

Estimation of Copper and Chromium in Type 2 Diabetes Mellitus Patients

Shaimaa Yousif Mohammed, Dr. Omer Balla Ibrahim*

Department of Chemical Pathology, Faculty of Medical Laboratory Sciences, University of Khartoum-Sudan.

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Dr. Omer Balla Ibrahim

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Abstract: Type 2 diabetes mellitus is assumed to be associated with disturbances in the plasma level of several trace elements. There is accumulating evidence that the metabolism of several trace elements is altered in patients with type 2 DM and that these nutrients might have specific roles in the pathogenesis and progression of these disorders. The aim of the present study is to estimate the levels of essential trace elements including copper (Cu), chromium (Cr) in type 2 diabetic patients and healthy control. Thirty three patients with type 2 DM and thirty three healthy control. Blood samples of all individuals were collected after an overnight fasting for estimation of blood glucose, copper, chromium. Fasting blood glucose (FBG) was estimated using enzymatic spectrophotometric method while trace elements concentration were measured with Atomic Absorption Spectrophotometer. chromium in the patients and control group were (mg/L \pm) and (mg/ L \pm) respectively copper in the patients and control group were (mg/ L \pm) and (mg/ L \pm 12) respectively. Results of the patients when compared to that of the controls, showed a significant decrease in chromium (P = 0. 000) and copper (P = 0.000). The study concluded that a decrease of chromium and copper is associated with diabetes mellitus.

Keywords: Diabetes Mellitus, FBG, Trace Elements (Cu, Cr).

INTRODUCTION

Diabetes Mellitus is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. It is divided into two types: type 1 (IDDM) and type 2 (NIDDM) [1].

Type 2 diabetes mellitus is characterized by hyperglycemia as a result of an individual's resistance to insulin with a defect in insulin secretion. Type 2 DM constitutes the majority of the diabetes cases. It goes undiagnosed for many years and is associated with a strong genetic predisposition, with patients at increased risk with an increase in age, obesity, and lack of physical exercise [1]. The chronic hyperglycemia damages blood vessels and nerve cells throughout the body, producing microvascular disease such as retinopathy, neuropathy, and nephropathy [2].

Trace elements are widely distributed in nature in variable proportions according to geographical sites, which lead to variation in content of these elements according to their availability, and they play a vital role in growth, health, and maintenance of human body [3].

The clinical interest in trace elements determination, for diagnosis and prognosis of different diseases related to deficiency or toxicity of these elements [4].

Disturbances in trace elements status and increased oxidative stress in diabetes may contribute to

insulin resistance and the development of diabetes and diabetic complications [5, 6]. From the other side, progression of diabetes may also lead to disturbances in trace element metabolism and homeostasis [7].

Many trace elements are essential for proper metabolic functioning of the human body. Their deficiency is caused by many disorders such as anemia, heart disease, and diabetes mellitus [8, 9, 10].

The deficiency of micronutrients such as Cu, Cr, have been shown to affect glucose homeostasis causing glucose intolerance, chronic hyperglycemia and thus diabetes mellitus.

Chromium

The biological activity of chromium depends on it is the chemical form of the complex of which it is a part. Glucose tolerance factor (GTF) is a trivalent form of chromium that has high biological activity [11]. Chromium (111), an essential dietary element, plays a role in maintaining normal metabolism of glucose, fat, and cholesterol¹. Chromium increases insulin binding to cells, insulin receptor number and activates insulin

receptor kinase leading to increased insulin sensitivity [12].

Copper

Plays a role in the oxidant mechanism, imbalance of which leads to increased susceptibility to oxidative damage of tissues, thereby leading to the pathogenesis of DM or diabetic complication [13].

Copper acts as oxidant and may participate in metal-catalyzed formation of free radicals [14]. The objective of this study was to estimate the levels of trace elements (Cu, Cr) in type 2 diabetic patients

MATERIALS AND METHODS

Study Design

Analytical case control study to estimate the status of trace elements in type 2 DM patients.

Study populations

The present study conducted on 33 patients and 33 healthy control at Khartoum state.

Inclusion criteria

Patients with type 2 DM will be enrolled in this study.

Exclusion criteria

These included hypertension, anaemia, renal disease, heart disease, alcohol and smoking.

Specimens collection

After overnight fasting venous blood was collected into fluoride container for fasting blood glucose and lithium heparin to estimate trace elements.

Analytical procedures

Blood glucose was measured by enzymatic spectrophotometric method read at 320 nm and trace elements measured by Atomic Absorption Spectrophotometer.

RESULTS

Glucose

The mean value of fasting Blood glucose level for the patients and control groups were (185 mg/dl ± 60), (93 mg/dl ± 8.6), respectively. The result showed a significance differences between patients and control groups. (P =.000)

Chromium

The mean value of chromium level for the patients and control groups were (.02 mg/l ± 0.004), and (0.1 mg/l ± 0.05), respectively. The result showed a significance differences between patients and control groups (P =.000).

Copper

The mean value of copper level for the patients and control groups were (0.2 mg/l ± 0.05), and (0.8 mg/l ± 0.1) respectively. The result showed a significance difference between the patients and control groups.

Table-1: Mean, SD, and sig for the different parameters of the patients (P) and controls (C)

Parameters	Group	Mean	SD	Sig
FBG	P	185	60	.000
	C	93	8.6	
Chromium	P	.02	.004	.000
	C	.1	.05	
Copper	P	.2	.05	.000
	C	.8	.1	

DISCUSSION

There is accumulating evidence that the metabolism of several trace elements is altered in diabetes mellitus and that these nutrients might have specific roles in the pathogenesis and progress of this disease [15].

In this study plasma level of chromium was found to be significantly decreased when compared to that of the control group (P=.000). This may be due to impaired absorption of chromium during diabetes mellitus. In this finding we agree with [16, 17, 18].

In this study plasma level of copper was found to be significantly decreased when compared with control group (P =.000) this is in a disagreement with [17, 19, 16]. They said: "significance higher in diabetic patients than non-diabetic".

CONCLUSION

Plasma chromium and copper level were significantly decreased in diabetes mellitus patients.

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