**Correlation between visfatin and hemoglobin A1c in type 2 diabetic patients**

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| **Abstract**  Hyperglycemia is the hallmark of type two diabetes mellitus (T2DM), a chronic metabolic disease. It could be because of a lack of insulin production or a resistance to insulin effects on the body. There's a direct correlation between visfatin levels and T2DM, where visfatin is a newly discovered adipocyte hormone. The study included 120 volunteers who attended some hospitals in Salah al-Din/IRAQ, divided into two groups. The first group included 60 patients diagnosed clinically and under periodic monitoring with type two diabetes for more than five years. The second group included 60 volunteers of an age group close to the patients. The descriptive analysis was conducted, and the mean and standard deviation of the parameters was obtained, where the age was (58.721±7.850 years) for the healthy and (59.345±8.150 years) for the patients, where there was no significant difference. Still, the concentration of visfatin in the serum was elevated in the patients versus healthy volunteers, with a significant difference where; the p-value was ≤0.001\*\*. Concerning glycated hemoglobin was elevated in the patients versus healthy volunteers where there was a significant difference, and the p-value was ≤0.001\*\*; finally, the fasting blood sugar level was elevated in the patients versus healthy volunteers, there was a significant difference, and the p-value was ≤0.001\*\*. Visfatin was positively correlated with HbA1c, where the values of r = 0.3510\*\* and p = 0.0060. In addition, there was no correlation between visfatin and fasting blood sugar, as the values of r = 0.7710 and p = 0.0380. Correlation is considered significant at the 0.01 level (2-tailed). In conclusion, visfatin was positively correlated with HbA1c and no correlation with fasting blood sugar in patients with T2DM as per the statistical analysis. |
| Keywords: T2DM, Visfatin, HbA1c, FBS, Correlation |

1. **Introduction**

Diabetes Mellitus (DM) is a chronic, multi-factorial health disorder that affects a considerable portion of the population and is anticipated to rise in prevalence among adults, based on the World Health Organization [1]. In the past, Type 2 Diabetes Mellitus (T2DM) was referred to as adult-onset diabetes characterized by insulin resistance, or non-insulin-dependent diabetes that could progressively worsen to total insulin resistance. In the last decade, however, it has been recognized that diminished -cell function is a key issue in T2DM. In T2DM, the decrease of -cell insulin secretion is often accompanied by insulin resistance [2].

Visfatin is a recently uncovered adipocytokine hormone in living beings that has a molecular weight of 52 kilodaltons and is mostly generated by visceral adipose tissue [3]. By attaching to the insulin receptor-1, it has an action that is analogous to that of insulin. Therefore, visfatin can produce hypoglycemia by a combination mechanism that involves the inhibition of glycogenolysis in hepatocytes and the promotion of glucose metabolism in adipocytes and myocytes via downstream signaling. This results in a lower blood sugar level [4]. A significant relationship between plasma visfatin concentrations and the presence of T2DM [3].

1. **Materials and Methods**

**2.1. Study Participants**

The study included 120 volunteers who attended some hospitals in Salah al-Din/IRAQ, where they were divided into two groups. The first group included 60 patients (35 men and 25 women) diagnosed clinically and under periodic monitoring with type 2 diabetes for more than five years, while the second group It included 60 volunteers (29 men and 31 women) of an age group close to the patients.

**2.2. Sample collection and analytical kits**

Venipuncture was used to collect 5 milliliters of blood from both patients and healthy controls, and the samples were kept at a temperature of four degrees Celsius until further examination. The specimen that we worked with was coagulated in a gel tube for fifteen minutes at room temperature. After centrifuging the sample for ten minutes at a speed of 4000 rpm, serum was extracted and kept at a temperature of -20 degrees Celsius until it was required. To evaluate visfatin in the serum of volunteers, an ELISA kit from (BT LAB/China) was used, to evaluate HbA1c in the serum of volunteers, a kit from (BODITCH/South Korea) was used, and to evaluate FBS in the serum of volunteers, a kit from (BIOLABO /France) was used.

