Evaluation of Tumor Necrosis Factor (TNF-α) Concertation and Renal Function in The Sera of Patients With Type 2 Diabetes Mellitus in Erbil City

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Submission date: 12-Jul-2024 10:50AM (UTC+0700)
Submission ID: 2415536129
File name: Sera_of_Patients_With_Type_2_Diabetes_Mellitus_in_Erbil_City.doc (270.5K)
Word count: 2121
Character count: 10939

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ABTRACT

The research included a total of 70 samples, including 40 samples from patients diagnosed with type 2 diabetes and 30 samples from the control group. The participants' age ranged from 40 to 60 years. The samples were gathered during a one-year duration from the Chronic Diseases Unit / Diabetes Department in the city of Erbil. Later, blood samples were collected from both ill and healthy individuals, and then separated via the process of centrifugation. The variables that were evaluated include glucose, ferritin, Tumor necrosis factor-alpha (TNFα), C Reactive Protein (CRP), Urea, Creatinine, and Uric acid. The results of this research showed a significant rise in the concentrations of Glucose, Ferritin, TNF-alpha, CRP, Urea, Creatinine, and Uric acid in persons with type II diabetes as compared to the control group.

Keywords: Renal Function, Type 2 Diabetes Mellitus (T2DM), Tumor Necrosis Factor (TNF-α)

INTRODUCTION

Type II diabetes mellitus is a severe and persistent metabolic disorder that arises from genetic, abnormal, or environmental factors. Its primary symptom is elevated blood glucose levels, which can contribute to the development of various complications. Diabetic condition, potentially fatal Alam et al. (2021); Ali et al. (2022).

Research has shown that the occurrence of diabetes worldwide is influenced by several characteristics, such as gender, ethnic background, and geographical location Genuth et al. (2021). Hence, diabetes mellitus is an established risk factor for substantially elevated death rates in many acute or chronic illnesses, including cerebrovascular disease and cardiovascular disease, due to inadequate glycemic control and persistent hyperglycemia Seshasai et al. (2011); Bragg et al. (2011); Mustafa et al. (2018).

Glucose serves as the primary fuel for the human body and is intricately involved in several metabolic processes Odiga et al. (2020). The ultimate outcome of carbohydrate digestion involves the decomposition of polysaccharides and oligosaccharides into smaller entities called monosaccharides, which may be readily absorbed by the body. These monosaccharides are then converted into glucose by metabolic processes, some of which occur in the liver Wach (2021).

Ferritin levels in the blood serum serve as a reliable and accurate measure of iron stores in the body. A decrease in ferritin indicates a decrease in iron levels, while a high ferritin level is not a precise indicator and lacks sensitivity. This is because ferritin levels can increase in various situations, such as chronic alcohol consumption, metabolic syndrome, and obesity, due to elevated iron levels. Excessive body weight Diabetes, cancerous tumors, and inflammatory disorders Lee et al. (1995). TNFα, a cytokine, is secreted by macrophages, killer cells, and T cells. This cytokine promotes inflammation and activates the endothelium of blood vessels. It acts as an antigenic factor, stimulating endothelial cell division and influencing pro-antigenic elements. The kidney plays a crucial role in maintaining homeostasis by regulating fluid and salt balance, as well as eliminating metabolic wastes from the bloodstream Newburgh (1943). The assessment of kidney function involves several factors, such as urea, creatinine, and uric acid. Blood urea nitrogen and creatinine are the last byproducts of nitrogen metabolism in humans Matsue et al. (2017).

Various disorders may impact the kidneys, with diabetic kidney disease being the predominant cause of renal failure. Given that about 50% of individuals with type 2 diabetes acquire the condition, timely identification and control of type 2 diabetes is crucial in a clinical setting to prevent associated problems Forst et al. (2022). The objective of this study was to evaluate the correlation between tumor necrosis factor levels and kidney function in individuals with type 2 diabetes. Specifically, the research intended to measure the levels of tumor necrosis factor and certain biochemical markers in the blood samples of patients with type 2 diabetes in the city of Erbil.

METHOD

The study was conducted on 70 samples, 40 samples of patients with type 2 diabetes and 30 samples of a control group and their ages ranged between (40-60) years, and the samples were collected from the Chronic Diseases Unit / Diabetes Department in the city of Erbil city.

