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# Evaluation of Some Biochemical Parameters in Iraqi type 2 diabetes Patients

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## Abstract

Diabetes mellitus is a class of metabolic problems where an individual has raised glucose, either because there is not sufficient insulin delivered by the pancreas, or because cells do not respond to the insulin generated. This study aims to evaluate some biochemical variables in humans with type 2 diabetes and their relationship to exacerbating the disease condition. Seventy patients suffering from diabetes mellitus and fifty healthy people were incorporated as should be expected controls for this review. Blood examination was done for every one of them which incorporate serum glucose, lipid profile, urea, creatinine and liver enzymes (ALT, AST, GGT) levels. This study included the verification of some biochemical variables by measuring their levels in diabetics and healthy people.

As the levels of all the variables under study increased in diabetics except for high-density lipoproteins, its level decreased compared to the results obtained for the same variables in healthy people.

***Keywords: Diabetes mellitus, lipid profile, liver function, kidney function.***

## Introduction

Diabetes is a metabolic disease characterized by high blood sugar levels due to impaired insulin production or both. Chronic diabetic hyperglycemia is associated with relatively common long-term microvascular problems affecting the skin, kidneys, and nerves, as well as an increased risk of cardiovascular disease (CVD). The clinical criteria for diabetes are focused on glucose levels related to microvascular disease, in particular retinopathy [1]

The proportion of people with type 2 diabetes represents 90-95% of all diabetics, and it is the type that is not dependent on insulin. It usually affects people who have insulin resistance due to a defect in insulin receptors on cells or a lack of insulin secretion in proportions that do not make them need insulin therapy as cells Beta in the pancreas still secretes insulin [2]

Fat cells, liver cells, and muscles usually show insulin resistance compared to other body cells with type 2 diabetes patients.

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Most type 2 diabetes are obese with more than 20% of their ideal weight by calculating the Body Mass Index. People who are overweight have insulin resistance and therefore the pancreas must work hard to produce more insulin. However, the amount of insulin secreted will not be sufficient to maintain a normal level of blood sugar.

Type 2 diabetes can be controlled by controlling the type and amount of food and exercise and thus controlling weight. As the disease progresses, diabetes medications are needed.

To ensure control of the perfect diet and exercise, in addition to adhering to taking medications, it is advised to do the HbA1c test several times during the year that this test gives the average level of glucose during the life of red blood cells [3-5]

When the blood sugar level rises to the point where it appears in the urine, it will cause excessive urination, thirst, hunger, and disruption of protein and fat metabolism. [6]. Type 2 Diabetes is the major problem in developing and developed countries, It is considered one of the leading causes of mortality and ranks seventh among the other death-causing illnesses.

The diversity of diet systems and the lifestyles that differ in different countries and cultures have a great role in increasing the number of diabetics during the year and it is expected to reach about 300 million in the year of 2025 [7].

The complications caused by insulin deficiency are problems with metabolic disorders, which causes blood glucose to increase in addition to the high level of creatinine, cholesterol and transaminase enzymes accompanied by a decrease in the body proteins [8].

It was observed that secondary complications in diabetics are changes in the formation of the vascular basal membrane in addition to the accumulation of glucose and the products of the reactions that lead to an increase in the use of glucose in the insulin non-dependent tissues. [9]. Most studies confirmed that increasing blood sugar leads to an increase in serum glycated proteins [10-12] along with alterations in other atherogenic risk factors.

This study included an evaluation of some biochemical factors in type 2 diabetes patients and their comparison with the results obtained for healthy people.

## Materials & Methods

**Control Groups:** The study included 50 healthy adults who did not suffer from any disease (females and males) as a control group.

**Patients:** The group of patients includes 70 patients with type 2 diabetes, their ages range from 20 to 70 years, and blood samples were taken from them after a 12-hour fasting period.

Full history and general physical examination were obtained from the patient's file.

**Sample Collection:** Venous blood samples were collected from the patient and placed in EDTA tubes, then separated using a centrifuge at 2000 rpm for 10 minutes. The samples were kept at -20 ° C until analyzed.

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The statistical study was performed on the data obtained and the outcome are expressed as mean standard deviation. To compare the outcome of the two groups under study, a T-test was used. If the value of P is equal to or less than 0.05, then these are significant differences.

**The two group's distribution, depending on age and health status**

| Groups | No. | Age range (Years) |
|---|---|---|
| Normal | **50** | **22-60** |
| Type 2 DM Patients | **70** | **20-70** |

**Blood glucose measurement:** The blood glucose concentration was measured after a fasting period (FBG) using the commercially available enzymatic chromatography method [13].

**Determination of Serum Total Cholesterol and Serum Triacylglycerol by** using an enzymatic method. [14].

**Measurement of Serum High-Density Lipoprotein- Cholesterol (S.HDL-C)**

Using the Burstein et al. process, 1980 [15] The serum HDL-C is determined by the HDL-C package.

**Measurement of Low-Density Lipoprotein- Cholesterol (S.LDL-C) in serum**

The LDL amount is most frequently extracted from the formula of friedwalds as mentioned [16].

