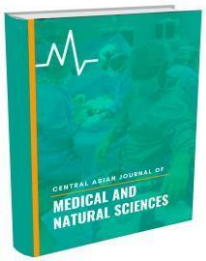

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*Article*

# Evaluation of Insulin Levels, Insulin Resistance, and Some Biochemical Variables in Males With Complications of Uncontrolled Diabetes

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**Abstract:** Diabetes complications significantly impact health, yet the relationship between insulin levels, insulin resistance, and related biochemical variables in males with uncontrolled diabetes remains underexplored. This study aimed to assess insulin, HbA1c, glucose levels, insulin resistance, and body mass index (BMI) in males with diabetes complications compared to healthy controls. Conducted from December 2023 to May 2024 in Hawija's hospitals and clinics, the study included 70 male patients aged 40-70 with diabetes complications and 20 age-matched healthy controls. Results revealed significantly higher levels of insulin, glucose, insulin resistance, and BMI in patients with diabetes complications ($P \leq 0.01$) compared to controls. The study concludes that increased insulin resistance due to elevated insulin and glucose levels contributes to severe diabetes complications, including neuropathy, retinopathy, and vascular disease.

**Keywords:** Diabetic Complications, HbA1c, Insulin, Insulin Resistance, Glucose, Body Mass Index

## 1. Introduction

Diabetes (DM) is a chronic condition that occurs as a result of the failure of the pancreas in the production of sufficient amount of insulin or when the body's production of insulin is ineffective or an insulin receptor imbalance [1] . DM diabetes is the most prevalent endocrine disease and is a source of health anxiety around the world in developing countries in particular and which is increasingly spread along with poor control, serious complications lead to the most common causes of diabetes and the increased death rate [2] . Complications that increase unexpectedly occur if the disease is not well organized, such as hyperglycemia, Ketoacidosis, or hyperosmolar coma, cardiovascular disease, the final stage of kidney failure and retinal damage that can cause blindness and damage Nerves of all kinds and microscopic damage that can cause sexual impotence and slow recovery are all serious long -term complications, as well as slow wound healing [3].

The risk of developing diabetes is associated with a set of genetic and metabolic factors as well as other factors that include race, family history and previous pregnancy diabetes, in addition to that increasing aging, weight gain and obesity, the risk of developing the disease, as well as the unhealthy diet, lack of exercise and smoking, increases the risk of Diabetes, there are also social and demographic risk factors associated with diabetes [4]. As is well known, type 2 diabetes is a chronic spreading disease that is

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associated with complications, including diabetic retinopathy, nephropathy, neuropathy neuropathy, and myopathy [5].

The problem of diabetes has become increasingly spread in the world, as both males and females are affected and the main factors responsible for this global problem return to genetic disorders, behavioral factors, environmental factors, obesity and low physical activity, and one of the pathological methods that cause diabetes begins to destroy beta cells in the pancreas By Autoimmune Diseases, Bacteria and Viruses, which leads to a decrease in insulin secretion from beta cells and a lack of sensitivity to the receptors responsible for insulin work and thus a metabolism disorder occurs in proteins, fats and carbohydrates [6] . Patients with T1DM or T2DM may develop complications of diabetes that can lead to great pathology and death, the most prevalent consequences of diabetes are microangiopathy and large blood vessels and Macroangiopaths with a frequency of the first much more than a second [7] . From the foregoing, the current study aims to assess the levels of HBA1C, insulin and glucose, calculating insulin resistance and the body mass index in males with complications of diabetics that are not controlled.

**Related Works**

The results of our study were compatible with the findings of the [8], as they found an increase in the average insulin values in diabetic kidney disease patients compared to the group of healthy people. The results of this study were compatible with the results of who indicated a moral increase in the percentage of HBA1C diabetes in diabetics compared to healthy people. This result was compatible with the , and with the study of [9] that showed that the high level of glucose in diabetics may be the result of a decrease in the secretion of the hormone insulin from the beta -Benkerian cells or is due to an imbalance in insulin receptors in Body cells. The results of the current study were compatible with the results of [10],[11] as they found an increase in the average value of insulin and insulin resistance in the group of patients with diabetes compared to the control group.

## 2. Materials and Methods

### 2.1.Study Design:

This study was conducted for the period from the beginning of December 2023 until the end of May 2024 in government and private hospitals and specialized medical clinics in the city of Hawija , and included (70) male patients who suffer from complications of diabetes after confirming that they are infected with ages of (40-70) years, as well as (20) healthy people with the same average age of patients.

