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Estimation of Biochemical Changes in Diabetic Patients

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ABSTRACT

Diabetes mellitus is a heterogeneous metabolic disorder characterized by hyperglycaemia resulting from defective insulin secretion, resistance to insulin action or both.. The role of trace elements in some of the metabolic dysfunctions and their contributions in the development of vascular complications is not clear. Therefore, the present study investigates the relationship among diabetes mellitus, trace elements status, lipid profiles in the serum of 50 diabetes mellitus patients and healthy subjects. The serum level of Cu was increased, whereas, Zn, Mg and Ca levels were significantly decreased in diabetic patients as compared to the healthy subjects. The levels of total cholesterol (CHOL), triglyceride (TG) and low-density lipoprotein-cholesterol (LDL) were higher in diabetes mellitus in comparison to the healthy subjects. The mean value of high-density lipoprotein cholesterol (HDL) was lower in diabetic patients. These findings may explain the role of impaired trace element status.

Keywords: *Trace Metals, Lipid profile, serum and Diabetes*

1. INTRODUCTION

Diabetes mellitus is characterized by absolute or relative deficiencies in insulin secretion and/or insulin action associated with chronic hyperglycemia and disturbances of carbohydrate, lipid and protein metabolism. Long-term vascular complications represent a major cause of morbidity and mortality in patients with diabetes mellitus. Metal ions are known to play an essential role in living systems, both in growth and in metabolism. Impaired metabolism of trace elements is observed in diabetic patients. It has been reported that the urinary excretion of calcium, zinc and magnesium is increased in two types of diabetes mellitus causing a decrease in blood levels of these elements from these patients **(1, 2)**. Another study reported that the levels of zinc and magnesium were significantly lower while the level of copper was significantly higher in serum of patients with IDDM **(3)**. In diabetes mellitus (DM), the disorders of carbohydrates, lipids and proteins metabolism play predominant role in diabetic complications. Hypercholesterolemia (CHOL) and hypertriglyceridemia (TG) are mostly observed and related largely to the degree of diabetic control **(4)**. Serum HDL was reported to be low in diabetic patients of both types of DM **(5)**. Hyperglycemia may alter lipoproteins to a form that promotes atherogenesis. Low-density lipoprotein-cholesterol (LDL) levels are frequently altered in diabetic patients.

In the present study, the estimation of serum metals (Cu, Ca, Mg, and Zn) along with levels of cholesterol, triglyceride, LDL, and HDL were evaluated in patients with diabetes with the aim of defining biochemical mechanisms.

2. MATERIALS AND METHODS

Intravenous blood (10mL) samples from fifty patients and healthy subjects were collected and made to clot before serum was separated by centrifuging at 5000 r/min for 20 min.

Each metal the serum samples were analyzed using a Hitachi atomic absorption spectrophotometer (Tokyo, Japan). Cholesterol, triglycerides, HDL and LDL were determined using a kit method on Microlab 300.

3. STATISTICAL ANALYSIS

All values are expressed as mean ± SE. For comparison between the patient's and healthy subjects.

4. Results

The levels of Zn, Ca and Mg were significantly lower in the serum of patients as compared to the healthy subjects. Whereas, the levels of Cu were significantly higher in the serum, respectively, in comparison to the control subjects. The levels of cholesterol, triglyceride and LDL were higher in patients as comparison to the healthy subjects. The level of HDL was lower in diabetic patients.(Table1).

Table (1) showed the results of serum trace metals in patients and healthy controls. Expressed as mean±standard deviation

Trace Metals	Healthy Subjects	Patients
Copper	94. 4±3.22	100.36±5.32

Zinc	**77.81±4.22**	**67.71±2.11**
Magnesium	**18.11±0.42**	**16.28±1.33**
Calcium	**144.09±4.33**	**122.05±3.57**
cholesterol	**4.16±0.33**	**4.93±0.45**
Triglyceride	**1.03±0.9**	**1.44±0.15**
HDL	**2.58±0.12**	**2.03±0.11**
LDL	**2.12±0.12**	**3.27±0.34**

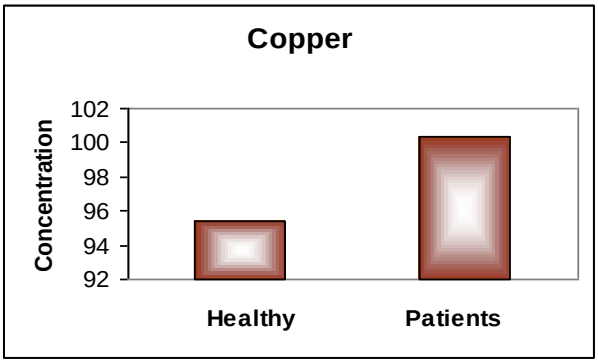

Figure 1

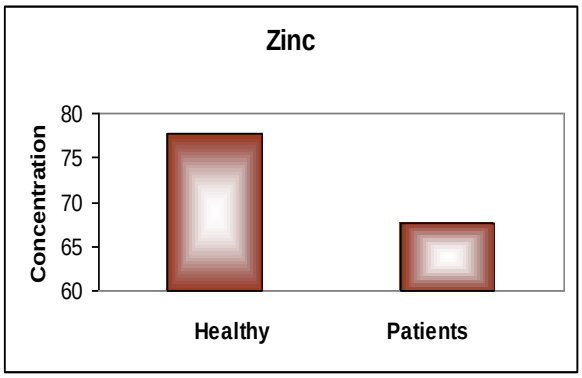

Figure 2

Fig: 1 shows the increased copper level in patients and in figure 2 decreases level of zinc in patients as compared to healthy subjects