The concentration of glucose was estimated using the ready-made kit for the determination of glucose and according to the colorimetric method in the blood serum Dingeon (1975). Ferritin concentration was measured by a kit from the Korean company Boditech and using a device minividas. The tumor necrosis factor level was determination according to the kits supplied by Chinese company Melsin and by using ELISA technology using the double ELISA Sandwich antibody method. The CRP level was estimated using the VEDA.LAB device according to the following method Ridker (2003). The urea concentration was quantified using commercially available kits specifically designed for measuring urea levels in blood serum Searle (1984).

Quantification of creatinine levels in the study cohorts The blood creatinine concentration was determined using commercially available kits that use the Jaffe and Henry colorimetric techniques Tietz et al. (1986); Henry (1974). Quantification of the U.A levels in the blood serum. The uric acid content was measured using commercially available kits that use the colorimetric technique Burtis et al. (1999); Fossati et al. (1980).

The SSPS software was used to analyze the collected findings, using the arithmetic mean and standard deviation for the data being studied. The T-test was employed to compare the biochemical variables across all groups, with a significance threshold of $p < 0.05$.

RESULT AND DISCUSSION

The study includes determining the some biochemical variables represented by (Glucose , Ferritin , TNF-α , CRP, Urea, Creatinine, Uric acid) in the blood serum of patients with T2DM compared to the control group. The results are illustrated according to Table **1**.

Table 1. Mean ± S.D of the biochemical variables for the healthy people and T2DM

Groups Variables	Mean ± SD	
	Healthy people n=30	T2DM n=40
Glucose (mg/dl)	90.243 ± 20.28	275.231 ± 67.231
Ferritin (ng/ml)	156.731 ± 28.78	501.123 ± 62.471
TNFα (Pg/ml)	8. 565± 3.854	18. 331± 4.643
CRP (mg/L)	3.621 ± 0.734	25.843 ± 5.135
Urea (mg/dl)	41.872 ± 8.27	60.071 ± 23.123
Creatinine(mg/dl)	2.381 ± 1.02	4.032 ± 0.791
Uric acid(mg/dl)	6.106 ± 1.301	10.492 ± 3.152

The findings demonstrated a statistically significant increase at a probability level of $p \leq 0.05$ in the levels of the biochemical variables (blood sugar, ferritin, tumor necrosis factor, CRP, urea, creatinine, uric acid) in the serum of patients with T2DM compared to healthy individuals, as depicted in figures 1, 2, 3, 4, 5, 6, and 7, respectively. showed a significant elevated at $p \leq 0.05$ probability level in the level of the biochemical variables represented (blood sugar, ferritin, tumor necrosis factor, CRP ,urea, creatinine, uric acid) in the sera of patients with T2DM compared to healthy people, as in the figures (1, 2, 3, 4, 5, 6, 7) respectively.

The results of glucose is agree with Al-Samarrai in 2020 and Alhabbo in 2018, who showed in their study a significant elevated in glucose level in diabetes. and it was found that the reason for the rise is due to the resistance of the receptors of fat cells to insulin, which leads to the weakness of the insulin load of glucose inside the cells, which lead to its bulk in the blood Abbed (2019), In addition, the reason may be due to the excessive secretion of insulin from the β cells of the pancreas in order to regulate the process of glucose balance on individual tissues to distribute energy throughout the body, as the brain uses 50% of glucose to supply the body with energy while the rest of the insulin-dependent tissues, and muscles Structural takes up 25% of glucose, in addition to that, hyper suger affects lung position, leading to high glucose concentration and permeability through the blood vessels and its excretion into the airway Vital et al. (2006); Baron et al. (1988); DeFronzo (2004).

Also the result of ferritin was agree with Shehab in 2018 and Al-harbawi in 2017, who showed in their study a significant rise in ferritin level in sera of patients. The role of iron may play a role in the physiology of T2DM, as iron is a toxic and strong oxidizer, and an advance in its percentage may be accompanied by an elevated in the level of oxidizing factors and may increase the risk of type 2 diabetes Rajpathak et al. (2009). Ferritin plays a role in iron absorption and metabolism, reducing oxidative stress and reducing infection in animals and humans Garg et al. (2020). In addition, ferritin is a diagnostic test tool for iron deficiency anemia Hintze et al. (2005). Ferritin is an endogenous antioxidant as its guest is to sequester potentially toxic iron, when endogenous antioxidants are unable to neutralize oxidative stress Hintze et al. (2005).