### 2.2.Blood Samples:

Blood samples were collected from patients by (5) ml of vein, (1) ml of blood was placed in glass tubes containing an edta tubes, to find out the percentage of cumulative HBA1C cumulative hemocopin. The remaining amount of blood is placed (4) ml in glass tubes containing the gel and without the vaguum tube with gel and Clot Activator The sample left room temperature for 30 minutes for clotting, then the tubes were placed in the centrifugal device for (15) minutes and quickly (3000) a minute course for the serum.

### 2.3.Biochemical tests:

The concentrations of the vulgar and gray indicators of the studied groups have been estimated and included estimating the concentration of the hormone insulin through the use of the number of ready -made analysis (KITS) from the manufacturer Sunlong Chinese origin using the Sandwich ELISA technology as a method, and estimates the percentage of HBA1C diabetic by using the number of prefab analysis (KITS) From the manufacturer Boditech, the Mistributor, according to the method of immune detection [12]. The serum was estimated using the special prepared kit from the French biolbo -originally equipped company according to the method [13]. It is an enzymatic method in which oxidation of

glucose Insulin resistance is calculated by multiplying the fasting glucose concentration mg/100ml by the fasting insulin level in the blood serum and dividing it by 405 to produce the HOMA-IR index, according to the following equation [14].

Homa-IR = ( Fasting Blood Glucose × Fasting Insulin ) ÷ 405

The BMI was calculated through the following equation:

Height(m2)/Weight( kg) = BMI

**2.4.Statistical Analysis:**

The results obtained from the current study were analyzed using the statistical program SPSS based on the T-test where the arithmetic averages of patients and healthy people were compared at a significant level ($P \leq 0.01$) and the values of the variables were described as the average ± standard ±deviation [15]

## 3. Results and Discussion

### 3.1.Fasting Blood Sugar (FBS) in the studied groups.

The results in the current study in Figure (1) and Table (1) showed a moral rise ($p \leq 0.01$) in the focus of fasting blood sugar in people with diabetes (224.07± 24.36 ) mg/100 ml compared to the control group (109.63± 6.23) mg/100 ml , And this result came compatible with what reached the [16], which showed that the high level of sugar in diabetes patients may be the result of a decrease in the secretion of the hormone insulin from the Beta Bankerian cells or is due to an imbalance in insulin receptors in the cells of the body, attributed to the high level Fasting blood sugar in diabetics to low insulin hormone levels in the blood or a defect in insulin receptors, which leads to high levels of free fatty acids in the plasma as a result of not controlling the process of decomposing fat in the fatty tissues, reduces fatty acids from glucose metabolism in the surrounding tissues , Like structural muscles in addition, insulin deficiency increases the production of glucose in the liver by breaking the glycogenolysis storage or increasing the formation of glucose through the process of the formation of the new Gluconeogenesis , In structural muscles, insulin enhances the transmission and use of glucose and stimulates the creation of cacogine and prevents the demolition of proteins and in fatty tissues, insulin enhances the transmission of glucose and the generation of fats and prevents its degradation, so the occurrence of any imbalance in the metallin or the effectiveness of insulin leads to an imbalance in the level of blood sugar [17].

Another possible reason for the high level of glucose is poor control of blood sugar due to a lack of knowledge about self -control of the level of sugar or the lack of sugar measurement devices, so educating patients with diabetes on how to measure blood sugar and providing measuring devices for all is a major contribution to Early diagnosis of the level of glucose, which helps in early treatment and reduces the complications associated with it. [18].

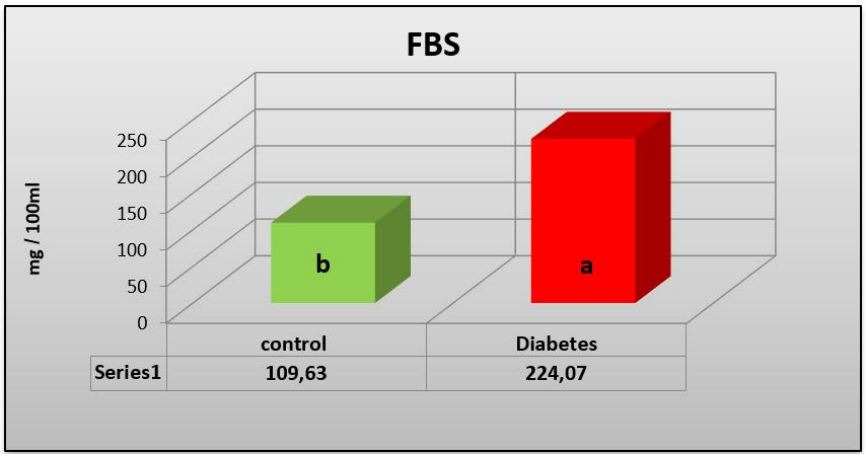


Figure 1. Fasting glucose concentration in the studied groups.

