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The Prevalence of Zinc Deficiency in Diabetic Subjects

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Abstract

Zinc (Zn) is an essential trace element for many physiological, immunological, and metabolic functions in the human body. Both developed and developing nations' populations are impacted by zinc deficiencies. Insulin is significantly influenced by zinc. Diabetes mellitus (DM) is a term used to describe impaired glucose metabolism, which can cause a variety of illnesses and is characterized by a weakened immune system in the affected individual.

Objective: The aim of this study was to assess serum zinc level in diabetic subjects in comparison of non-diabetic subjects.

Methodology: In the study normal (n 30) and type-2 diabetic (n 30) volunteer subjects of both genders (age 35-50 years) enrolled for the study. All normal and diabetic subjects were screened serum Zn level, to find out serum zinclevel among diabetic and non-diabetic subjects.

Result: The results revealed that the mean of serum zinc level in normal subjects was 101.37±25.76 µg/dl and diabetic subjects it was 62.70±11.74 µg/dl.

Conclusion: It was found that serum zinc levels were low in diabetic subjects.

Keywords: Zinc, Insulin, Diabetes, Metabolism, Non-diabetic.

INTRODUCTION

Diabetes is seen as a public health issue in both industrialized and underdeveloped nations. In recent decades, there has been a global increase in the prevalence of diabetes, which has led to severe complications and a rise in mortality among those who have the disease. Due to factors like population increase, age, urbanization, rising rates of obesity, and physical inactivity, there are more and more persons with diabetes. Worldwide, 85% of cases of diabetes are caused by type-2 diabetes mellitus. Of patients with type-2 diabetes over 30, approximately 35% truly require insulin. Both type-1 and type-2 diabetes problems can be postponed and minimized with proper glucose management. A cause of macro and microvascular problems that increase morbidity and mortality in type-2 diabetic patients, inadequate glycemic control in these individuals should no longer be tolerated. Diabetes type-2 is associated with a higher risk of microvascular sequelae such neuropathy, nephropathy, and retinopathy as well

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as macrovascular illnesses like peripheral vascular disease, coronary heart disease and cerebrovascular disease (Daradkeh *et al*., 2014).

Particularly in relation to diabetes, zinc plays a significant function in the body's antioxidant system by delaying the oxidative process. Zinc is specifically needed for the appropriate synthesis and operation of certain metallothioneins as well as the antioxidant enzyme copper-zinc superoxide dismutase (CuZnSOD) (Silky *et al*., 2024). Because these enzymes aren't working as well, prolonged zinc deficiency usually makes people more susceptible to the negative consequences of oxidative stress. In addition to its function as an antioxidant enzyme, zinc is also thought to contribute to the stability of cell membranes, defense against vitamin E deficiency, and limitation of endogenous free radical generation (Andrews, 2005). Many studies have shown that oxidative stress, primarily caused by the production of free radicals from hyperglycemia, plays a role in the onset, development, and progression of diabetes as well as related outcomes. As a result, it became evident that treating oxidative stress by using antioxidants could be a useful tactic for lowering the risks associated with diabetes (Johansen *et al*., 2005). The present study was undertaken to evaluate prevalence of zinc deficient in diabetic and non- diabetic patients

MATERIALS AND METHODS

The present study was conducted in Banasthali University and its surrounding area. Total 60 subjects including both gender (age 35-50 years) were selected, with middle socio economic status from both categories type-2 diabetic (n=30) subjects and non-diabetic subjects (n=30) to participate in the study on the basis of pre-decided criteria

Criteria for the selection of samples:

- Subjects diagnosed as well non-diabetic and type-2 diabetics
- Age between 35-50 years
- Without any physical deformity and free from any kind of infection
- Non allergic to any food item

Criteria for exclusion:

- Pregnant women
- Subjects on insulin therapy
- Subjects have any food allergy
- Subjects having treatment for abnormal lipid profile
- Age more than 50 years and less than 35 years

Assessment of Serum Zinc level of diabetic and non-diabetic subjects

To determine the difference between the serum zinc levels of both groups (diabetic and non-diabetic subjects) were screened for serum zinc level. Serum zinc was measured by Colorimetric method. Normal reference value of serum zinc taken was 65-70µg/dL (Hotz *et al*., 2003; Wessells and Brown, 2012). This indicate that serum zinc level and diabetes. The following stage of the study involved examination of the impact of dietary supplements of zinc rich food items on diabetic subjects

RESULTS

Table 1: Serum Zinc level of non-diabetic and diabetic subjects

Groups	Diabetic subjects	Normal subjects
Serum Zn (µg/dl)	62.70±11.74	101.37±25.76**

NS-non significant, *P≤0.05 and ** P<0.01 Values are in mean ± standard deviation

The mean serum zinc level of non-diabetic subjects and diabetic subjects was 101.37±25.76 µg/dl and 62.70±11.74 µg/dl respectively. Using student't'- test diabetic subjects were found to have significantly low in serum zinc level as compared to the non-diabetic subjects.