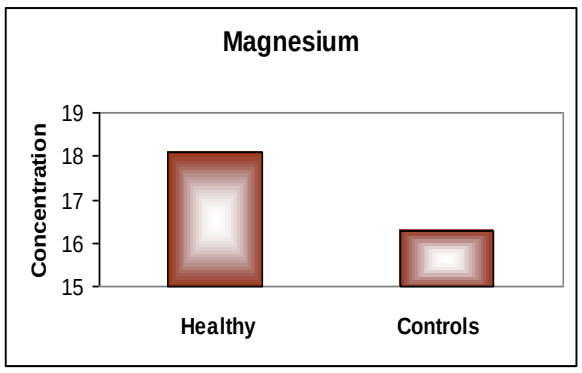

Figure 3

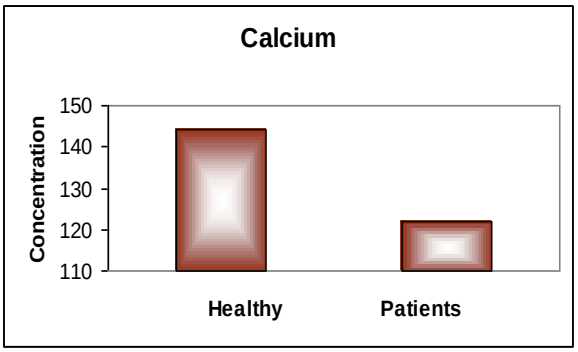

Figure 4

Fig: 3 show the decreased magnesium level in patients and in figure 4 decreases level of calcium in patients as compared to healthy subjects

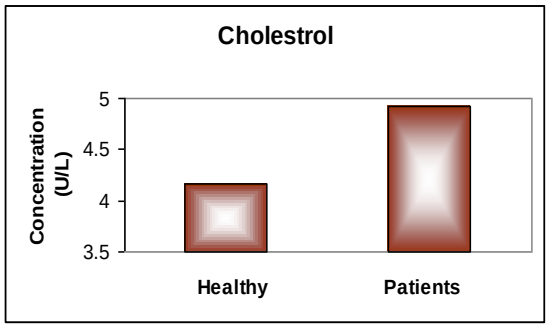

Figure 5

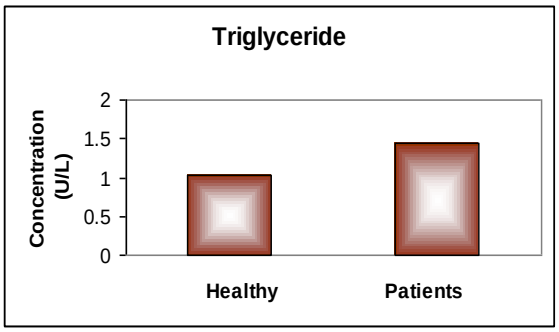

Figure 6

Fig: 5 show the decreased cholesterol level in patients and in figure 6 increases level of triglyceride in patients as compared to healthy subjects

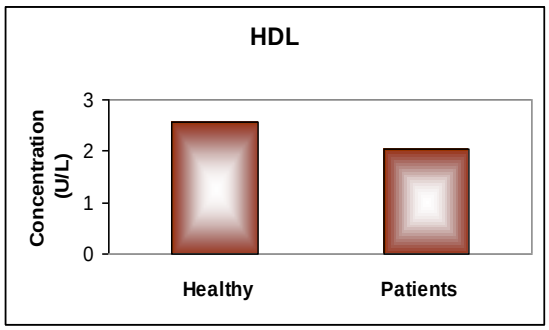

Figure 7

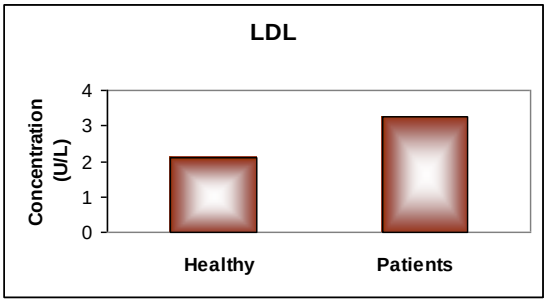

Figure 8

Fig: 7 show the decreased HDL level in patients and in figure 8 increases level of LDL in patients as compared to healthy subjects

5. DISCUSSION

Trace elements have important physiological effects when present at concentrations other than those associated with classical toxicity or with extreme deficiency. There is accumulating evidence that the metabolism of several trace elements is altered in diabetes