**3.2.Insulin Fasting concentration in the studied groups.**

The results in the current study in Figure 2 Table (1) shows a moral rise ($P \leq 0.01$) in the concentration of the hormone insulin in the group of people with complications of diabetes (23.82± 3.34) ml Unit/l compared to the control group (10.44 ± 0.92) ml Unit/l, these results are consistent with [19] as they found an increase in the average insulin values in diabetics compared to the group of healthy people. The most common cause of the high insulin concentration in people with diabetes is that insulin resistance (insulin resistance to enhancing glucose absorption by muscle and fatty cells) has preceded and caused insulin in the blood. Hence, we find that insulin resistance is the primary imbalance that led to the development of metabolic syndrome and high blood sugar levels, and thus the incidence of type 2 diabetes after years or even decades.

Moreover, correlation studies at the genome level indicate that insulin resistance is the main cause of type 2 diabetes, and some of these studies are due to defects in beta cells in the pancreas [20].Insulin resistance is usually associated with type 2 diabetes, however, studies have shown the presence of insulin resistance in type 1 diabetes patients as well, during insulin resistance, hormone secretion from beta cells in the pancreas does not effectively absorb glucose in tissues, which leads To the high levels of glucose in the blood, type 2 diabetes begins to a gradual decrease in the effectiveness of insulin, as the body cannot efficiently use insulin to transfer glucose to tissues, which leads to removing the sensitivity of insulin receptors. To compensate for insulin resistance, the body produces additional insulin to facilitate the balance of glucose, which leads to a high level of insulin in the blood [21].

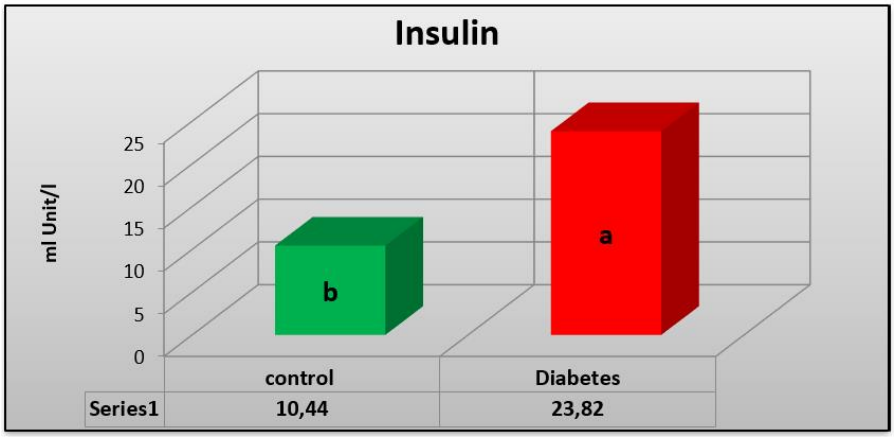


Figure 2. Fasting insulin concentration in study groups.

**3.3.Insulin resistance concentration in the studied groups.**

The results of the current study in Figure (3) and table (1) showed the presence of a moral height ($P \leq 0.01$) in insulin resistance in patients with diabetes complications(14.35±4.25 ) (compared to the control group of (2.82± 0.55 ) and the results came compatible with [22], as they found an increase in the average value of insulin and insulin resistance in the group of patients with diabetes compared to the control group. October in the development of insulin resistance, perhaps by launching fats and other widespread factors that enhance insulin resistance in other organs, , These outside cell factors disturb the concentration inside the cells of a group of intermediate materials, which leads to defects in the cell response to insulin, these media may cause insulin resistance by inhibiting one or more of the nearby ingredients in the insulin course signals (insulin future, substrate proteins For the future of insulin).

However, there is evidence that supports the opinion that insulin resistance is a heterogeneous disorder that may arise differently in a group of metabolic tissues and that the mechanism of this effect is likely to include a unified path to insulin resistance that

affects the remote step in the work of insulin, the most related path of response Final biological [23] .

Insulin secretion and insulin sensitivity are regulated by the Beta Benkerian Beta cells in a very specific way to maintain glucose concentrations in the plasma in healthy individuals, as there is a positive rebound diet between beta cells and insulin sensitive tissues while enhancing insulin supply with beta cells in response to liver, structural muscles, fatty tissues and tissues and tissues. The size of the insulin response from beta cells depends on the sensitivity of the insulin tissue. Insulin -resistant condition is very important to cause and increase this condition [24].

