52 ± 0.04	3.36×10^{-27}
B. urea (mg/dl)	60.47 ± 4.78	30.24 ± 2.08	0.00002
S. creatinine (mg/dl)	1.15 ± 0.12	0.73 ± 0.04	0.012

Except for HDL, which was not significant (P>0.05), there was a significant difference (P0.05) in lipid profile testing between the analyzed groups, as shown in the table (3).

Table (3): Lipid profile test between studied groups

Parameters	Mean ± SE		Probability
	Patients	Control	
Cholesterol (mg/dl)	199.03 ± 4.55	172.04 ± 4.87	0.0003
Triglyceride (mg/dl)	228.43 ± 12.83	148.96 ± 9.76	0.00006
HDL (mg/dl)	38.01 ± 0.96	37.48 ± 1.34	0.744
LDL (mg/dl)	115.81 ± 3.91	103.76 ± 4.08	0.05
VLDL (mg/dl)	45.82 ± 2.56	29.74 ± 1.96	0.00005

In our results in table (4), the concentration of Anti-CMV IgG in patients group was 122.87 ± 8.40 while in control group, it was 25.86 ± 1.37 with a great difference (P<0.05).

Table (4): Anti-CMV IgG in investigated groups

Groups	Anti-CMV IgG antibody mean ± SE (Unit)	Probability
Patients	122.87 ± 8.40	6.07×10^{-17}
Control	25.86 ± 1.37	

DISCUSSION

The results of our study showed a non-significant difference in age between males and females in the patients compared to those in the control group. This is in line with the findings of previous researches, one of which suggested that age is not a risk factor for the incidence of hyperglycemia and that other genetic and epigenetic variables may contribute to the development of T2DM [17] and the other study demonstrated that the age-standardised prevalence of T2DM varied by nation, considerably declining in nine of them while being stable in the remaining countries [18]. While other studies disagree with our study [19-20].

The findings of current study indicated that FBS, HbA1c, B. urea and S. creatinine significantly increased in T2DM patients group more than in control group and this result is similar with prior researches findings which indicated that FBS is more reliable to separate diabetic from non-diabetic subjects than HbA1c. Although, HbA1c cutoff points of 6% are an acceptable threshold for discriminating diabetics from non-diabetics [21] and HbA1c level was increased in diabetics [22]. Serum urea and creatinine are helpful, straightforward indicators for diagnosing renal impairment in diabetes patients [23]. According to a study, monitoring serum creatinine and blood urea levels, which is a quick way to determine whether diabetics are having trouble controlling their

blood sugar and how effectively their kidneys are working [24]. If there is also a rise in blood pressure, a rise in urea and creatinine levels in the blood can be a sign that the kidneys are not working as well as they should [25].

An aberrant lipid profile is closely related to insulin resistance. IR is also the primary component of T2DM. It has been linked to a high level of very-low-density lipoprotein (VLDL), a high level of blood triglycerides (TG), and a low amount of serum high-density lipoprotein (HDL). Therefore, the lipid profile is a significant risk factor for type 2 diabetes [26]. There is a high prevalence of dyslipidemia in diabetics, particularly those with poorly managed diabetes [27]. In our research findings in human serum, the lipid profile tests (Cholesterol, triglyceride, LDL and VLDL) had abnormal values among studied groups, while HDL was non-significant in the mentioned groups. In accordance with a Sudanese study, all serum lipids and lipoproteins were considerably greater in diabetic patients than in non-diabetic subjects, with the exception of HLD, which was significantly lower in diabetic patients than in non-diabetic people [28]. In diabetic males and females of both age groups, however, serum TC, LDL-C, and TG levels were statistically considerably higher, but HDL-C levels were dramatically lowered [29].

Also, our essay's results suggested that Anti-CMV IgG may play a role in the development of T2DM. A significant difference (6.07×10^{-17}) in the studied groups. This finding is consistent with a study determined the higher prevalence of CMV IgG in type 2 diabetes patients [30]. Other study found that the group with T2DM had higher incidence of CMV diseases than the group without T2DM, meaning the CMV infection increases the patients' risk of developing T2DM [31]. An Iraqi research, on Rheumatoid Arthritis (RA), showed that the antibodies of anti- CMV IgG had a significant differences ($P < 0.05$) between the compared groups [32].

CONCLUSION

We concluded from our results that there was trigger factors of autoimmune disease and other diseases by environmental factors like viruses. CMV virus plays a vital role in the pathophysiology of patients with complex type 2 diabetes mellitus (T2DM) characteristics.

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