Assessment of the Serum Chromium Level in Patients with Type 2 Diabetes Mellitus

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Abstract

Chromium is an essential micronutrient which is required for normal insulin effect and regulation of blood sugar level. Serum chromium status of patients with type 2 diabetes was compared with control non-diabetic subjects. Blood samples were collected and serum glucose level of both groups was determined. The serum chromium concentration of samples was measured by flame-less atomic absorption spectrophotometer. The results showed significant differences between mean of serum chromium concentration of diabetic patients (4.58µ/l) compared with control group (7.92µ/l). We found no significant differences between chromium level of women and men either among the diabetics or non-diabetic control groups. The finding of this study confirmed the idea that chromium is an essential microelement in diabetes.

Introduction

Diabetes mellitus is an impaired ability of body to regulate the utilization of blood glucose, as a result of failure of normal control by insulin. There are two main types of diabetes mellitus. Type 1 diabetes (insulin–dependent diabetes mellitus IDDM) is the failure in insulin secretion as a result of damage to the b-cells of pancreatic islets caused by viral infection or autoimmune disease [1,2]. Type 2 diabetes (non-insulin-dependent diabetes mellitus NIDDM) is impaired responsiveness to insulin, as a result of decrease formation or diminished sensitivity of insulin receptors in target cells.. Diabetes mellitus is a highly complex disorder, and the simple concept that its pathogenesis is solely due to insulin deficiency, is no longer tenable [3].

Chromium deficiency is relatively common in patients with type 2 diabetes. The significance of Chromium as a trace nutrient is well documented and its function in the control of glucose and lipid metabolism has been claimed [3]. Studies have shown that chromium can facilitate or potentiate the action of insulin [4-7]. This study was performed to determine the serum chromium status of Iranian individuals with type 2 diabetes compared to healthy volunteers.
syndrome X \[12\]. Patients with syndrome X are more likely to experience cardiovascular diseases and develop long-term complications of diabetes. Hyperinsulinemia and insulin resistance may be correlated with a decrease in insulin receptors, reduced insulin binding, or post-insulin-receptor signaling defects. Insulin resistance is thought to be the initial cause in people with type 2 diabetes. Patients with type 2 diabetes and insulin resistance demonstrate a diminished sensitivity of target tissue (primarily the liver and skeletal muscle) to the action of insulin and a relative deficiency of endogenous insulin secretion \[13,14\]. Impaired insulin secretion and increased glucagons contribute to continued hepatic glucose output resulting in elevated fasting glucose levels \[15\]. Some patients may have elevated blood glucose because of excessive glucagon or abnormal and excessive hepatic glucose production. Others may have a defect in somatostatin, an excess of growth hormone, cortisol, epinephrine, or other hormone that affects blood glucose regulation \[16-18\]. Cushing's syndrome, pheochromocytoma, aldosteronism, hyperthyroidism, pancreatitis, cirrhosis, pregnancy, emotional stress, and myocardial infarctions are other factors that may cause an increased in blood glucose. It appears that the etiology is probably multifactorial. It has been shown that trace elements may regulate hormone secretion and its function\[19\]. Among trace elements, chromium deficiency was first identified as a cause of impaired glucose tolerance in 1959 \[20\]. Chromium as part of a compound known ‘glucose tolerance factor’ (GTF) is needed for appropriate glucose use, lipid metabolism, and insulin receptor sensitivity \[21\]. One study has been reported that administration of 500mg chromium two times per day for 2 months resulted in a significant improvement of glycosylated hemoglobin (HbAlc) values, and indication of how well glucose is metabolized \[6\]. Recently, it has been reported that chromium may reduce triglycerides in patients with type 2 diabetes \[7\]. While some studies have demonstrated that chromium has positive effect on serum glucose levels \[5\], other studies have not shown any beneficial effects when used in patients with type 2 diabetes \[22,23\]. On the other hand, it is not clear whether differences in trace element status are a consequence of diabetes or, alternatively, whether they contribute to the disease. This study was carried out to verify the serum chromium status of patient with type 2 diabetes. The results of this study showed significant differences between mean serum chromium concentrations of diabetic patients (4.58 mg/l) compared with control group (7.92 mg/l). Our result indicates a similar profile with other study performed elsewhere \[20, 21\]. According to our results it seems that serum chromium

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### Results

Results of this study indicates that fasting blood sugar of diabetic patients (men and women) are significantly higher \(p\)
level of Iranian healthy individuals are higher than the value reported by Burtis and Ashwood [21]. Such difference may be due to race, life style, geographical influence and even analytical methods [24]. According to the results of this study there were not significant differences between mean serum chromium concentration of the adult women compared with the adult men of diabetic patients and also those of control group. This indicates that serum chromium concentration is not sex related factor. Few definitive studies of human chromium deficiency have been carried out, mainly because of analytical difficulties in determining ultra trace levels of chromium in tissue. This human study support the idea that chromium may be recommended as a supplement to improve serum glucose levels in diabetic patients.

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References

Illustrations

Illustration 1

Fig 1: Serum glucose level (mg/dl) in control and NIDDM male groups. Data are shown as mean±SEM. Significant difference between control and NIDDM group indicated as **p<0.01

![Illustration 1](image1.png)

Illustration 2

Fig 2: Serum glucose level (mg/dl) in control and NIDDM female groups. Data are shown as mean±SEM. Significant difference between control and NIDDM group indicated as **p<0.01

![Illustration 2](image2.png)
Illustration 3

Fig 3: Serum chromium level (mg/l) in control and diabetic groups. Data are shown as mean±SEM. Value significantly different from control, is indicated as **(P<0.01)

Illustration 4

Fig 4: Serum chromium level (mg/l) in male and female control groups. Data are shown as mean±SEM. There is no significant difference between male and female groups.
Illustration 5

Fig 5: Serum chromium level (μg/L) in male and female diabetic groups. Data are shown as mean±SEM. There is no significant difference between male and female groups.
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