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RESEARCH ARTICLE

Biochemical Investigation in Blood Serum of Female Patients in Type-2 Diabetes

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Abstract

Type-2 diabetes mellitus (DM) is considered as a chronic defect of glucose metabolism linked to deficiency of insulin or and resistance to the insulin action. This cross-section study includes forty-three female patients in type-2DM (50 ± 7 years old), with diabetes duration of10±4 years and thirty-six healthy subjects matched in the age and sex with patients as control. Fasting blood specimens were collected from both patients and healthy control. Serum blood level of zinc, magnesium, manganese, triglyceride (Tg), total cholesterol (Tc), alanine amino transferase (ALT), and γ-glutamyl transpeptidase (GGT) were evaluated and investigated. The results indicated that there is a significant decrease in Zn, Mg, and Mn serum concentration levels in female type-2 DM compared to control group ($p \leq 0.05$) which supports the close association of the above elements with glucose metabolism. Serum triglyceride (Tg), and total cholesterol (Tc) levels were significantly higher compared with the healthy control subjects ($p \leq 0.05$). while the results concerning to liver enzymes showed significant elevation in the mean level of ALT and GGT enzymes in compared with healthy subjects. The achieved results might be functioned as predictors for coronary heart disease and suggest that the measurement of serum liver enzymes could be signed as a biomarker for type-2 diabetes mellitus disease.

Keywords: *Type-2 diabetes, Trace elements, Lipid parameters, ALT, GGT,*

Introduction

Abnormal metabolism of carbohydrate is associated with diabetes mellitus (DM) disease which is leading to an increase the risk for a lot of health complications like cardiovascular disease, stork, nephropathy, retinopathy and polyneuropathy [1,2]. In this century, DM type-2 became one of the main challenges, and it counts about 90 to 95% of all diagnosed cases of diabetes. Lack in the physical activity and luxurious, inactive life style, obesity, and eating unhealthy food have a direct reflection in the increase risk of infection of this disease.

It can be classified based on the pathogenic process that leads to hyperglycemia in to two categories, type 1 and type 2. In type-2, patients are still able to produce insulin but it is unable to do its primary job and help cells to use glucose for energy. Typically, this is due to a problem with body receptors for insulin [3-5]. Evaluation of trace elements in blood have turn out to be extremely essential in several clinical and research laboratories due to their function in up keeping of health and physiological function improvement [6-8].Recent clinical studies suggest a relationship between trace elements and glucose homeostasis. Reports showed that imbalances of some trace elements could play vital roles in glucose and action of insulin hormone including activation of receptors, working as enzyme cofactors or components for process involved in metabolism [1, 9].

Moreover, trace elements may have certain role in the pathogenesis and development of the disease. For instance, Zn level has a straight affect in the storage, synthesis, and secretion of insulin. Deficiencies of Mg act an indicator of impaired glucose tolerance in earlier studies. Another study suggest that appropriate Mn levels are essential for enhance the synthesis and secretion of

insulin hormone for carbohydrate metabolism [10-12]. Dyslipidemia is considered as a collective feature of the diabetes [13]. In both type 1 and type 2 diabetes, there is an association between serum cholesterol with triglyceride levels and cardiovascular disease [13,14], in farther detail, type -2 (DM) is correlated to the cluster of interrelated plasma lipid and lipoprotein abnormalities and acts as predictors for coronary heart disease, [15,16].

It's well known that liver work as main organ for metabolism of glucose. Glucose uptake, synthesis, storage and metabolism were occurred in this organ, as a result if the liver exposed to diseases, this will have direct effect in its function and cause several health complications. The most common tests for liver function include aminotransferase which serves as hepatocyte injury, and γ-glutamyl transpeptidase that act as markers for cholestasis and biliary function [17].

As a result, assessment and comparison of these enzymes for type-2 DM with healthy subjects is important. Based on the above information, this study amid to evaluate and compare the levels of some trace elements like Zn, Mg, Mn, some lipid parameters (Tg, Tc), and ALP, GGT liver enzymes in the blood sera of type-2 DM female patients with healthy subjects as a control.

Materials and Methods

Blood specimens were collected from 43 female patients (50 ± 7years old) with type 2 diabetes (diabetes duration 10±4) and 36 healthy females matched the age (control group) at Al-Diwania general hospital in Al-Qadisiyah province during March until December 2017 period.

