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Study the levels of interleukin 9, insulin, HOMA-IR, and lipid profile in Iraqi type 2 diabetes mellitus

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Abstract

Diabetes mellitus DM is a sort of metabolism disorder that causes increases glucose in the blood on prolonged. various studies have found that different cytokines may have a role in the development and progression of type 2 DM. Many studies have suggested that interleukin 9 may have an etiopathological function in type 2 DM. In our study, we investigated the levels of interleukin 9 in diabetes patients and compared them to levels of the same marker in healthy controls.

A total of two hundred Iraqi volunteers (100 Type II diabetes mellitus patients and 100 healthy control individuals) were enrolled in the case-control investigation to evaluate interleukin 9, which has been measured using enzyme-linked immunoabsorbent assays.

Patients with type 2 diabetes Mellitus observed significantly decreased serum interleukin 9 levels compared to healthy controls. Type 2 Diabetes Mellitus patients with high lipid levels showed a significantly higher drop in interleukin 9 levels compared to those without. Therefore, low levels of interleukin 9 might be regarded as a possible biomarker associated with a higher risk of lipids. So, our results declare there is a relationship between the incidence of type 2 diabetes mellitus and increase in the levels of interleukin 9.

Keywords: T2DM, cytokines, interleukin 9, Iraqi diabetics, and HOMA- IR

Introduction

Diabetes mellitus DM is a sort of metabolic disorders that know as phenotypically by chronic increases glucose in blood also called (hyperglycemia). Hyperglycemia is classified depend on ability response cell to insulin hormones so the main classical definition, first class results mainly from Insulin deficiency secretion (type 1 DM) and second-class defect in insulin action, it is called insulin resistance that affecting on the liver and peripheral tissues (type 2 DM). The distinction between T1 DM and T2 DM Mis not as obvious and the categorization has been expanded to include many different particular diabetes subtypes. show that the current diffusion of DM disease has increased in ten years. The World Health Organization reported that about 422 million people suffer from diabetes illness all over the world but represent type 2 95% compared with others ^[1].

The relationship between DM and metabolic problems appears to have an impact on liver, adipose tissue, and skeletal muscle that is connected to insulin resistance.

The intensity of the disease's symptoms varies according to age, duration, and type of disease. Special cases include pediatric patients who suffer from symptoms of high diabetes, as we find them visual issues, dysuria, weight loss and increased hunger. Some patients with DM state, particularly those who are type-2 diabetics in their early stages, may not exhibit any symptoms.

If diabetes unmanaged, it may lead to unconsciousness, confusion, and, in rare cases, fatal outcomes such as nonketotic hyperosmolar syndrome. This condition necessitates proper treatment and regulation to control its risks ^[2].

According with global trends for the development of diabetes mellitus, diabetes has reached epidemic levels in Iraq over the previous decade, with a remarkable (115%) increase from 19.58/1000 in 2000 to 42.27/1000 in 2015 ^[3-5].

One pathogen low grade chronic inflammatory is type-2 DM. in this case that contribute with insulin resistance, B-cell pancreas dysfunction and improvement type -2 DM.

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So that the protocol treatment of inflammation chronic related cytokines, chemokines, adipokines and the molecules inflammatory signaling [6].

Studies have found that many cytokines may be associated to the progression of T2D [7].

Interleukin - 9 (IL-9) is a T cell-derived cytokine that was first classified as a Th2 cytokine [8]. Further research has revealed that Interleukin -9 may play an etio pathological function type-2 DM. [9].

In this investigation, our focus was on evaluating the levels of IL-9 in people diagnosed with diabetes type 2 and comparing them to the similar levels observed within a group of healthy controls.

2. Methods and Materials

A case-control study enlisted 200 Iraqi volunteers (100 Type II Diabetes mellitus patients with an average age of 50.4 ± 2.3 and 100 healthy controls with an average age of 48.7 ± 1.64) from January to December 2023. All volunteers have written informed consent.

Serum concentration samples of IL-9 and Insulin were assayed by utilized enzyme- linked Immunoabsorbant assays (ELISA) according to the manufacturer's procedures (elabscience and Monobind Inc company USA).

