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A STUDY ON DIABETES MELLITUS AND SERUM ZINC

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ABSTRACT

Introduction: The correct metabolism of proteins, lipids, and carbohydrates depends on certain trace elements, such as zinc.

Deficits of one or more trace elements in tissues are linked to chronic degenerative diseases like diabetes mellitus (DM). The aetiology of diabetes mellitus (DM) and several of its consequences may be influenced by improper zinc metabolism. The goal of the current study was to examine the relationship between serum zinc levels in diabetes mellitus (DM) and those levels.

Methods: In the current study, 40 known diabetic patients between the ages of 15 and 65 were used as the study group, and they were compared to a healthy control group of the same age. The Beckman AU480 biochemistry fully automated analyzer was used to estimate the serum zinc levels in both groups. The student unpaired t-test was used to evaluate the data.

Results: The serum zinc level in study group (DM patients) was significantly low as compared to controls.

Conclusion: Poor zinc reabsorption and increased excretion of zinc (zincuria) in diabetes patients may both contribute to the lower serum zinc levels in these people. Additionally, it may be inferred from this study that oral zinc delivery to diabetic patients may aid in wound healing and the prognosis of complications related to diabetes mellitus.

Key words: Serum zinc, Diabetes mellitus

INTRODUCTION

A diverse metabolic condition called diabetes mellitus (DM) is defined by hyperglycemia brought on by insufficient insulin production, resistance to insulin action, or both Gavin *et al*., 19971 **[1]**. An autoimmune-mediated attack on pancreatic beta-cells results in insulin insufficiency and type 1 diabetes. Insulin resistance and a relative rather than an absolute insulin shortage are two characteristics of type-2 diabetes. An estimated 346 million persons were expected to have diabetes mellitus in 2011, making it a major cause of morbidity and mortality worldwide **[2]**. Between 2005 and 2030, the incidence is predicted to quadruple, with the largest increases occurring in low- and middle-income developing nations of Africa, Asia, and South America **[3]**. 80 percent of people with diabetes worldwide today reside in low- and middle-income nations **[4]**. Zinc's role in gene expression and endocrine function is explained by the idea of zinc fingers, and the metal's modes of action include its impact on cell division, DNA synthesis, and RNA synthesis. Additionally, key hormones including somatomedin-C, osteocalcin, testosterone, thyroid hormones, and insulin interact with zinc in ways that affect bone formation Maria *et al*., 2002 **[5]**. Raulin **[6]** was the first to realise the importance of zinc for the development of microbes in 1869. One of the vital trace elements in humans is zinc.

An important trace element called zinc is intimately involved in the physiology of insulin. A dysfunctional zinc metabolism has been connected to the development of diabetes mellitus and some of its consequences. The known sensitivity of diabetics to infection and the importance of zinc in the immune system, particularly cell mediated immunity, are what make the relationship between zinc and diabetes mellitus so intriguing **[7, 8]**. Zinc supplementation increases fasting insulin levels and fasting glucose in mice, according to animal research **[9]**. Additionally, research on humans have demonstrated the advantages of zinc supplementation in both type-1 **[10, 11]** and type-2 diabetes **[12, 13]**. The goal of

the current study was to assess blood zinc levels in people with diabetes mellitus and connect them with age, sex, type of DM, and duration of DM; the main consequences of DM were poor wound healing.

MATERIALS & METHODS

In the current study, 80 participants—80 men and women—were examined. They were split into two groups: the Healthy Control group (40 participants) and the Diabetes mellitus group (40 participants). Santosh Medical College & Hospital Ghaziabad was the site of the study. As a control, 30 employees of the hospital who were generally healthy and had no medical history were included. In this study, 30 ambulatory diabetic patients with moderate to poor management of their diabetes, wound infections, particularly foot ulceration, and attendance at the diabetic clinic at Santosh Medical College & Hospital Ghaziabad, were included. They ranged in age from 13 to 60 years old. Diabetes could last anywhere from one month to fifteen years. The study excluded patients who were taking zinc supplements and had ischemic heart disease, persistent drinking, or had pancreatitis. Each individual underwent a thorough clinical examination and history. All groups had their serum zinc levels and fasting blood sugar assessed. The significance of the study and the methods were explained to the participants. The human research ethics committee of the institute approved the experiment after receiving written informed consent from the participants.