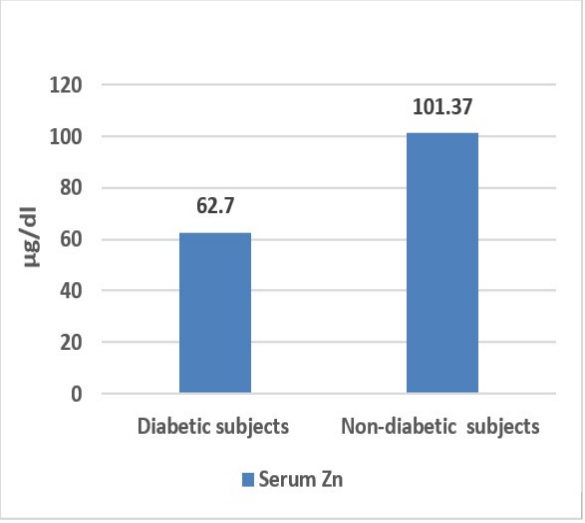

Fig. 1: Mean serum zinc level of diabetic and non-diabetic subjects

DISCUSSION

Our study revealed that diabetic participants had significantly low mean zinc levels than control subjects. These results were consistent with a previous study done by Sahria and Goswami, (2013) which also showed low levels of zinc in diabetic patients compared to their controls. This finding also concurred with studies done by Saha-Roy et al. (2014) and Masood et al. (2009) AlMaroof and Al-Sharbatti (2006) also observed significantly lower serum zinc levels in diabetics than in control subjects. Marchesini et al. (1998) explained that low zinc seen in the diabetic population was due to the decreased gastrointestinal absorption and increased urinary excretion. In one study, the zinc levels were reported as similar in diabetic and control subjects (Zargar et al., 1998). However, a study done by Mamza et al. revealed high zinc levels in diabetic patients (Mamza et al., 2016). Having diabetes and aged 50 and over were predictors for zinc deficiency.

This finding was different from the study done by Masood et al., (2009) in which there was no significant difference regarding age, but Hwalla et al. (2017) revealed in a study that there was significant deficit of micronutrient including zinc in the elderly population.

The zinc level was significantly low in a group of poor glycemic controlled diabetic participants compared to diabetic participants with good glycemic control. This agrees with the study by Bandeira et al., (2017) which revealed that plasma zinc level was inversely related with glycosylated hemoglobin in type-2 diabetic patients. The same results were shown in a local study (Farooq, 2019) in Saudi Arabia which revealed that high HbA1C was associated with low zinc levels.

This zinc deficiency can be counterbalanced by zinc replacement as research has revealed that there are health benefits for healthy individuals, and has also demonstrated the protective effect of zinc for diabetic patients (Phungamla et al., 2013). A study by Zhu et al. (2013) on diabetic mice demonstrated that the zinc supplementation increased the activity of superoxide dismutase and decreased malondialdehyde concentrations in both serum and pancreas.

There were some limitations of our study. First, since it was experimental study cause and effect relationship between diabetes and low zinc level could not be established. Second, in this study, other minerals such as magnesium, chromium or copper were not done concurrently with zinc levels to know the influence of these trace elements on serum zinc level. Therefore, the low zinc levels could be due to some effects of other minerals particularly copper. Third, the history of diet which could have some effect on serum zinc levels or glycemic control was not included. Furthermore, the analysis did not include diabetic medications which would have some effect on glycemic and zinc levels, although all participants received standard management by endocrinologist in diabetic and endocrinology clinic in our hospital. Finally, the history of iron intake which has some effect on absorption of zinc from intestines was not included. Therefore, an acceptable sample size, a good match of diabetic and control participants, showing relationship in coefficient significance and 80% power of study are the strengths of this study.

CONCLUSION

The serum zinc level deficit is a major cause of suffering for diabetic patients. In order to supplement zinc in identifiable risky groups as soon as possible, preventive measures must be put in place. Our study concludes that population with diabetes have low zinc level compared to healthy population. This significantly low level of zinc could be the cause of the development of diabetes or possibly diabetes is causing zinc deficiency. We suggest further studies designed as case–control or cohort studies to evaluate cause, affect relationship between zinc levels, and type-2 diabetes mellitus. We recommend a check on the zinc levels in diabetic patients if they have poor glycemic control, longer duration of diabetes, obesity, aged more than 50 years, so that zinc replacement therapy may be initiated to reduce oxidative stress in this high-risk population.

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