**2.3. Statistical analysis**

Venipuncture was used to collect 5 milliliters of blood from both patients and healthy controls, and the samples Graph pad Prism program version 9.0 was used for statistical analysis, the mean and standard deviation of all parameters were determined, and the correlation between visfatin versus glycated hemoglobin and fasting blood sugar was analyzed.

**3. Results and Discussion**

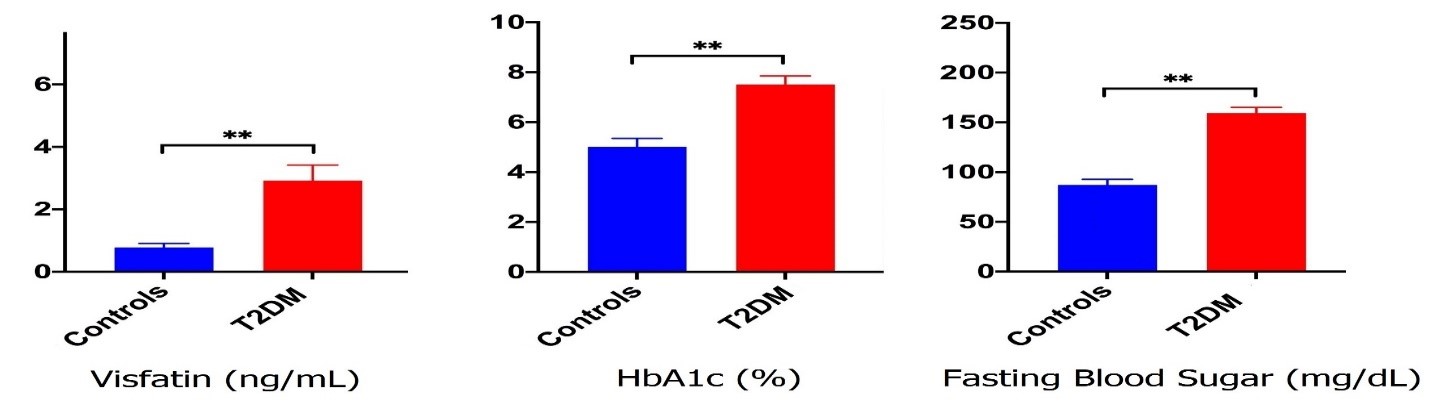
**3.1. Results**

Concerning the results, a questionnaire was conducted for all volunteers in the study, where information was collected about the age and medical history of the participants, and tests for visfatin, glycated hemoglobin, and fasting blood sugar were conducted. The descriptive analysis was conducted, and the mean and standard deviation of the parameters was obtained, where the age was (58.721±7.850 years) for the healthy and (59.345±8.150 years) for the patients, where there was no significant difference, but the concentration of visfatin in the serum was (0.781±0.141 ng/mL) for the healthy and (2.935±0.415 ng/mL) for patients where there was a significant difference, and the p-value was ≤0.001\*\*, concerning glycated hemoglobin it was (5.150±0.350 %) for the healthy and 7.650±0.430 %) for the patients where there was a significant difference, and the p-value was ≤0.001\*\*; finally, the fasting blood sugar level was (88.500±6.150 mg/dL) For healthy subjects and (160.300±5.550 mg/dL) for patients, there was a significant difference, and the p-value was ≤0.001\*\*, as per table (1) and figure (1).