Collection of blood sample

In order to estimate fasting blood sugar and serum zinc, roughly 3 ml of fasting blood was drawn from the antecubital vein into a sodium fluoride vial.

Santosh Medical College & Hospital Ghaziabad provided the Beckman AU480 biochemistry fully automated analyzer used in our investigation, and the equipment was operated in line with the manufacturer's operating handbook. The GOD-POD method was used to assess the serum glucose. By contrasting the signal from diluted serum with the signal from watery standards, the presence of zinc was ascertained. From the most diluted to the most concentrated zinc standard solutions were aspirated first. Aspirating the diluted specimen serum samples into the atomic absorption flame allowed for analysis and recording of their absorbance. The working curve was created using the calculated values. Absorbance vs. concentration is represented on a graph. Zinc concentrations in sample specimens were calculated by comparing sample absorption

to the typical zinc curve. The data were given as mcg/dl, or micrograms per 100 ml.

Statistical analysis:

After the data was collected and organized it was statistically analysed using the student's unpaired "t" test and the significance of the results was established by calculating the "p" value. The "p" value was calculated in contrast to the control group. For each of the parameters, the analysis's findings were reported as Mean ± Standard Deviation.

RESULTS:

There were 80 total subjects in the current study, 80 of them male and female. They were separated into the subsequent groups.

Table 1: Showing distribution of study groups subjects and their serum zinc levels in mg/dl

Sr. No.	Group	No. of cases	Male	Female	Range	Mean± S.D.
1.	Group- A Control	40	21	19	60-155	107.32 ± 32.00
2.	Group B Diabetes mellitus	40	20	20	48-235	106.77 ± 42.23

Group A: The amount of serum zinc was calculated in 40 volunteers who appeared to be in good health. There were 21 men and 19 women, ranging in age from 22 to 66 years old (mean age was 42.00 ± 11.71 years). The aforementioned table clearly shows that the serum zinc levels in healthy individuals ranged from 60 to155 mcg/dl, with a mean value of 107.32 ± 32.00

Group B: Serum zinc levels were measured in 40 diabetes patients, 20 of whom were male and 20 of whom were female, ranging in age from 20 to 60 years (mean age, 39.5 ± 10.79 years). Diabetes patients had serum zinc levels that ranged from 48 to 235 mcg/dl with a mean value of 106.77 ± 42.23

Table 2: Showing means ± S. D. of age of diabetics and serum zinc levels

Sr. No.	Age range (In yrs.)	No. of cases	Range	Mean± S.D.	P. Value
1.	20 – 60	40	20 – 60	39.55 ± 10.79	0.001*

Significant: The above table shows that the age of diabetics and serum zinc level show statistically significant.

Table 3: Showing means ± S. D. of sex of diabetics and serum zinc levels

Sr. No	Sex of diabetics	No. of cases	Range	Mean± S.D.	P. Value
1.	Male	20	20 – 60	37.45 ± 9.32	0.001
2.	Female	20	22 – 50	41.65 ± 11.95	0.001

Significant: The above table shows that the age of diabetics and serum zinc level show statistically significant.

Table 4: Showing Comparison of controls & Diabetic

Parameter	Controls	Diabetic	P *value
	Mean±S.D.	Mean±S.D.	
Fasting blood sugar mg/dl	88.07±7.86	135.50±64.81	0.000*
Serum Zn µg/dl	96.90±25.05	106.07±43.28	0.260

Table 5: Showing Correlation of blood sugar and Serum Zinc in control group

		Control FBS	Control Serum Zn
Control FBS	Pearson Correlation	1	
	Sig. (2-tailed)		
Control Serum Zn	Pearson Correlation	0.220	1
	Sig. (2-tailed)	0.173	

Table 6: Showing Correlation of blood sugar and Serum Zinc in diabetic group

		Diabetic FBS	Diabetic Serum Zn
Test FBS	Pearson Correlation	1	
	Sig. (2-tailed)		
Test Serum Zn	Pearson Correlation	0.280	1
	Sig. (2-tailed)	0.080	