Detailed history of each patient was recorded before clinical examination was performed. Patients who were taken nutritional supplementations, laxatives with magnesium contain, diuretics, and any medication cause hepatic enzymes alteration were excluded from this study. Fasting samples of blood were collected from patients and healthy female using sterilized disposable needles.

Fasting glucose serum FSG was measured by enzymatic colorimetric assay using AGAPPE kit, while the lipid profile parameters (triglyceride Tg, total cholesterol Tc) were performed based on enzymatic determination according to Biomercux kits. Enzymatic kits Randox (Manufacture Company) were used for assessment of ALT, and GGT. Determination of Zn, Mg, and Mn were done using atomic absorption spectrophotometer (AAS).

Statistical Analysis

Statistical analysis Data were analyzed using Microsoft excel. Continuous data were written as mean ± SD (Standard Deviation). The mean values of two groups were compared by unpaired t-test. It was taken as statistically significant when P value equal or less than 0.05.

Results and Discussion

Trace Elements Analysis

This study was conducted to female Type-2 diabetes mellitus patients group had mean age (50 ±7.3) years compared with healthy female control groups their mean age (44 ± 9.3). All other descriptive physical characteristics for both groups were shown in table 1. In general, patients group less in weight than control group, and there was significant increase in the BMI of control group compared with diabetic patients group. Fasting sugar glucose was measured for both groups and the results revealed that there is a significant increase in glucose level in patients in compared with healthy control as expected (194.5±23 mg/dL) vs (98.3±12 mg/dL).

The concentration of examined trace elements in blood sera were measured and the results showed that Zn, and Mg serum concentration levels were significantly lower in female type-2 DM compared to control group (table 2, Fig. 1). for Zn (67.1± 6.37 µg/dL) vs (91.4 ± 13.22µg/dL), for Mg(1.3 ± 0.23 mg/dL) vs (2.2 ± 0.41 mg/dL).This significant decrease of Zn level in type-2 DM was expected due to the important role of this element in the insulin hormone sensitivity, acts as potential controller of insulin secretion, and has a vital functional role in beta-cell physiology [18].

Moreover, several studies were indicated that Zn has direct effect in serum lipid profile and this might be due to work as antioxidant. For that reason, decreasing in Zn level in patients could cause increasing in the lipid peroxidation, as a result will increase Tg, Tc, and LDL levels. This explanation consistent

with our finding results. The lower mean Mg serum level is in agreement with [19]. The depletion of Mg as known before has negative effect on the homeostasis of glucose and sensitivity of insulin in diabetic patients. It is well known Mg is very important element in oxidative stress and high level of them could accelerate this process and cause imbalance antioxidants available in the body.

For Mn, the present study indicates that there is a significant decrease in patient's serum level compared with healthy control by (1.88± 0.41µg/dL) vs (3.1±0.32 µg/dL), this result is in agreement with [20]. Recent studies showed that Mn has a significant biological effect in enhance hepatic and muscle insulin sensitivity in type-2 diabetes [21, 22].

Table 1: Physical characteristics of both patients and controls

Physical characteristics	Patients	Control
Age (years)	50 ±7.3	44 ± 9.3
Gender	Female	Female
Height (cm)	162.8 ±34	164.4 ± 23
Weight (kg)	72.5 ±10.1	74.1 ±9.7
B.M.I (Ht/m^2)	27.02 ± 3.3	29.71± 6.6

Table 2: Serum concentration levels of zinc (Zn), Magnesium (Mg), and manganese (Mn) offemale patients in type-2 DM and control

Trace element	Patients, n= 43	Control, n = 36
(Zn) µg/dL	67.1± 6.37	91.4 ± 13.22
(Mg) mg/dL	1.3 ± 0.23	2.2 ± 0.41
(Mn) µg/dL	1.88± 0.41	3.1±0.32

