

# Minerals Nutritional Status of Type 2 Diabetic Subjects

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## ABSTRACT

The aim of the present study was to investigate the zinc (Zn), chromium (Cr) and magnesium (Mg) nutritional status in type 2 diabetic subjects. The study was conducted on 30 type 2 diabetic subjects and 30 age matched control subjects within the age range of 40-55 years. Glucose, Zn, Cr and Mg were analyzed in fasting serum of all subjects. Diabetic subjects had significantly lower serum concentrations of Zn, Cr and Mg as compared to the controls and exhibited significant increase in serum glucose levels. The serum levels of glucose were found negatively correlated with serum levels of Zn, Cr and Mg of diabetic subjects. The low serum levels of Zn, Cr, Mg in diabetics compared to control subjects may be due to the poor glycemic control.

**KEYWORDS:** Type 2 diabetics, Zinc, Chromium, Magnesium, Nutritional status.

## INTRODUCTION:

In recent years, there has been a growing understanding of the role of minerals, in particular Zn, Cr and Mg in diabetes (1-3). Overall, available studies on role of minerals in diabetes suggest deficiency of Zn, Cr and Mg in some diabetics (4-9). Zinc is an essential trace metal that is directly involved in the synthesis, storage and secretion of insulin, as well as conformational integrity of insulin in the hexameric form (1).

The trace element, chromium increases insulin binding to cells by increasing insulin receptor numbers and it may lead to increased insulin sensitivity, glucose utilization and beta-cell sensitivity (2). Magnesium is an essential ion involved on multiple levels in insulin secretion, binding and activity and is a critical cofactor of many enzymes in carbohydrate metabolism (3).

Despite the large literature on the role of dietary composition in control of diabetes mellitus, there are relatively few studies on the mineral nutritional status of diabetes. Thus, the present study was conducted in order to investigate the fasting serum

Zn, Cr, Mg and glucose in diabetes mellitus subjects and the results were compared with healthy controls. The serum levels of Zn, Cr, Mg and glucose were correlated in type 2 diabetic subjects to determine the relation of minerals nutritional status to the hyperglycemia.

## MATERIALS AND METHODS

**Selection of Subjects:** 30 type 2 diabetic subjects and 30 age matched non-diabetic healthy subjects (control group) within the age range of 40-55 years were selected after obtaining their consent for active participation during the entire study period.

**Collection of Blood Samples:** After an overnight fast, blood samples were collected and serum was used for analysis of glucose, Zn, Cr and Mg.

**Assay Methods:** Serum glucose was analyzed by using Qualigens diagnostics kit. Zn, Cr and Mg were estimated by atomic absorption spectrophotometer (model, spectr AA-20) from Varian Techtron Pvt. Ltd., Springvale, Australia.

**Statistical Analysis:** The data was analyzed with the help of independent 't' test and Pearson's correlation. The differences between the diabetic and control groups with respect to serum levels of glucose, Zn, Cr and Mg were tested by using independent 't' test. The interrelationship between serum levels of glucose with serum levels of Zn, Cr and Mg in diabetic subjects was assessed by using Pearson's correlation.

## RESULTS

Table 1 documents the mean serum levels of glucose, Zn, Cr and Mg in diabetics and controls. In diabetics, significantly elevated ( $P < 0.01$ ) serum levels of glucose was noticed as compared to healthy age matched controls. Diabetic subjects had significantly lower serum concentrations of Zn, Cr and Mg as compared with the control group. In diabetics, the serum glucose levels were significantly correlated negatively with the serum concentrations of Zn, Cr and Mg (Table 2).

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**Table 1: Mean Serum Levels of Glucose, Zn, Cr and Mg in Diabetics and Control Subjects.**

Subjects	Parameters			
	Glucose (mg/dl)	Zn (µg/dl)	Cr (µg/dl)	Mg (mg/dl)
Diabetics(30)	171.07±45.9**	138.0±34.0*	0.05±0.03**	2.2±0.41**
Control (30)	73.07±14.5	162.5±32.9	0.09±0.03	2.7±0.39

\* Significant at  $P<0.05$ ; \*\* Significant at  $P<0.01$ ; Mean values are given as mean±standard deviation. Figures in the parenthesis indicate the number of subjects.

**Table 2: Correlations of Serum Glucose, Zn, Cr and Mg with Glucose in Type 2 Diabetic Subjects.**

Correlation	Glucose	Zn	Cr	Mg
Glucose	1	-0.408*	-0.368*	-0.405*

\* Correlation is significant at  $P<0.05$

## DISCUSSION

Diabetes mellitus is a complex disorder affecting the metabolism of carbohydrates, fat and protein. In the present study, diabetic subjects showed an elevated fasting serum glucose level as compared to healthy controls, which is the hallmark of diabetes.

It is generally agreed that disturbed body distribution of Zn, Cr and Mg are often found in human subjects with diabetes mellitus. Diabetic subjects of the present study were found to have lower levels of Zn in serum as compared with healthy controls. This finding confirms results presented earlier (5, 8). Present study reports that there is a significant decrease in serum Cr concentrations when compared to controls. This decreased serum Cr levels in diabetics than controls has been well described in an earlier study (9). The mean serum Mg in diabetics was significantly lower than controls which supports the earlier reports (4, 10, 11).

Present study demonstrated negative correlations of serum glucose with serum Zn, Cr and Mg levels in diabetics. Significant negative correlations between plasma Zn and glycosylated hemoglobin or 24 hr urine glucose has been reported earlier (12). A significant decline in plasma Cr with an increase in glucose concentrations after a glucose load to healthy subjects has also been documented earlier (13). An increase in fasting plasma glucose level associated with decrease in fasting plasma magnesium level in diabetics was earlier demonstrated (14). Serum Mg levels has been found to correlate inversely with the glycosylated hemoglobin (15). These inverse correlations suggest that Zn, Cr and Mg nutriture may found to deteriorate with the abnormal metabolic milieu of diabetes.

In summary, present study suggests that serum Zn, Cr and Mg concentration were profoundly altered in diabetics compared to controls. Moreover, the altered Zn, Cr and Mg levels were related to the degree of glycemic control.

**ACKNOWLEDGEMENT:** The authors are grateful for the whole hearted cooperation of all the subjects who participated in the study. The authors also wish to thank Professor and Head, Department of Foods and Nutrition for providing the necessary facilities for the analysis.

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