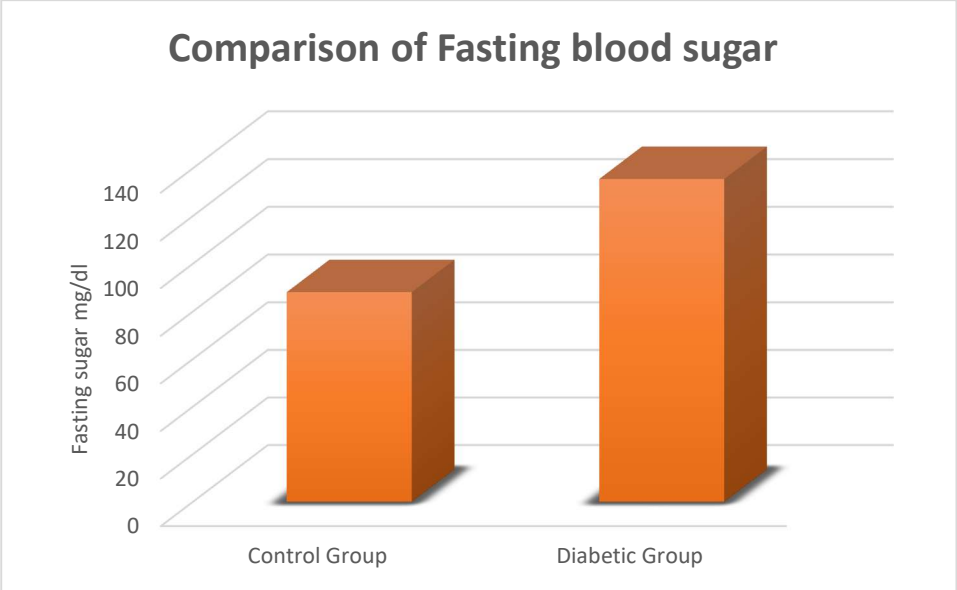

Figure 1

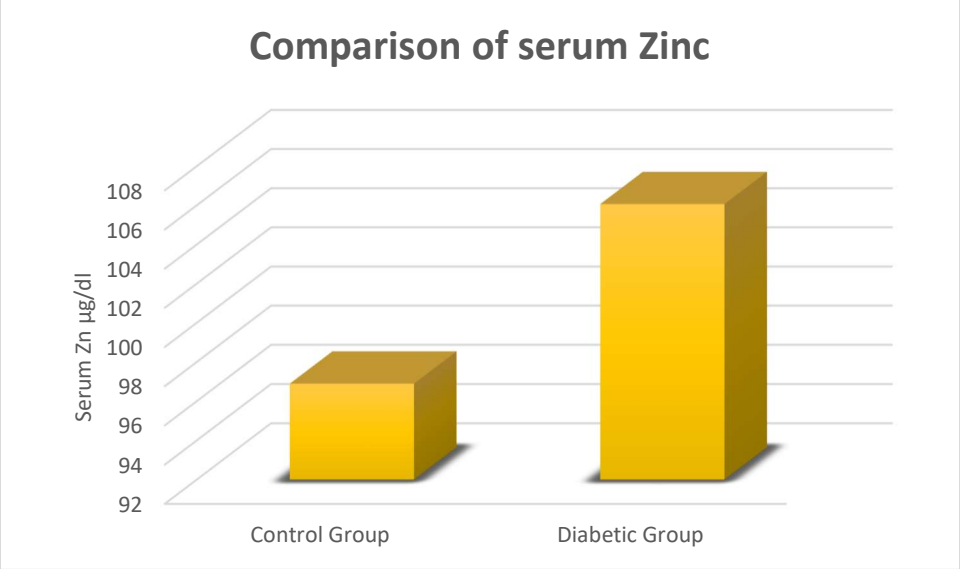

Figure 2

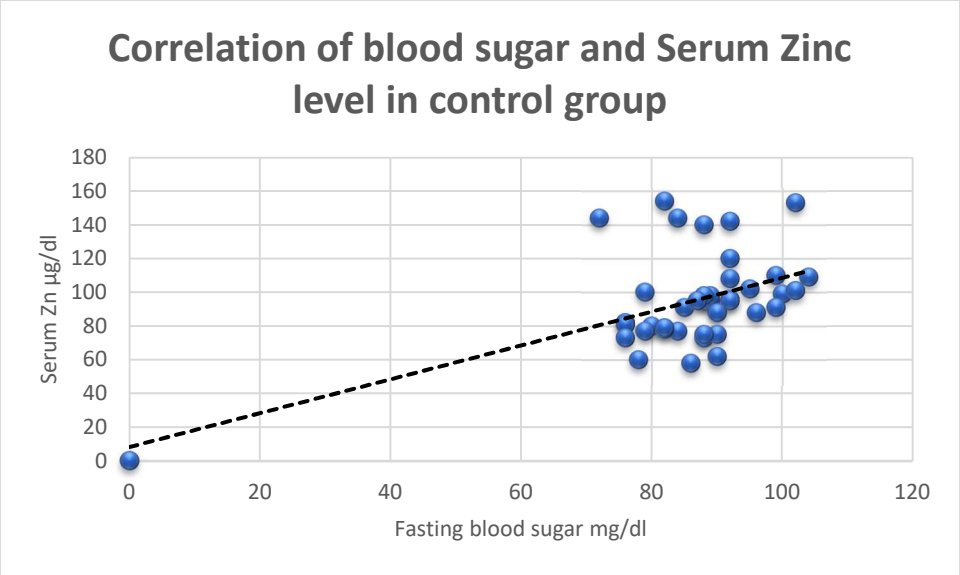

Figure 3

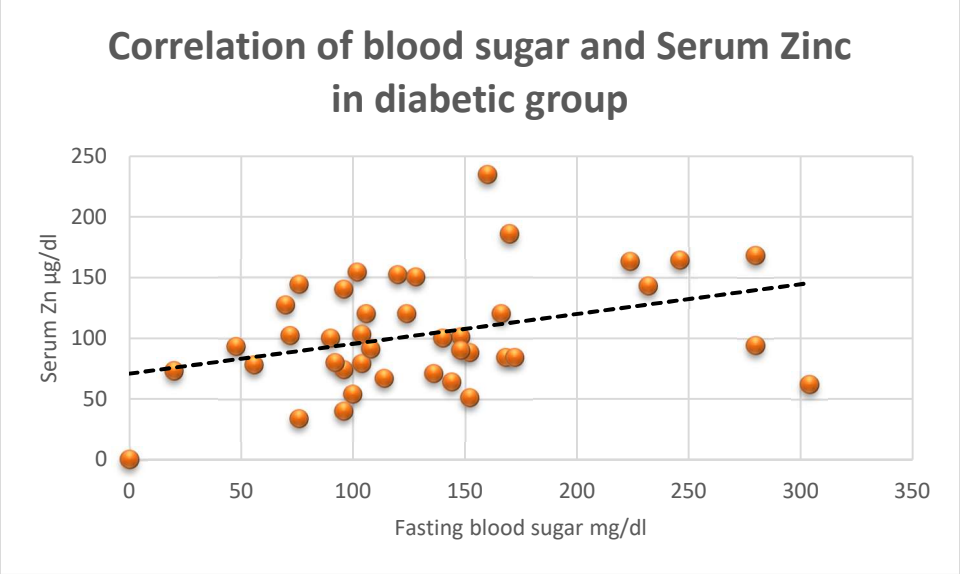

Figure 4

DISCUSSION:

In India, the beginning of diabetes occurs before the age of 50 in more than 50% of cases **[17]**. After receiving their agreement, 80 patients (40 diabetics and 40 controls) were treated to a medical history interview, physical examination, and investigations. In this investigation, it was discovered that all diabetics had considerably lower mean serum zinc levels than controls. This was in line with the findings of McNair *et al*, who found that serum zinc was inversely related to the glycemic status of diabetes. Garg *et al*. **[18]** also reported similar findings in diabetes.

Williams *et al*. **[19]** found that the concentration of zinc was 17 percent lower in people with diabetes when compared to controls.

The reason that diabetics have lower serum zinc levels could be attributed to gastrointestinal malabsorption, genetics, reduced renal function associated with the condition, increased urine excretion, or symptoms of infection during which zinc works as a defensive mechanism. Hypozincemia and a reduction in tissue zinc reserves coexist **[21**. However, it has been hypothesised that aberrant zinc metabolism contributes to the aetiology of diabetes and associated consequences. The goal of the current investigation was to determine how serum zinc affected diabetes mellitus.