P ≤0.05

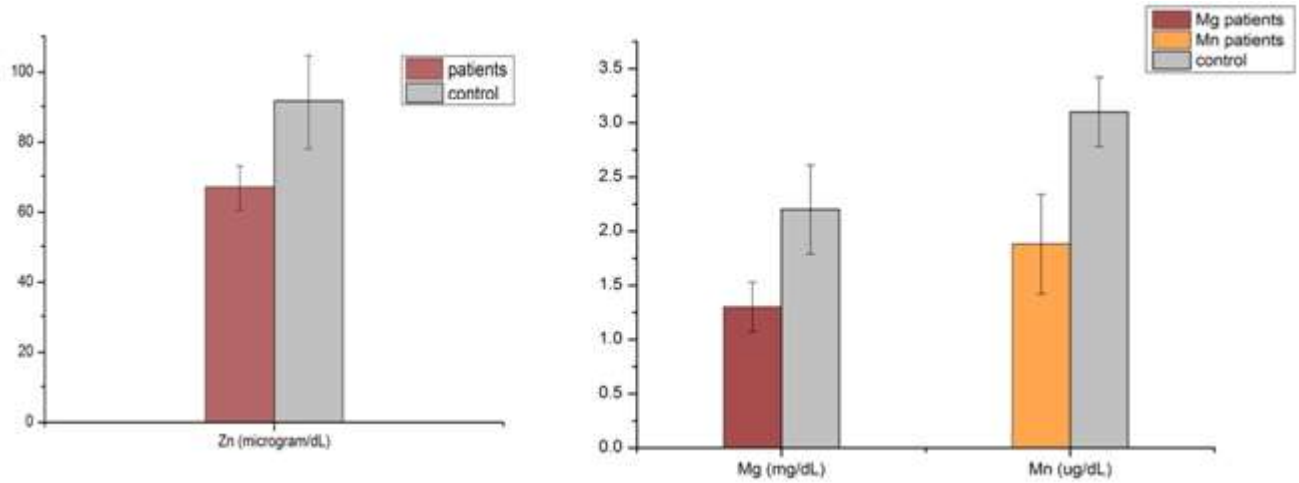

Figure 1: Zn, Mg, and Mn levels in female patients in type-2 DM compared with healthy control

Lipid Parameters and Liver Enzymes Analysis

Regarding to lipid parameters for type-2 DM female patients, the results demonstrated that there is significant increase in triglyceride (Tg), total cholesterol (Tc), as shown in Table (3), Fig 2. For Tc (177.4 ± 13.2 mg/dL) vs (143 ± 8.2 mg/dL), Tg (155.7 ± 22.1 mg/ dL) vs (90.8 ± 9.1 mg/dL). This result is in agreements with [23, 6].

Hypercholesterolemia in type-2 DM patients is clearly recognized compared with control group, the possible explanation is due to loss Apo B receptors their affinity to glycated-LDL and this might be contributed to the increase cholesterol serum level in diabetes patients.

Elevated Tg and Tc concentration levels in plasma used to strongly linked with increase the chance to infect with coronary heart disease. for the liver enzymes, the results showed that ALT and GGT were higher in compared with healthy control (Table 4, Fig. 3) by (44.59 ± 9.4 IU/L) vs (38.3 ± 6.2 IU/L), and (39.66 ± 8.3 IU/L) vs (30.44 ± 7.06 IU/L) respectively.

Although, the concentrations are different but ALT and GGT were within normal values. These finding results are in agreement with [24]. Several perspective studies stated that elevated levels of GGT and ALT even within the normal range had a direct association with incidence of type-2 DM.

Table 3: Lipid parameters for patients with type-2 DM and control

Biochemical Parameters	Patients, n = 43	Control, n = 36
(Tc) (mg/dL)	177.4±13.2	143± 8.2
(Tg) (mg/dL)	155.7 ±22.1	90.8± 9.1
FSG (mg/dL)	194.5±23	98.3 ± 12