Also the result of TNF-α was agreed with Majeed in 2019 and Saleh in 2017, who showed a significant elevated in TNF-alpha in the sera of patients with T2DM, due to the reason The rise in the level of sugar and the growing in chronic inflammation in the blood leads to a change in the balance between inflammatory cytokines, so chronic inflammation is a critical factor contributing to the development of T2DM, as its evolution may lead to the production of high inflammatory cytokines, including TNF-α and the resulting On insulin resistance and the development of diabetes Lee (2014).

The results for C-reactive protein are in agreement with those of Shaheer in 2017 and Devaraj in 2009 findings indicating elevated CRP in serum of type 2 diabetes mellitus. Serum protein values are important for the diagnosis of T2DM, and may have a role in knowing Metabolic diseases Al-Hardawi et al. (2020).

CRP is one of the proteins whose concentrations are raised by specific inflammation, as it participates in a process known as the acute phase response, so low-grade inflammation may be responsible for causing T2DM Behl et al. (2014), while the high F.S.B level in the serum is a factor associated with the increase in CRP level in patients with T2DM Lima et al. (2007).

While the result of urea was agree with the results of Zahid in 2013 and Mulesy in 2022, who showed in their study the high level of urea in the blood serum of patients with type 2 diabetes. The reason for the rise is due to the low ability of the kidneys to filter, which leads to an top-up in metabolic products and vital processes within the system Wagle (2010), or the cause of the rise may be due to a kidney defect such as a decrease in size and necrosis of the kidneys Adler et al. (2003), as urea is produced from deamination The oxidative stress of amino acids where the generated ammonia is transported to the liver to form urea through the urea cycle, and the cause of the rise in the level of urea may be due to the presence of necrosis and exudate in the kidneys or irregular functioning properly Shrestha et al. (2008).

Also The results of creatinine agree with the results of Hussin in 2020 and Mulesy in 2022, who showed in their study a significant rise in creatinine level in the sera of patients. The reason for the rise is due to chronic and acute diseases of the kidneys. Or a case of kidney failure or blockage of the urinary tract, because is creatinine a compound that is produced from metabolic processes and is excreted naturally with urine, but in the event of confusion in the kidneys or defects such as kidney failure, the kidneys will be unable to filter and excrete waste, so the concentration of creatinine in the blood will increase. The creatinine concentration is usually inversely proportional to the glomerular filtration rate, so a slight decrease in GFR leads to an elevated in creatinine concentration in the blood plasma, so it always depends on the creatinine concentration as a sensitive indicator of changes in kidney functions and kidney diseases of all kinds Searcy (1969); Rosano and Brown (2006).

While the result of showed The reason for the rise is attributed to the occurrence of kidney failure, where the biological utilization of nitric oxide in endothelial cells is inhibited, and the excessive increase of uric acid leads to a rapid progression in kidney disease. Where kidney stones form as a result of the union of calcium salts with oxalates Ul-Haq et al. (2010) and the increase in the concentration of uric acid in the serum leads to the activation of the renin-angiotensin system, which works to shrink blood vessels and thus raise blood pressure in patients, and that high uric acid leads to constriction of blood vessels and thus High blood pressure Assob et al. (2014).