**Table 1.** Parameters of Visfatin, Hemoglobin A1c, and Fasting blood sugar in all participants.

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Control  n (60)  Male (29), Female (31)  Mean ± SD | Patients  n (60)  Male (35), Female (25)  Mean ± SD | P value |
| Age (year) | 58.721 ± 7.850 | 59.345 ± 8.150 | NS |
| Visfatin (ng/mL) | 0.781 ± 0.141 | 2.935 ± 0.415 | ≤0.001\*\* |
| Hemoglobin A1c (%) | 5.150 ± 0.350 | 7.650 ± 0.430 | ≤0.001\*\* |
| FBS (mg/dL) | 88.500 ± 6.150 | 160.300 ± 5.550 | ≤0.001\*\* |

FBS: Fasting blood sugar; NS: non-significant; \*\*: significant less than 0.01



**Figure 1**. Levels of Visfatin, Hemoglobin A1c, and Fasting blood sugar in control versus patients.

**3.1.1. Correlation**

When conducting a statistical analysis of the correlation between visfatin, HbA1c, and fasting blood sugar, it was found that visfatin was negatively correlated with HbA1c, where the values of r = -0.3510\*\* and p = 0.0060. In addition, there was no correlation between visfatin and fasting blood sugar, as the values of r = 0.7710 and p = -0.0380. Correlation is considered significant at the 0.01 level (2-tailed), as per table (2).

**Table 2.** Correlation between Visfatin versus Hemoglobin A1c and Fasting blood sugar.

|  |  |  |
| --- | --- | --- |
| Test | | Visfatin (ng/mL) |
| Visfatin (ng/mL) | p |  |
| r | 1.0 |
| Fast Blood Glucose (mg/dL) | p | 0.7710 |
| r | 0.0380 |
| Hemoglobin A1c (%) | p | 0.0060 |
| r | 0.3510\*\* |

Correlation is significant (\*\*) if the level at 0.01 (2-tailed)

**3.2. Discussion**

Higher concentrations of visfatin, HbA1c, and FBS were found in the blood of those with type 2 diabetes. Visfatin appears to have lost its insulin-like hypoglycemic effect in people with type 2 diabetes, as seen by the patients' raised blood sugar levels. T2DM's etiology and progression could be influenced by this. T2DM and visfatin levels appear to be linked, despite the lack of thorough understanding of this relationship. Visfatin's role in T2DM pathophysiology and development will be clarified with the help of these findings.

Visfatin, which regulates glucose levels in a manner analogous to insulin, helps to maintain a consistent glucose level in the blood [3]. From the above facts and it is well known, the increase in blood sugar level in patients with type 2 diabetes, due to lack of insulin or lack of secretion and the response of the pancreas to the increase in circulating blood sugar, and since visfatin plays a mimicry role for insulin, it is natural that its concentration in the blood increases in response to the increase in the level of sugar in the blood. T2DM patients' plasma visfatin levels are likewise elevated by hyperglycemia, which worsens as blood glucose levels rise [5]. A considerable rise in plasma visfatin levels was seen in healthy individuals when levels of glucose were 8.3 mmol/l or higher [6]. Beta cell death has also been linked to a rise in plasma visfatin [7].Since the patients in this study have type 2 diabetes, it is normal to note that glycated hemoglobin levels are higher and higher than normal in healthy individuals. In a study conducted in 2012 on patients with type 2 diabetes, visfatin levels were determined, which were found to be high compared to healthy people and gave a positive correlation with glycated hemoglobin, and this is the same as what our study led to and also explains the insulin-like behavior of visfatin [5].

Our study showed that there is no statistical correlation between the level of visfatin and fasting blood sugar for patients. In contrast, a research conducted on humans has showed that the amount of visfatin drops after a period of overfeeding for seven days that is greater than seventy percent of the typical dietary requirements. These findings were found in recent investigations. This suggests that visfatin is not likely involved in the regulation of the glucose metabolic process [8]. It is not clear what caused these differences in opinion or judgment. It is likely that the population that was tested had superior glucose regulation, or that the time frame that was used was not long enough to generate a significant increase in the level of visfatin.

**Conclusion**

Higher concentrations of visfatin, HbA1c, and FBS were found in the blood of those with type 2 diabetes. Visfatin Visfatin was positively correlated with HbA1c and no correlation with fasting blood sugar in patients with T2DM as per the statistical analysis.

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