P ≤0.05

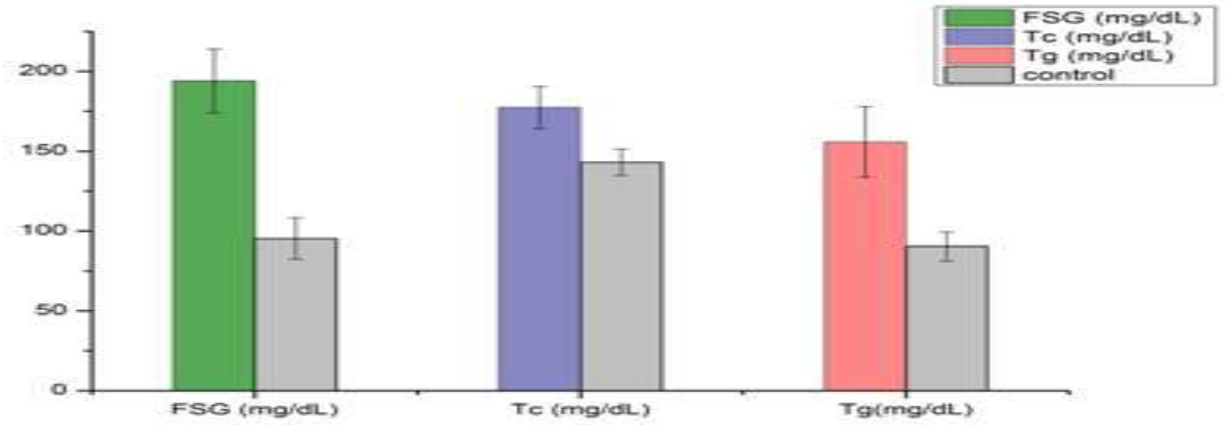

Figure 2: FSG, Tc, and Tg levels in female patients in type-2 DM compared with healthy control

Table 4: Liver enzyme levels of female patients compared to control

Liver enzyme	Patients n = 43	Control n =36
ALT (IU/L)	44.59 ±9.4	38.3 ±6.2
GGT (IU/L)	39.66 ± 8.3	30.44 ± 7.06

P ≤0.05

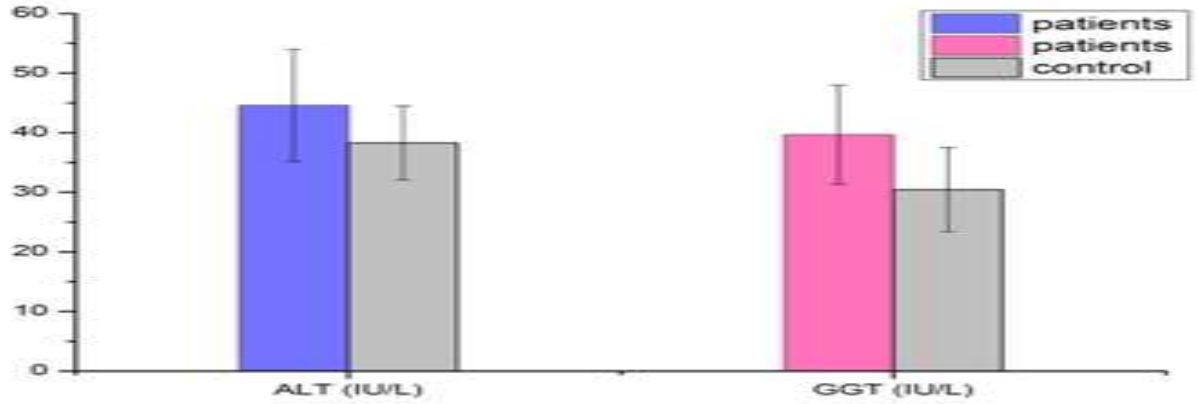

Figure 3: ALT, GGT liver enzymes levels in female patients in type-2 DM compared with healthy control

Conclusion

Patients with type-2 DM have alteration in blood sera concentration levels of several trace elements that support a strong relationship with glucose metabolism as well as elevated concentration for Tc and Tg lipid parameters that might be caused coronary heart disease. The ALT and GGT elevated levels might be used as markers for type-2 DM.

References

1. Yeasmin R, Muttalib MA, Sultana N, Bhuiyan NH, Alam R (2016) Status of some Trace Elements in Type-2 Diabetic Patients and its Relationship with Lipid Profile. Journal of Bangladesh Academy of Sciences, 40(1), 79-85.
2. Haase H, Overbeck S, Rink L (2008) Zinc supplementation for the treatment or prevention of disease: current status and future perspectives. Experimental gerontology, 43(5): 394-408.
3. National Diabetes Information Clearinghouse. National Diabetes Statistics. (Accessed 2/19/2008).
4. Nicki R, Colledge Brian R, Walker Stuart, H Ralston (2010) Davidson's principles & practice of medicine 21st edition. 801-803.
5. Sapna S, Alok ML (2008) A study on lipid profile levels of diabetics and Non- diabetics among Naini Region of Allahabad, India. Turk J. Biochem., 33 (4): 138- 141.