There are many mechanisms as possible reasons behind the increase in insulin resistance and these include genetic abnormalities for one or more of the insulin series work and an increase in visceral obesity, insulin resistance occurs as part of a group of cardiovascular disorders and metabolism that is usually referred to as' insulin resistance syndrome Insulin Resistance Syndrome or Metabolic Syndrome, this set of distortions may lead to the development of diabetes, atherosclerosis, high blood pressure, or polycystic ovary syndrome, depending on the genetic background of the individual that has insulin resistance [25]

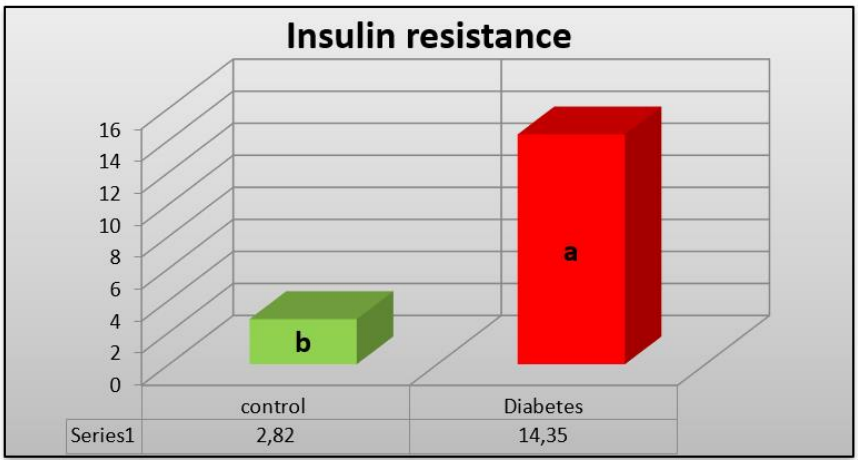


Figure 3. Insulin resistance concentration in the studied groups

**3.4.Concentration of Glycated Hemoglobin (HbA1c) in the Studied Groups**

The results of the current study Figure (4) Table (1) indicate a significant increase ($P \leq 0.01$) in the percentage of cumulative sugar with diabetic complications, as it reached (10.20 ± 1.50) compared to the control group that amounted to (4.81±0.40), the results of this study coincided with the findings of [26] who indicated a significant increase in the percentage of glycated hemoglobin HbA1c in diabetic patients compared to healthy.

HbA1c is the main biological indicator used to evaluate control of blood sugar in the long run in individuals with diabetes, and the high level of cumulative sugar may be attributed to poor control of the level of glucose and an increase in blood viscosity, as the percentage of glucose affects the properties of red blood cells as it reduces Its elasticity and increases its tendency to gather, which leads to the association of glucose with hemocopine [27].

Also, the high concentration of the HBA1C results from the presence of high levels of glucose in the blood, which leads to the addition of the glucose part to the hemocopine in an automatic and non -enzymatic reaction, which is proportional to the age of red blood cells, so it is a good sign of high blood sugar for a long time It reaches three months [28]. The cause of the height may also be attributed to the fact that the A1C diligence is formed by the correlation of glucose with various amino groups, including lisen and fillene of the chain (Alpha) and the two series of hemoglobin A. This test cannot be diagnosed with diabetes, but it is one of the best ways to know the extent of diabetes control over the level

of blood sugar, in addition to that it gives the doctor important information through which he can determine the amount of insulin that it needs and the pattern of the diet in order to maintain the level of sugar in the blood Good, and that the increase in the percentage of hemocopine associated with glucose increases the possibility of complications in diabetics, including kidney, eye diseases, heart diseaase [29].

