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Serum TNF-A Concentrations In Type Two Diabetes Mellitus

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Abstract

Diabetes is one of the most common metabolic diseases, and its incidence continues to increase in many parts of the world. It is estimated that more than 90% of diabetes is type 2 diabetes mellitus (T2DM), which occurs for two main reasons: a lack of insulin production by β-cells of the pancreas, as well as peripheral insulin resistance (IR) in many organs such as the liver, skeletal muscles, and adipose tissues. It can be considered that pro-inflammatory cytokines are one of the most important variables that lead to T2DM and also contribute to the development of insulin resistance. Tumor necrosis factor-alpha (TNF-α) is the most important pro-inflammatory mediators, as it causes inflammation in various parts of the body.

TNF-α concentrations in sera were measured by enzyme-linked immunosorbent assay technique (ELISA) using Human tumor necrosis factor-alpha (TNF-α) ELISA Kit (Elabscience Company /china).

Serum TNF-α concentrations displayed a significant difference in T2DM patients when compared with the control group (Diabetic patients 30.36 ± 14.51 compared with control 23.30 ± 7.030, P-value = 0.0149, T-test = 2.489). TNF-α concentrations of males with diabetic patients displayed significant difference when compared with controls (31.83 ± 13.27 versus 22.41± 6.32, P-value = 0.0438, T-test = 2.751). However, the TNF-α concentrations of females of diabetic patients displayed non-significant difference when compared with controls (28.87 ± 77 versus 24.19 ± 7.79, P-value = 0.4377, T-test = 1.069).

We conclude that there may be a correlation between high levels of TNF-α and type 2 diabetes mellitus (T2DM).

Keywords: TNF-α , T2DM , ELISA

1. Introduction

Diabetes is one of the most common metabolic diseases, and its incidence continues to increase in many parts of the world (Zochodne, 2014). It is estimated that more than 90% of diabetes is type 2 diabetes mellitus (T2DM), which occurs for two main reasons: a lack of insulin production by β-cells of the pancreas, as well as peripheral insulin resistance (IR) in many organs such as the liver, skeletal muscles, and adipose tissues(Galicia-Garcia et al., 2020). There is ample evidence that the development of T2DM is the result of a combination of environmental and genetic variables(Goldstein, 2003; Z. Li et al., 2020). It can be

considered that pro-inflammatory cytokines are one of the most important variables that lead to T2DM and also contribute to the development of insulin resistance (Akash et al., 2013; Donath & Shoelson, 2011). Tumor necrosis factor-alpha (TNF-α) is the most important pro-inflammatory mediators, as it causes inflammation in various parts of the body(Donath & Shoelson, 2011).TNF-α is thought to be one of the most important pro-inflammatory cytokines, having polymorphic effects and varying amounts from person to person. It is important in the host's defense against infections and also plays a role in autoimmune disorders (Sandhya et al., 2013).

In patients with T2DM and insulin resistance, TNF-α levels are unusually high, indicating that this cytokine plays an important role in the development of insulin resistance and pathogenesis of T2DM (Chen et al., 2015). As a result the relationship among TNF-α and T2DM seems to have become a subject of diabetic research(M. Y. Shiau et al., 2003). The number of cytokines that have been studied for their association with T2DM is very large, and TNF-α is one of these cytokines that took a large part of this kind of study.Because of the different results of many studies, this study aims to evaluate the levels of TNF-α in the sera of patients with T2DM by means of Enzyme - linked immunosorbent assay (ELISA).

2. Materials and Methods

This study included (50) patients with T2DM (25 males, 25 females) whose ages ranged from 40 to 80 years, and (30) apparently healthy individuals(controls) subjects (15 males and 15 females) whose ages ranged from 37 to 65 years. They were chosen from different hospitals in Wasit governorate which include: AL-Zahra,a hospital, AL-Karamah hospital, and private clinics from different regions in Wasit governorate. The glycemic status of patients with diabetes and controls was used to differentiate them. Verbal consent was taken from all participants. Age, sex, weight, BMI, smoking, medications, and medical or family history of diabetes were all measured using standardized questionnaires.