6. Syed M Farid (2016) Correlation between serum trace elements and lipids in patients with type 2 diabetes mellitus in Jeddah, Saudi Arabia. Global Journal of Bio-science and biotechnology, 5 (3): 311-317.
7. Fadhel AA, Johnson M, Trieu K, Koculi E, Campiglia AD (2017) selective nano-sensing approach for determination of inorganic phosphate in human urine samples, *T alanta,* 164: 209.
8. Diabetes: KSA is 7th. in the world, 1st. in Gulf. Arab News 24: (2015).
9. Fadhel AA, Yue X, Ghazvini Zadeh EH, Bondar MV, Belfield KD (2016) 11: 6161-6168.
10. Viktoriniva A, Toserova E, Krizkov M, Durackova Z (2009) Altered metabolism of Cu, Zn, and Mg is associated with increased levels of glycated hemoglobin in patients with diabetes mellitus. Metabolism, 58(10): 1477-1482.
11. El-Nabarawy K, Mohamed A, Ahmed M, Ei-Arabi H (2010) α-Lipoic acid therapy modulates serum levels of some trace elements and antioxidants in type 2 diabetic patients. Am. J. Pharm. Toxicol., 5 (3): 152-158.
12. Yerlikaya FH, Toker A, Aribas A (2013) Serum trace elements in obese women with or without diabetes. Indian J. Med. Res., 137(2): 339-345.
13. Schofield JD, Liu Y, Rao-Balakrishna P, Malik RA, Soran H (2016) Diabetes Dyslipidemia. *Diabetes Therapy*, 7(2):203-219.
14. BassamAlfarhani (2018) Direct analysis of benzo[a]pyrene metabolites with strong overlapping in both spectral and lifetime domains, 137: 51-61.
15. Gregory L, Bryan K, Deridachen Y, David R, Bruce Jr, M Psaty, J Rotter, D Siscovick, S Ian HB (2010)"Glucose insulin and incident hyprtension in the multi-ethnic study of atherosclerosis"; American journal of epidemiology, 172(10)1144-1154.
16. Tchaicaya A, Braun M, Lorenz N, Delagardelle C, Beissd J (2013) "Social inequality in awareness of cardiovascular risk factors in patients undergoing coronary angiography";.Eur. J. prevcardiol., 20 (5):872-879.
17. Harris E (2005) Elevated Liver Function Tests in Type 2 Diabetes. Clinical Diabetes, 23(3): 115-119.
18. Jayawardena R, Ranasinghe P, Galappatthy P, Malkanthi R, Constantine G, Katulanda P (2012) Effects of zinc supplementation on diabetes mellitus: a systematic review and meta-analysis. Diabetology & Metabolic Syndrome. 4:13.
19. Rusu M, Cristea V, Frențiu T, Măruțoiu C, Rusu Ld (2013) Magnesium and selenium in diabetics with peripheral artery disease of the lower limbs. *Clujul Medical*., 86(3):235-239.
20. Eva H, Akhter QS, Alam MK (2016) Serum zinc and manganese levels in subjects with type 2 diabetes mellitus. J Bangladesh Soc. Physiol., 11(2):50-53.
21. Hori H, Ohmari O, Shinkai T, Kojima H, Okano C, Suzuki T, Nakamur J (2000) Manganese superoxide dismutase gene polymorphism and schizophrenia: relation to tardive dyskinesia. Neuropsychopharm., 23(1): 170-7.
22. Akhuemokhan IK, Eregie A, Fasanmade OA (2013) Diabetes prevention and management: the role of trace minerals. Afr. J. Diabetes Med., 21 (2): 37-41.
23. BakaaHazem Ismail (2010) Comparison Study of insulin level and lipid profile in diabetes mellitus in Ramady city, J. of univ. of anbar for pure science, 4 (2): 19-24.
24. Salmela PI, Sotaniemi EA, Niemi M, Maentausta O (1984) Liver function tests in diabetic patients. Diabetes Care, 7: 248-254.