LDL-cholesterol = Total cholesterol – [HDL- cholesterol + TG/5]

**Measurement of Serum Urea**

Urease enzyme hydrolysis urea by-product ammonium by (urease –modified Berthelot) reaction [17], by this method urea concentration, was measured.

**Determination of Serum Creatinine**

Creatinine was evaluated by the Jaffes reaction, in which creatinine was quantified with picric acid, which produces an orange color in alkaline medium; after a 15-min incubation at room temperature for color development, the color was measured at 520 nm.

**Determination of Serum ALT, AST & GGT**

The enzymes Alanine aminotransferase (ALT) and Aspartate aminotransferase (AST) were assayed by Reitman and Frankel method [18]. Gamma Glutamyl Transferase (GGT) was determined by SZASZ [19]

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## Results and discussion

The study included seventy diabetics and fifty healthy people as a control group. The results obtained for diabetes patients were divided into two groups, females and males, due to the presence of some differences in biochemical parameters, and then compared with the control group.

Tables 1&2 show the levels of glucose of fasting control and diabetes patients. The results showed a high level of blood glucose in male fasting patients (175.4 ± 1.46) compared to the control group under the same conditions (88 ± 4.0) and this also applies to female results, where a high level of blood glucose was recorded (170.4 ± 1.65) compared to the control group of females who recorded (84 ± 4.2).

**Table (1) Average fasting blood glucose level (FBG) (mg/dl) in the diabetic and control group**.

| Gender / FBG | Normal | Diabetics | p-value* |
|---|---|---|---|
| **Mail** | **88±4.0** | **175.4 ±1.46** | **<0.001** |
| **Female** | **84±4.2** | **170.4 ±1.65** | **<0.001** |

* Significantly different at P<0.01 from the corresponding control value

The routine method for screening for diabetes is measuring blood glucose concentration; however, there are differences in blood glucose concentrations if measured randomly. [20], this is in addition to glucose intolerance by diabetics. This study showed an increase in the level of blood glucose in diabetics compared to the healthy group as agreed in all studies.

Tables 2 and 3 show the concentrations of lipid profile in diabetics and in healthy subjects, where total cholesterol showed an increase of 183.6 ± 35.9 mg/dl in addition to low-density lipoprotein LDL-C (155 ± 4.75 mg/dl) and triglycerides (39 ± 11.42 mg/dl) On the other hand, the results showed a decrease in the level of high-density lipoprotein HDL-C (21 ± 3.0 mg/dl). These results were compared with the results obtained for the same tests on the healthy group. Their levels were as follows cholesterol (**182.8 ± 34.1**), LDL-C (**155** ±4.75 mg/dl), triglycerides (**39** ±11.42 mg/dl) and HDL-C (24 ± 3.77).

**Table (2) The mean of serum Total Cholesterol, HDL C, Triglyceride and LDL- Cholesterol levels (mg/dl) in diabetic and healthy groups (Males).**

| **Biochemical Parameters**(mg/dl) | Normal | Diabetics | p-value* |
|---|---|---|---|
| **Total cholesterol** | **182.8 ± 34.1** | **183.6 ± 35.9** | **0.658** |
| **HDL cholesterol** | **24 ±3.77** | **21 ±3.0** | **<0.001** |

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| | | | |
|---|---|---|---|
| **Triglycerides** | **30 ±13.42** | **39 ±11.42** | **0.006** |
| **LDL cholesterol** | **151 ±3.77** | **155 ±4.75** | **0.001** |

**Table (3) The mean of serum Total Cholesterol, HDL C, Triglyceride and LDL- Cholesterol levels (mg/dl) in diabetic and healthy groups (Females).**

| Biochemical Parameters(mg/dl) | Normal | Diabetics | p-value* |
|---|---|---|---|
| **Total cholesterol** | **192.9 ± 36.7** | **200.2 ± 36.2** | **0.001** |
| **HDL cholesterol** | **48.6 ± 11.7** | **45.8 ± 10.9** | **<0.001** |
| **Triglycerides** | **123 ± 86** | **161 ± (113–243.5)** | **<0.001** |
| **LDL cholesterol** | **119.7±3.27** | **122.2±4.65** | **0.001** |

*Significantly different from corresponding control value at P<0.01

Metabolism pathways are generally controlled by many enzymes. In the case of diabetes, these pathways will be affected, including fat metabolism, through changes in the activity of these enzymes.

The increased incidence of death for patients with diabetes type 2 coincides with the myocardial infarction; the hyperlipidemia must be treated severely.

The most important signs of arteriosclerosis and coronary heart disease (CHD) are high levels of low-density lipoprotein cholesterol (LDL-C) lowering of its level decreases the worsening of the condition and death.

This study is consistent with the results of Sharma (1970) and Jain (1980) who demonstrated that high total cholesterol and triglyceride levels were increased with the reduction of LDL-C and HDL-C in the drug-treated group where the above substances were regulated and the lipid values were restored to normal levels [22,23].