Mellitus **(6, 7)**. Dysfunctional neuroendocrine–endocrine interactions contribute to the disturbances in trace element metabolism and cause severe complications in diabetes mellitus **(8).** The present results showed that the levels of zinc, calcium and magnesium decreased in the blood of both types of Diabetic (Table 1, Fig: 2, 3, 4). The loss of these minerals might be attributed to impaired absorption and the excess excretion of these metals in urine (glycosuria) in these patients, which may induce a deficiency or marginal state of these minerals in blood of diabetic patients **(1, 2).** The increase in the Cu levels (Table 1, Fig: 1) in patients with Diabetic may attributed to hyperglycemia that may stimulate glycation and release of copper ions from copper-containing enzymes. These observations are supported by the findings that zinc, copper and magnesium have antioxidant activities because not only do they constitute the active sites and stabilize the conformation of several antioxidant enzymes, but they also compete for iron- and copper- binding sites and can provide protection against transition metal-mediated and free radical-induced injury **(9).** The decrease in Zn may potentiate the toxicity of other metals such as iron and copper. Zinc deficiencies in diabetics are associated with excess free-radical activity and the increased oxidation of lipids, damaging the heart, arteries, and other integral parts of the vascular system **(10).** An increase in Cu concentration has been linked to disorders in the structure of the arterial walls, stress, infection, and diabetes mellitus **(11).** The relationship between an increase in Cu concentration and the oxidation of low-density lipoproteins has been confirmed **(12).** As shown in Table 1, fig: 5 -8, the levels of total CHOL, TG and LDL were lower in patients as compared to healthy subjects. It can be concluded that hyperglycemia in diabetes mellitus is associated with accelerated nonenzymatic glycation and oxidative stress. The impaired trace element metabolism of the present study may have a role in the pathogenesis and progression of Diabetes where the increase of copper level and decrease of zinc, calcium and magnesium levels may disturb the antioxidants. All these parameters may contribute in the development of vascular complications in diabetic patients. Lipid abnormalities are due to resistance to insulin and hyperglycemia which are decreased high density lipoprotein, and increased and, more small dense low density lipoprotein and elevated triglycerides **(13)**. The outcome confirms that deficiency of some trace metals may play a vital role in the development of diabetes mellitus. In order to better understand the role of trace metals in diabetes, further clinical studies are required.

REFERENCES

[1] Brown IR, McBain AM, Chalmers J, Campbell IW, Brown ER, Lewis MJ. Sex difference in the relationship of calcium and magnesium excretion to glycaemic control in type-1 diabetes mellitus. Clin Chim Acta 1999;283:119– 28.

[2] Cunningham JJ, Fu A, Mearkle PL, Brown RG. Hyperzin- 168 M.A. Abou-Seif, A.-A. Youssef / Clinica Chimica Acta 346 (2004) 161–170 curea in individuals with insulin-dependent diabetes mellitus: concurrent zinc status and the effect of high dose zinc supplementation. Metabolism 1994;43(12):1558– 62.

[3] Isbir T, Tamer L, Taylor A, Isbir M. Zinc, copper and magnesium in insulin-dependent diabetes. Diabetes Res 1994; 26(1):41– 5.

[4] Paterson J, Pettegrew A, Dominiczak MH, Small M. Screening for hyperlipidaemia in diabetes mellitus. Relation to glycemic control. Ann Clin Biochem 1991;28:254– 8.

[5] Tallman DL, Taylor CG. Potential interactions of zinc in the neuroendocrine – endocrine disturbances of diabetes mellitus type 2. Can J Physiol Pharmacol 1999;77:919–33.

[6] Walter RM, Uriu-Hare, Olin JY, Oster MH, Anawalt BD, Critchfield JW and Keen CL. Copper, zinc, manganese and magnesium status and complications of diabetes mellitus. *Diab Care* 1991; **11**:1050- 1056.

[7] Fujimoto S. Studies on the relationship between blood trace metal concentration and the clinical status of patients with cerebrovascular disease, gastric cancer and diabetes mellitus. *Hokoido Igaku Zasshi* 1987; **62**:913-932

[8] Lin J. The association between copper ions and peroxidative reaction in diabetic cataract. Nippon Ganka Gakkai Zasshi 1996;100(9):672– 9

[9] Alcock NW. Trace elements. In: Kahn AL, Pesce AJ, editors. Clinical Chemistry, Theory, Analysis and Correlation. St. Louis: Mosby-Year Book; 1996. p. 746– 59.

[10] Di-Silvestro RA (2000) Zinc in relation to diabetes and oxidative disease. J Nutr 130:1509–1511.

[11] Beshgetoor D, Hambidge M (1998) Clinical conditions altering copper metabolism in humans. Am J Clin Nutr 67:1017S–1021S.

[12] Tan KCB, Aiv VGH, Chow WS, Chau MT, Leong L, Lam KSL (1999) Influence of low density lipoprotein (LDL) subfraction profile and LDL oxidation on endothelium-dependent and independent vasodilation in patients with type-2 diabetes. J Clin Endocrinol Metab 84:3212–3216.

[13] Ronald M. Lipid and lipoproteins in type 2 diabetes. Diabetes Care 2004;27:1496-504.