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SERUM ZINC CONCENTRATIONS IN DIABETIC PATIENTS COMPARED WITH NON- DIABETICS IN ISFAHAN

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ABSTRACT

To study the zinc concentration differential in diabetic patients compared with non-diabetics and borderline subjects in a sample of two hundred individuals under investigation, we gathered information on history and duration of diabetes as well as type of treatment and diet. In addition, capillary blood glucose and serum zinc concentrations were measured. The serum zinc level was higher in diabetic patients compared to borderline and non-diabetics. The higher level of zinc in diabetic patients may be due to their change of energy source and the lower phytate and higher zinc content of their new diets which consequently reduce the effect of this substance on zinc absorption. The reason for lower levels of zinc in the borderline subjects is not presently clear and needs further investigation.

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INTRODUCTION

In 1943, Todd and coworkers[1] reported on the role of zinc as an essential element for survival of animals and its probable effect as a nutrient in human nutrition. In recent years the relationship between the amount of trace elements including zinc in the soil and incidence of diabetes mellitus has been pointed out.[2] Zinc is essential for storage of insulin in crystal form in the beta cells of the pancreas. Also it has been shown that zinc has insulin-like activity on adipocytes.[3] Zinc delays the absorption of insulin from injection sites. It seems that zinc can alter glucose tolerance in rats.[4] Also the glucose tolerance test in zinc deficiency shows a delayed absorption of glucose and impaired release of insulin.[5] Another report shows that zinc-deficient subjects have normal intravenous glucose tolerance and delayed absorption of a glucose load.[6]

To our knowledge, very little has been done on the zinc content of serum, plasma or other tissues of the body in diabetics. Still, the results of the few available studies are controversial. Rosner, et al,[7] Sulivan, et al,[8] and Pidduck, et al,[9] concluded that plasma zinc levels decrease in diabetics while Davies, et al,[10] Constam, et al,[11] and Buczkowskie[1] believe the contrary.

Regarding the recent increasing interest in the role of zinc in animal and human nutrition, especially in relation to insulinase secretion in the liver, we undertook a study on the normal serum zinc concentration and its possible changes in diabetic patients with special emphasis on food habits of the community in this part of the world, where 75-85% of most nutrients come from cereals, mainly wheat and wheat products.[13,14]

PATIENTS AND METHODS

Two hundred male and female diabetic and non-diabetic subjects (129 and 71 subjects, respectively) aged 25-66 years were referred to our laboratory for routine examination, each of whom completed a general questionnaire including information on history of diabetes, duration of the disease, type of treatment and diet. Capillary blood glucose and serum zinc concentrations were measured using Nelson, Somogyi, and atomic absorption spectrophotometry methods, respectively.[15,16]

RESULTS

Table I shows the mean serum zinc level of normal, borderline and diabetic patients. As can be seen, the difference between the serum zinc concentrations of normal, borderline and diabetic patients was significant. Zinc concentrations in diabetic patients was much higher than those in borderline and normal subjects($P<0.01$). Zinc concentrations in normal controls were still higher when compared to borderline subjects ($p<0.01$).

Table I. The serum zinc concentration of normal, borderline and diabetic subjects in the group under study

Group	Mean serum zinc level(μg/100ml)
Normal	128.94 (S.D.±24.86)
Borderline	104.27 (S.D.±21.63)
Diabetic	140.75 (S.D.±22.43)

DISUSSION

Prior to this study, we believed that in our patients, the level of serum zinc would be less than those reported for diabetics in other communities; this judgement was based on the following information:

1. high phytate content of our staple food (bread),[17]

2- decreasing effect of phytate on zinc absorption,

3- amount of zinc in our daily diet (about 9mg per day per cap.), as reported by the Nutrition Institute of Iran,[13] and

4- amount of zinc in the daily diet of other communities.[18]

Interestingly however, after completion of our study, we found that the level of serum zinc is much higher among our diabetic patients compared to borderline subjects and non-diabetic individuals. As far as our results are concerned, the high level of zinc in our diabetic patients (most of whom were under insulin or hypoglycemic drug treatment and were to some extent following low-carbohydrate diets), could be due to two factors:

1- Decrease of phytate content of diet due to the reduction of starchy foods mainly cereals which can be directly related to the absorption of zinc in the intestine which in turn will increase the zinc bioavailability.

2- The increase of zinc intake in diabetic patients due to the change of energy source from sugar and other carbohydrates to protein sources such as milk, cheese, yoghurt and poultry, all of which are rich in zinc.

However, as mentioned above, some other factors such as diet and amount of drugs, injection of insulin, etc. in turn might have interfered in our findings, which necessitate further investigation.

In the case of borderline subjects, it seems that all the cases with abnormal glucose tolerance tests have lower levels of serum zinc compared to those of diabetics and non-diabetics. The lower levels of zinc in these subjects may be attributed to glucose intolerance as a whole. Again in this case, further investigations are needed to elucidate the matter.

The serum zinc concentration in our normal subjects was almost equivalent to the findings reported in other communities; (eg, about 120μg/100ml). The high phytate content of our normal subjects leads to the presumption that perhaps recommended daily allowances of zinc[19] should be far less than 15mg/day.

It is recommended that study of serum zinc concentration and dietary intake of this essential trace element may serve as a complementary approach in the control and treatment of diabetes.

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