Five milliliters of blood were collected from all participants and placed in a tube without anticoagulant and placed in a centrifuge at a speed of 2000 rpm for 10 minutes. After that, the serum was withdrawn into an eppendorff tube 2ml and preserved after being labeled with deep freezing until further processed.

TNF-α concentrations in sera were measured by enzyme-linked immunosorbent assay technique (ELISA) using Human tumor necrosis factor-alpha (TNF-α) ELISA Kit (Elabscience Company/china).

3. Results

The results are shown in Table 1 and Figure 1. Serum TNF-α concentrations displayed a significant difference in T2DM patients when compared with the control group (Diabetic patients 30.36 ± 14.51 compared with control 23.30 ± 7.030, P-value = 0.0149, T-test = 2.489).

Table 1: Concentration of serum TNF-α in diabetic and control groups

Parameters / Groups	TNF Pg/ml Mean + SD
Control	23.30 ± 7.030
Diabetic Patients	30.36 ± 14.51
P-value	0.0149 *
T-test	2.489

*

significant at p-value ≤ 0.05

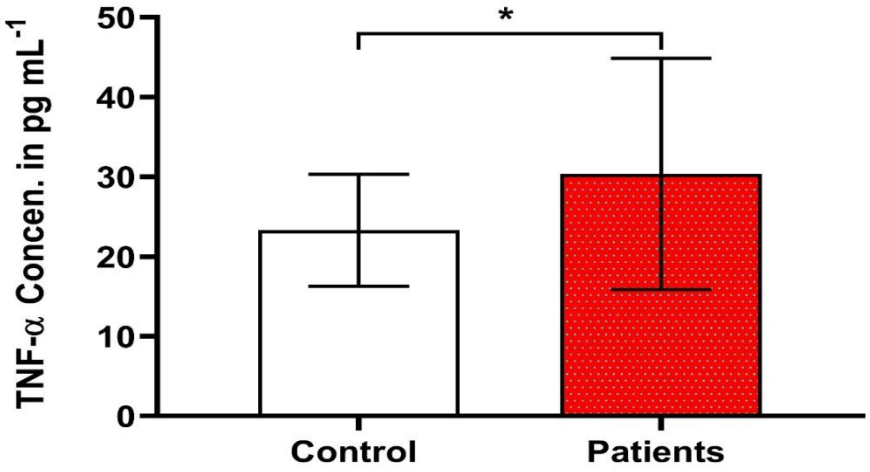

Figure 1: Concentration of serum TNF-α in diabetic and control groups.

The assessment of circulating levels of TNF-α on the basis of gender (males and females) of investigated groups are described inTable 2 and Figure 2. TNF-α concentrations of males with diabetic patients displayed significant difference when compared with controls (31.83 ± 13.27 versus 22.41 ± 6.32, P-value = 0.0438, T-test = 2.751). However, the TNF-α concentrations of females of diabetic patients displayed non-significant difference when compared with controls (28.87 ± 77 versus 24.19 ± 7.79, P-value = 0.4377, T-test = 1.069).

Table 2: Concentration of serum TNF-α on the basis of gender (males and females) in diabetic and control groups.

Parameters	TNF Pg/ml Mean + SD

Groups	male	Female	P-value	T-test
Control	22.41 ± 6.32	24.19 ± 7.79	0.9059	0.69 NS
Diabetic Patients	31.83 ± 13.27	28.87 ± 77	0.6394	0.7183 NS
P-value	0.0438	0.4377	----	----
T-test	2.751 *	1.069 NS	----	----

NS=Non-significant, * significant at p value ≤ 0.05.