Cholesterol levels were measured through enzymatic hydrolysis and oxidation, while triglyceride levels were assessed using an enzymatic colorimetric test from the Biolabo kit for triglycerides in France. Additionally, commercial kits were utilized to analyze total cholesterol, triglycerides, and high-density lipoprotein (HDL), while low-density lipoprotein (LDL) levels were calculated using Friedwald's formula.

The percentage level of HbA1C in whole blood samples preserved with EDTA was evaluated using Roche's automated method in Germany.

Body Mass Index determined by employing the equation that divides weight in kilograms by the square of height in meters. In addition, the Homeostatic Model Assessment for Insulin Resistance (HOMA-IR) has been estimated utilizing the following equation:

$$\text{HOMA-IR} = (\text{FSG} * \text{FSI}) / 22.5$$

Where

FSG: Fasting serum glucose is expressed by mg/Dl unite

FSI: Fasting serum insulin expressed by $\mu\text{IU} / \text{mL}$ unit

Statistical data analysis

The data sample was analyzed using version -25 of the Statistical Package for the Social Sciences (SPSS). Data were given as percentages, means, ranges, and standard deviations S.D (minimum-maximum values). To ascertain the significance of differences among various means in quantitative data, either a student t-test was employed for comparing two independent means or a paired t-test for assessing discrepancies between paired observations or dependent means. A p-value less than 0.05 was deemed statistically significant in determining the presence of significant differences.

Results

The mean of fasting blood sugar of diabetic patients is 219.4 ± 12.09 and the mean of healthy control is 91.24 ± 16.9 while the mean levels of Fasting Plasma Insulin in diabetic patients is 20.7 ± 7.9 and the levels of it in healthy control is 7.8 ± 2.9 , the means of body mass index (BMI) is 30 ± 2.12 for diabetic patients and 26.19 ± 2.5 in healthy control, The hemoglobin A1c (HbA1c) is 8.8 ± 0.511 for diabetic patients and 4.7 ± 0.27 in healthy control and as the Table 1.

Table 1: The means of F.B.S, BMI, HbA1C, HOMA-IR in diabetic patients, fasting plasma insulin, and healthy control

Parameter	Control $\pm$ S. D	Patients $\pm$ S. D	P value
F.B.S (mg /dl)	91.24 ± 16.9	219.4 ± 12.09	$p < 0.0001$
BMI (kg/m ²)	26.19 ± 2.5	30 ± 2.12	$p < 0.0001$
HbA1C	4.7 ± 0.27	8.8 ± 0.511	$p < 0.0001$
Fasting Plasma Insulin ($\mu\text{U}/\text{mL}$)	7.8 ± 2.9	20.7 ± 7.9	$p < 0.0001$
HOMA-IR	1.21 ± 0.07	4.3 ± 0.78	$p < 0.0001$

The mean of levels of lipid profile is significantly difference between the patients and healthy controls as Table 2.

Table 2: The means of lipid profile in diabetic patients and healthy control

Parameter	Control $\pm$ S. D	Patients $\pm$ S. D	P value
LDL (mg /dl)	92.65 ± 16.5	156.7 ± 11.7	$p < 0.0001$
VLDL (mg /dl)	34.6 ± 11	49.9 ± 1.03	$p < 0.0001$
HDL (mg /dl)	54.32 ± 3.2	35.77 ± 7.5	$p < 0.0001$
T.G (mg /dl)	125.6 ± 10.79	223.86 ± 16.61	$p < 0.0001$
cholesterol (mg /dl)	181.58 ± 34.6	243.69 ± 9.02	$p < 0.0001$
IL-9	43.788 ± 2.7	30.02 ± 3.61	$p < 0.0001$

The levels of interleukin -9 in healthy controls are significantly higher than the levels of it in patients as Figure 1.