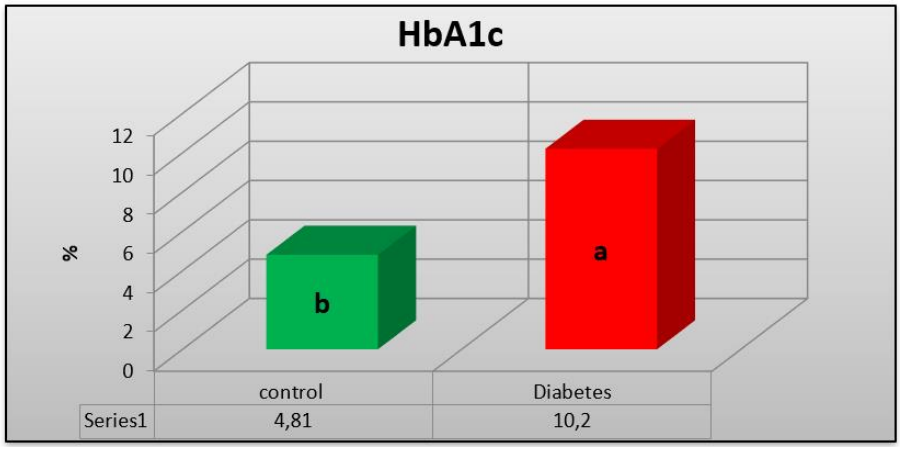


Figure 4. Concentration of Glycated Hemoglobin (HbA1c) in the Studied Groups

**3.5.Body mass index**

BMI is defined as a measure dependent on a person's length and weight and allows the classification of individuals into categories such as obesity or weight gain. Using these classifications we can assess the risks of high blood pressure, diabetes, cancer and high cholesterol in the blood and other chronic diseases [30].The results of the current study shown in Figure (5) and table (1) showed the presence of a moral height (P 0.01) in the body mass index in people with diabetes complications, reaching (1.06 ± 28.52 (compared to the control group of (1.32 ± 24.30), agreed The results of this study, with the findings of the [31], which indicated the high body mass indicator in patients who suffer from some chronic complications of diabetes, such as alcoholic fatty liver disease when compared to the body mass index for healthy people.

This may be attributed to the presence of some possible mechanisms that may explain the high body mass index in some people who suffer from complications from diabetes, including metabolic imbalances and the occurrence of various metabolic disorders as a result of diabetes that enhances weight gain, such as insulin resistance, weak glucose, as well On the change of fat metabolism, these metabolic changes work individually or combined on the development of obesity and the complications associated with it at the expense of the length, which increases the body mass index in this category [32],Lifestyle factors such as physical inactivity and unhealthy diet, which are common behaviors in diabetics, which contribute to weight gain at the expense of height and thus lead to an increase in body mass index in people with diabetes complications , as well as side effects of medications taken by diabetics orally or by injection such as insulin, which can lead to aggravation of complications and weight [33].

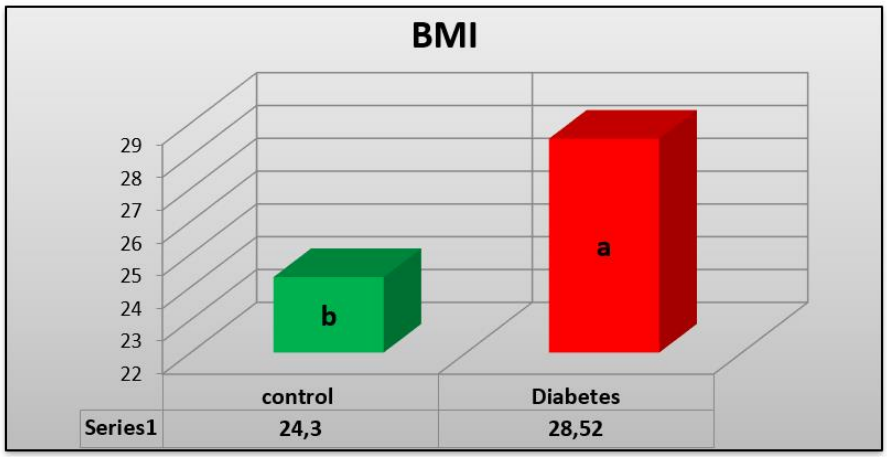


Figure 5. Body mass index values in the studied aggregates

Table 1. Concentrations of indicators studied in the study groups.

| Group<br>Variables | **Diabetic** Patient<br>Mean±SD | Control<br>Mean±SD |
|---|---|---|
| **BMI** | **28.52 ±1.06**<br>**A** | **24.30 ± 1.32**<br>**B** |
| **HbA1c (%)** | **20.10 ± 50.1**<br>**A** | 4.81 ± 0.40<br>B |
| **Insulin (mU/L )** | **23. 82±3.34**<br>**A** | 10.44 ±0.92<br>B |
| **Glucose (mg /100 ml )** | **224.07 ± 24.36**<br>**A** | 109 .63 ±6.23<br>B |
| **Insulin resistance** | **14.35±4.25**<br>**A** | 2.82± 0.55<br>B |

## 4. Conclusion

We conclude from the current study that the increase in insulin resistance in people with diabetes resulting from increased levels of insulin and glucose in the blood for long periods lead to serious diabetes complications, including diabetic nephropathy and from this we find that insulin resistance is the most prominent defect that led to the development of metabolic syndrome, hyperglycemia and type II diabetes.

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