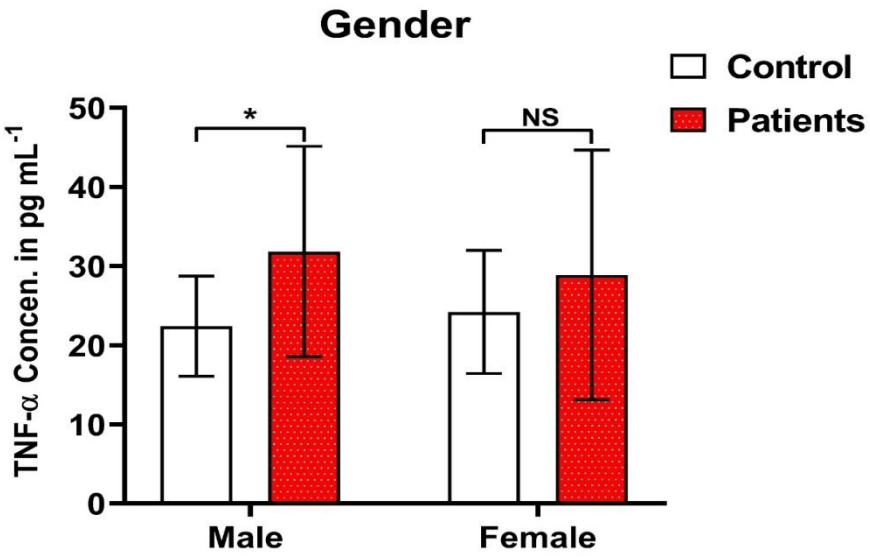

Figure 2: Concentration of serum TNF-α on the basis of gender (males and females) in diabetic and control groups.

4. Discussion

The current study revealed a significant difference of TNF-α levels when compared patients with T2DM to controls (Diabetic patients 30.36 ± 14.51 compared with control 23.30 ± 7.030, P-value = 0.0149, T-test = 2.489). These results are in agreement with Abd-Elbaky and others on the residents of Egyptian population (Abd-Elbaky & M Abo-El Matty, 2016). Clausell et al., 1999 displayed that the TNF-α levels are elevated in diabetic patients. But these levels in another study in the blood of diabetic patients demonstrated decreased values (M.-Y. Shiau et al., 2003). Lu et al., 2011 also found the levels of TNF-α concentration was 1.92 in the patients of T2DM. Navarro et al. found the concentrations of this cytokine was 0.27 in the patients group (Navarro et al., 2008). These findings are disagreed with our results.

Inflammation can be considered as an important characteristic of T2DM with high elevated levels of pro-inflammatory cytokines such as IL-1, IL-6, and TNF-α (Thamer et al., 2021). Considering TNF-α can disrupt insulin signaling pathways and destroy β-cells, increased production of TNF-α may play a key role in the development of T2DM(Nishimura et al., 2003).

Based on our study, TNF-α concentrations of males with diabetic patients displayed significant difference when compared with controls (31.83 ± 13.27 versus 22.41 ± 6.32, P-value = 0.0438, T-test = 2.751). Female diabetic patients, on the other hand, had non-significant differences in TNF-α concentrations when compared to controls (28.87 ± 77 versus 24.19 ± 7.79, P-value = 0.4377, T-test = 1.069). Hellmich et al., 2000discovered that sera from T2DM patients had considerably higher TNF-α than sera from normoglycemic controls. TNF-α has pro-inflammatory properties, although it may also has other effects(Jamil et al., 2017; H. Li et al., 2003). TNF-α is primarily involved in regulatory immune cells. TNF-α may hasten the release and synthesis of inflammatory cytokines and contribute to the advancement of T2DM (Fritzenwanger et al., 2009).

There were substantial differences in blood TNF-α levels between patients and control groupsin various investigations (Abd-Elbaky & M Abo-El Matty, 2016; Hellmich et al., 2000; Ishii et al., 2000).These results indicate that TNF-α serum levels may have some pathogenic roles in T2DM.

5. Conclusion

There may be a correlation between high levels of TNF-α and type 2 diabetes mellitus (T2DM).

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