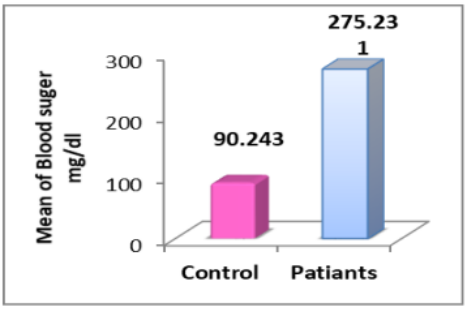

Figure 1. Glucose concentration in Patients and healthy people

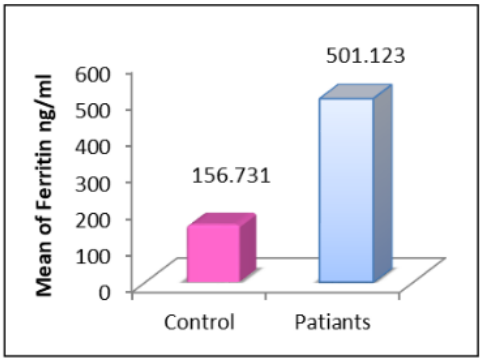

Figure 2. Ferritin concertation in Patients and healthy people

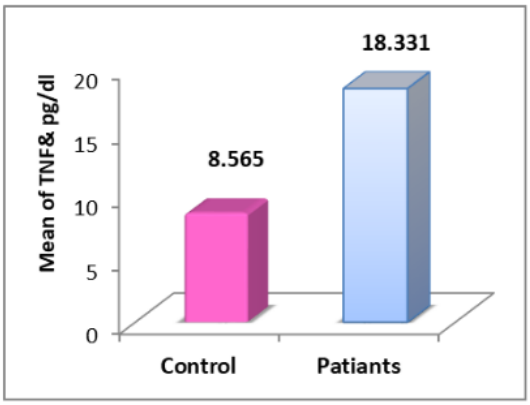

Figure 3. TNF-α Concertation in Patients and healthy people

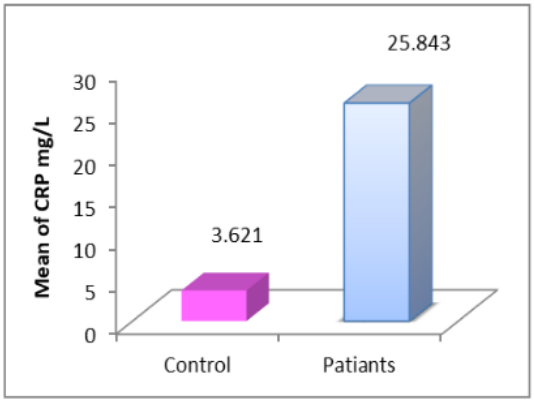

Figure 4. CRP Concertation in Patients and healthy people

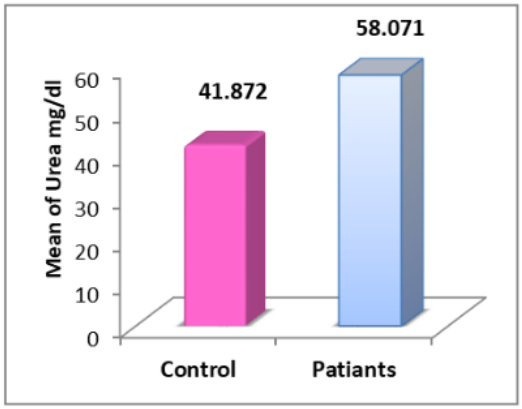

Figure 5. Urea Concertation in Patients and healthy people

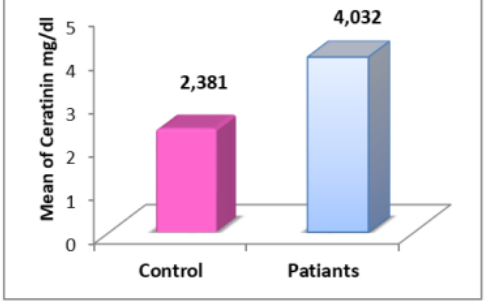

Figure 6. Creatinine Concertation in Patients and healthy people

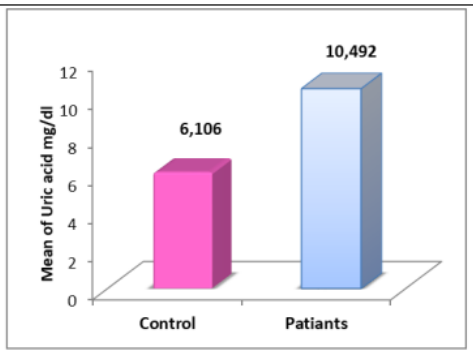

Figure 7. Uric acid Concertation in Patients and healthy people

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