Serum zinc, chromium and magnesium levels in Type 2 diabetes

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BACKGROUND: Direct association of trace elements in both Type 1 diabetes and Type 2 diabetes has been observed in many research studies. An alteration in the metabolism of these minerals has been demonstrated in diabetes. The aim of the present study was to investigate zinc (Zn), chromium (Cr) and magnesium (Mg) levels in the serum of Type 2 diabetes subjects. The study was conducted in 40 Type 2 diabetic subjects and 40 age-matched control subjects. Samples were analyzed using atomic absorption spectrometric methods.

RESULTS: Serum levels of zinc in the Type 2 diabetic patient group were not found to be statistically different. Serum magnesium levels were significantly lower in diabetic subjects ($P < 0.05$). Serum chromium levels in both diabetic and control groups were below the detectable limits. Reliable direct assessment of chromium status in humans is still not feasible. Additional studies are needed to elucidate the mechanism of action of the trace elements and their role in diabetes.

KEY WORDS: Chromium, Diabetes mellitus, Magnesium, Zinc

Direct association of trace elements with health and disease is already established. Chromium is an active component of glucose tolerance factor. It improves insulin sensitivity, glucose utilization and is required for normal protein, fat and carbohydrate metabolism. Chromium is acknowledged as a dietary supplement.[1] Magnesium is a cofactor in phosphorylation of glucose, and it helps in carbohydrate metabolism. Zinc, an essential trace element, is useful in synthesis, storage and secretion of insulin.[1,2] Though there are numerous studies regarding mineral levels in diabetic subjects, yet there are inconsistent and contradictory results.[2,3] In this study, we evaluated the levels of Zn, Cr and Mg in serum of Type 2 diabetic patients in order to assess their status and to compare the same with age-matched non-diabetic control group.

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Materials and Methods

The study population consisted of 40 Type 2 diabetics and 40 age matched nondiabetic healthy subjects within the age range of 40-60 years. Patients were selected after obtaining written informed consent. Clearance was obtained from the institutional ethical committee. Detailed history was recorded and clinical examination was performed. Patients currently taking nutritional supplementations, magnesium containing laxatives, alcohol and diuretics were excluded from the study. After an overnight fast, blood samples were collected. Fasting and postprandial blood glucose levels were monitored using an autoanalyzer. For estimation of Zn, Cr and Mg, 1 ml serum was used. Ashed serum was dissolved in dilute HCl and analyzed with atomic absorption spectrophotometer (AAS-Chemito series AS 201 India).

Statistical analysis

The values were presented as mean. Student 't' test was applied for data analysis. P value of <0.05 was considered to be statistically significant.

Results

In Type 2 diabetic group, serum magnesium levels were found to be significantly low ($P < 0.05$) as compared to the non-diabetic group, whereas there was no significant difference in zinc levels in diabetics and non diabetics [Table 1]. Serum chromium levels were found to be below

Table 1: Mean serum level of glucose, magnesium and zinc in type 2 diabetic group

	Diabetic Group N = 40	Nondiabetic Group N = 40
Glucose fasting, mean (mg/dl)	181	88
Glucose postprandial mean (mg/dl)	255	126
Magnesium mean, (mg/dl)	1.42	2.1
Zinc mean, (µg/dl)	156	157

the detectable range in both the groups. Detectable limit of chromium for atomic absorption spectrophotometer Chemito India was 0.067 parts per million.

Discussion

Some trace elements act as antioxidants and prevent membrane peroxidation while others act directly on glucose metabolism. It is generally agreed that disturbed concentration of Zn, Cr and Mg in the body are often found in patients of diabetes mellitus. In the studied population, Mg levels were found significantly low ($P < 0.05$) as compared to healthy controls. This decrease in serum Mg levels has been described in an earlier study.[2] Though serum Mg may not accurately reflect the level of total body Mg stores; persistent glycosuria with osmotic diuresis leads to Mg wasting and likely contributes to high frequency of hypomagnesemia in poorly controlled diabetics.[6] Though zinc deficiency has been described in other studies,[2,5] in our study there was no significant difference in serum zinc levels. The element chromium is the subject of growing interest in the public and in scientific communities.[4] Mammals need trivalent chromium to maintain balanced glucose metabolism. In one study carried out in 20 diabetic Iranian patients, Cr in hair samples revealed significantly lower values.[3] In the present study, attempts were made to evaluate serum chromium levels, but they were found to be in the below detectable range in both groups. Serum Cr levels in healthy humans from developed countries are documented as 2.3-40.3 nmoles / L.[2] It is difficult to detect Cr in small volume of blood. Even after many attempts in different laboratories working for AA spectroscopy we were unable to get the absorbance in detectable range.

In summary, in the present study, serum Mg levels were low in the diabetic group, while serum Zn levels were not found to be significantly different. Chromium in both groups was below the detectable range. In order to better understand the role of these trace elements in diabetes, further clinical studies are required enrolling larger number of patients and using more sophisticated techniques besides blood, hair samples should also be obtained to allow clear conclusions.

Acknowledgment

We thank RSSDI (Research Society for Study of Diabetes in India) for funding the project. We are grateful to Dr. U. V. Wagh [Director, Interactive Active Research School for Health Affairs (IRSHA)] and Dr. M. V. Hegde (Scientific Advisor, IRSHA) for their guidance.

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Source of Support: Nil, **Conflict of Interest:** None declared.