The results in Table 4 showed urea and creatinine concentrations in normal and diabetic patients. In normal subjects, the concentration of urea (30.1±3.20) and creatinine (0.95±0.06) obviously, it is higher in diabetics (58.9±1.195), (1.96±0.109) than normal subjects.

**Table (4) The level of Urea & Creatinine concentration (mg/dl) in DM patients and normal groups**

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| Biochemical Parameters(mg/dl) | Normal | Diabetics | p-value* |
|---|---|---|---|
| **Urea** | **30.1±3.200** | **58.9±1.195** | **0.001** |
| **Creatinine** | **0.96±0.067** | **1.96±0.109** | **<0.001** |

Kidney function measured by measuring the levels of creatinine and urea in the blood, it is necessary to monitor their levels in diabetics because the kidneys can be exposed to failure due to diabetes and as shown, the level of creatinine and urea is higher in patients with diabetes compared to healthy people, so these results show the strong relationship between the blood sugar and urea levels.

High blood urea level is observed when the blood sugar level increases. High blood sugar level is the leading cause of kidney failure [24]. From these data, it is possible to confirm the relationship between high blood sugar level and high urea level, as shown in the results.

A study was conducted on diabetic mice by Anjaneyulu *et al.,* 2004 and it was found that the high level of urea and creatinine in mice serum caused kidney damage gradually [25]. Urea and creatinine levels decreased after treating diabetic patients.

Tables 5&6 show the concentration of ALT, AST, and GGT in normal groups and diabetic patients. In normal subjects the serum AST (**25 ±3.43**), ALT (**21 ±3.54**) and GGT (**30 ±4.02**) appeared to be higher in diabetic patients (**26 ±4.45**), (**24 ±4.43**) and (**39 ±4.50**) than normal subjects.

**Table (5) The mean of serum ALT, AST & GGT levels (mg/dl) in Diabetes groups and normal groups (males)**

| Biochemical Parameters(units/l) | Normal | Diabetics | p-value* |
|---|---|---|---|
| **AST** | **25 ±3.43** | **26 ±4.45** | **0.089** |
| **ALT** | **21 ±3.54** | **24 ±4.43** | **<0.001** |
| **GGT** | **30 ±4.02** | **39 ±4.50** | **0.006** |

***** It differs significantly from the corresponding control amount at P<0.01

**Table (6) The mean of serum ALT, AST & GGT levels (mg/dl) in Diabetes groups and normal groups (females)**

| Biochemical Parameters(units/l) | Normal | Diabetics | p-value* |
|---|---|---|---|

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| | | | |
|---|---|---|---|
| **AST** | **22 ±3.46** | **23± 3.64** | **0.076** |
| **ALT** | **16 ±3.64** | **20 ± 3.34** | **0.001** |
| **GGT** | **15 ±4.32** | **20 ± 4.45** | **0.001** |

*Significantly different from corresponding control value at P<0.01

This study showed the relationship between liver enzymes present in blood serum and type 2 diabetes. As the results showed that serum levels of ALT and GGT positive association with increased risk of type 2 diabetes and for both sexes in comparison to healthy subjects.

One of the major functions of the liver is to regulate metabolic processes and maintain glucose concentrations in all cases. When insulin is lost, its effect on the liver will lead to the activation of glycogenolysis to produce glucose from the liver and an increase in the process of lipolysis that leads to increased production of fatty acids.

The process of lipolysis and Abnormalities of triglyceride storage in tissues sensitive to insulin, such as the liver, is an early indication of cases that are described as insulin resistance and can be detected before fasting hyperglycemia.

The results regard to liver enzymes are agree with the results of previous studies [26,27], where they have proven high levels of alanine aminotransferase, aspartate transaminase, and GGT in diabetics in comparison to to healthy people. The reason is that the liver has been affected by an increase in fatty acid production that may lead to toxic effects on the liver.

Mechanisms may include disturbance of the cell membrane at high concentration, imbalance of mitochondria, the formation of toxins, Activating and inhibiting major metabolic processes. The oxidative stress of reactive lipid peroxide, peroxide beta-oxidation, and recombinant inflammatory cells are other potential reasons for the increase in transaminases in insulin resistance states.

Increased pro-inflammatory cytokines such as α-tumor necrosis factor (TNF-α) are associated with insulin resistance which may help to damage hepatocytes. We also assume that elevated ALT, a gluconeogenic enzyme whose gene transcription is suppressed by insulin, may indicate insulin signal impairment rather than injury to pure hepatic cells [28]. Another possibility for ALT elevation is due to weight gain [29].

## Conclusion

The most common metabolic disease is diabetes mellitus and one of the main causes of death. It is known by a lack of insulin secretions in the pancreas from the beta cells, or insufficiency of insulin receptors on the cells, chronic hyperglycemia and metabolic disorders of carbohydrates, fats and proteins.

In our research, different biochemical parameters for normal and diabetic patients have been examined. In addition to T. cholesterol, TG, LDL, urea, creatinine, AST, ALT, and GGT, a high amount of fasting glucose was observed and the amount of high-density lipoprotein in diabetic patients decreased relative to the normal control group.

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