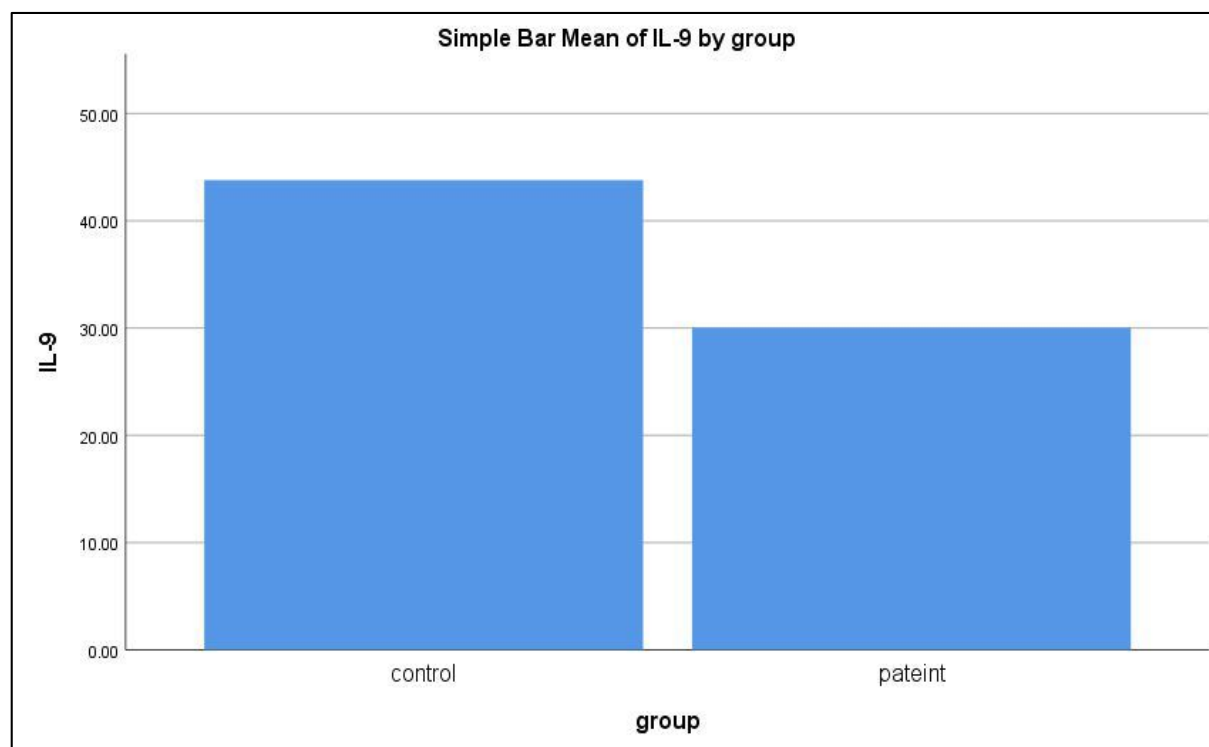


Fig 1: The levels of interleukin 9 in healthy controls and patients.

Discussion

This study confirmed that T2DM is association with inflammation and insulin resistance. Our study displays the levels of F.B.S, BMI, HbA_{1c}, Fasting Plasma Insulin and HOMA-IR is significantly increased in patients than healthy controls. The clinical significance of an increase in TG (hypertriglyceridemia) cannot be overstated, but it can significantly impact human health. This rare condition, which raises risk when paired with obesity, is particularly disturbing since it has the potential to cause disruptions in glucose metabolism. The relationship between increased TG levels and insulin resistance (IR) is positive, and the body's cells become fewer responsive to insulin, which is considered the hormone responsible for regulating blood glucose levels. Furthermore, hypertriglyceridemia can impede the function of beta cells in the pancreas, which are responsible for insulin production. As a result, this combination lays the foundation for a series of metabolic disturbances, which might lead to illnesses like type 2 diabetes mellitus. Thus, treating hypertriglyceridemia is critical not only for cardiovascular health, but also for avoiding issues associated with glucose metabolism^[10]. The current study supports earlier findings^[11, 12], which demonstrate that obtained triglyceride levels can be caused by increasing hepatic release of very low-density lipoproteins (VLDL) and slow clearance of triglyceride-rich lipoproteins. This weak clearance is mostly caused by high amounts of substrates favorable to triglyceride synthesis, including free fatty acids and glucose.^[12] lipoprotein lipase enzyme activity is a rate-limiting step for very low density lipoprotein VLDL, which is responsible for TG accumulation in tissue and has been linked to the of HOMA-IR and Type 2-DM^[13].

The results of our study that measured the levels of IL-9 express that the levels of the interleukin in diabetic patients is significantly increased than the levels in healthy controls and this consist with results of^[9] and disagreement with the study achieved by^[14].

Conclusions

There is a relationship between T2DM and a decrease in IL-9. The levels of all lipid profiles except HDL are increased in diabetic patients, while the levels of fasting insulin are increased in diabetic patients.

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