Serum zinc in Diabetes mellitus:

Observations were made in the current study regarding the relationship between the blood zinc levels in diabetic individuals and many factors, including age and sex of the diabetic subjects, type of diabetes, length of diabetes, complications of diabetes, and those of normal healthy controls.

Serum zinc and age and sex of diabetics:

56 to 130 mcg/dl was the wide range of serum zinc levels in the various age groups (from 15 to 65 years old) (mean 78.33). Serum zinc levels in 17 diabetes males ranged from 56 to 122 mcg/dl (mean 78.30), while levels in 13 diabetic females ranged from 60 to 130 mcg/dl (mean 78.35). There is no proof that a diabetic subject's age or gender affects the serum zinc level. These research's findings agree with those of Davies *et al*., Pidduck *et al*., and Khandelwal *et al* **[22]**.

Serum zinc and type of diabetes mellitus:

15 cases of Insulin Dependent Diabetes Mellitus (IDDM) and an equal number of cases of Non-Insulin Dependent Diabetes Mellitus had serum zinc measurements (NIDDM). In IDDM, the serum zinc concentration ranged from 56 to 100 mcg/dl (mean 74.76).

In contrast, the range for NIDDM was 60 to 130 mcg/dl (with a mean value of 83.46 mcg/dl). The findings showed that, compared to normal healthy controls, blood zinc levels were lower in instances of IDDM and NIDDM, but there was no statistically significant association between the type of diabetes mellitus and serum zinc level. Niewoehner *et al*. confirm our findings regarding the type of diabetes mellitus and serum zinc level **[23]**. In Mani Uliyar's study, participants with IDDM had statistically significant lower serum zinc levels than subjects without IDDM or normal blood sugar levels.

Serum zinc and duration of diabetes mellitus:

Regarding the relationship between serum zinc levels and the length of diabetes mellitus, diabetics with longer durations (more than 5 years) of the disease had significantly lower serum zinc levels (mean 73.23) than those with shorter durations (less than 5 years) (mean 82.23). Additionally, this study discovered an inverse relationship between serum zinc levels and the length of diabetes mellitus, showing that as diabetes mellitus lengthens, serum zinc levels decrease. This finding seems to support Khandelwal *et al*findings. .'s A previous study by Pidduck *et al*. found no association between the length of diabetes mellitus and serum zinc **[24]**.

Serum zinc and complications of diabetes mellitus:

The mean serum zinc level in 12 diabetic participants without any difficulties was 90.17 mcg/dl, compared to 70.44 mcg/dl in 18 diabetic patients who presented with symptoms, including poor wound healing. Patients with problems from diabetes showed statistically lower serum zinc levels than patients without issues. The findings of Khandelwal *et al*. are in favour of this **[24]**. According to a study by Poggine *et al*., oral zinc sulphate administration sped up the healing process for a group of military hospital patients' wounds. Most likely, zinc is essential for immunity and wound healing. Zinc may control the production of collagen.

Serum zinc in diabetes mellitus and control

In this investigation, serum zinc levels ranged from 60 to 155 mcg/dl (mean 107.32 ± 32.00) in healthy individuals, while they ranged from 48 to 235 mcg/dl in diabetic subjects (mean 106.77 ± 42.23). When compared to control participants, we found that diabetes subjects had statistically significantly lower serum zinc levels. Our results are consistent with earlier research by Khandelwal *et al*. However, Rosner *et al*. and Pidduck *et al*. found no statistically significant difference between diabetes and healthy individuals in their studies. Diabetes patients had higher serum zinc levels than healthy people, although this difference was not statistically significant. Contrarily, diabetes mellitus was found by Constam *et al*. to have significantly lower plasma zinc levels. There is a zinc disorder that has not yet been explained. Metabolism, as evidenced by a notable hyperzincemia. Diabetes mellitus and several of its consequences may have abnormal zinc metabolism as evidenced by the extremely significant variations in urine zinc excretion

between the diabetic and control groups. It's possible that the hyperzincuria seen in diabetics is due to an anomaly in the metalloenzymatic or zinc-enzyme complex synthesis or breakdown. Diabetes patients are more prone to have zinc deficiency because their high urine losses are not made up by higher gastrointestinal absorption.

CONCLUSION

According to the findings of our study, oral zinc supplementation in diabetic patients may aid in the healing of wounds and the prognosis of complications related to diabetes mellitus.

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