

A study of association between serum zinc and HbA1c in type2 diabetic patients in a tertiary care hospital in Puducherry, Tamilnadu



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ABSTRACT

Background: Diabetes currently affects more than 66.8 million people in India which has become a major health care problem, representing the largest number of any country in the world. Reduced concomitant intake of Zinc studies proved to be associated with risk of increased HbA1c percentage in individuals with Type 2 Diabetes patients. **Aims and Objective:** The current study was designed to assess serum Zinc level in Type 2 Diabetes patients and to find out the correlation between serum Zinc and HbA1c level in Type 2 Diabetic patients. **Materials and Methods:** One hundred patients were included in the study and they were divided into two groups like Group I (50 patients): Type 2 Diabetic patients with HbA1c more than 7 percent. Group II (50 patients): Type 2 Diabetic patients with HbA1c less than 7 percent (50). Estimation of blood glucose (Fasting and post prandial), Glycated haemoglobin (HbA1c) and serum Zinc was done. **Statistical Analysis:** The data is collected, recorded and analyzed statistically to determine the significance of different parameters by using SPSS package for windows version 23.0. **Results:** The mean value of serum zinc was lower in the diabetic group whose HbA1c more than 7 (p value – 0.001) when compared to the diabetic group whose HbA1c less than 7. **Conclusion:** Estimating the level of serum zinc becomes important to know the status of insulin in diabetic patients and correlating the levels of HbA1c and Serum zinc in Type 2 DM patients, can monitor the levels of glycemic control and prevent the risk of development of complications.

Key words: Serum Zinc; HbA1c; Diabetes; Complications

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INTRODUCTION

Diabetes currently affects more than 66.8 million people in India has become a major health care problem with largest number of cases in the world.¹ Trace elements are essential for the metabolism of proteins, carbohydrates and lipids. In 1938, Scott and Fisher first reported that amount of zinc (Zn) in pancreatic tissue of cadavers of diabetic patients was approximately 50% of that in nondiabetics, suggesting an association between zinc and Diabetes mellitus.² Symptoms of diabetes include excessive urination, increased thirst and hunger, weight loss, slow

wound healing, numbness in feet.³ It may cause severe health complications if not treated on time including microvascular complications (Diabetic nephropathy, neuropathy, retinopathy), Macrovascular complications (Atherosclerosis, Peripheral Vascular Diseases, Ischemic Heart Disease, Cerebrovascular Diseases), and other miscellaneous complications (Diabetic cardiomyopathy).⁴ Studies suggests that reduced concomitant intake of Zinc studies might be associated with increased risk of elevated HbA1c in individuals with Type 2 Diabetes.⁵ Postmenopausal women are especially vulnerable to zinc deficiency, due to serious hormonal changes during that

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time.⁶ Zinc is a trace element that acts as a co-factor for synthesis, storage, stability and secretion of insulin by pancreas. In addition to this, it also accounts for the conformation integrity of insulin in its hexameric crystalline form.⁷ Insulin present in beta-cells of the pancreas as a hexamer of six insulin and two zinc molecules. Its crystallization occurs under specific conditions in secretory granules, in which both insulin and zinc exist in high concentration and acidic pH is maintained.⁸ Zinc is involved in the regulation of insulin receptor initiated signal transduction mechanism and insulin receptor synthesis. Furthermore, it acts as a cofactor of intracellular enzymes involved in protein, lipid, glucose metabolism and is an integral component of several antioxidant enzymes.⁹ Zinc has an important role in the glucose utilization by muscle and fat cells.¹⁰ Metallothioneins (MTs), zinc importers (ZIP, SLC39A), and zinc exporters (ZnT, SLC30A) are proteins that regulate cellular zinc homeostasis.¹¹ ZnT8 plays a key role in the accumulation of zinc within insulin secretory granules.¹² Study suggest that several key glycemic indicators are significantly reduced in diabetic patients on zinc supplementation and the findings support the notion that zinc supplementation has a clinical potential for preventing or treating diabetes.¹³ Inadequate Zinc distribution may affect the onset of diabetes by regulating various critical biological events.¹⁴ Observations during zinc deficiency indicate that the absence of this trace element most severely affects the immune response indicating their role in immunity.¹⁵ Several beneficial effects of Zinc supplementations in patients with diabetes mellitus, namely improved glycemic control, lipid parameters, antioxidant status has been identified. Additionally, it also causes significant reduction in FBG, PPBG and HbA1c in patients with Type-2 diabetes due to its insulin mimetic and hypoglycemic properties.¹⁶ With the all above relationship of zinc with insulin, the aim of the present study is to study the correlation of serum zinc levels with HbA1c in type 2 DM.

This is a hospital based case control study conducted on Type 2 Diabetes mellitus patients attending the General Medicine and Diabetology clinic of Sri Venkateshwaraa Medical College Hospital, Ariyur, Puducherry. The duration of study was 6 months from January 2019 to August 2019. A convenient sample of 100 old and new patients of Type 2 Diabetes Mellitus were included in the study consisting of Group I (50 patients): Type 2 Diabetic patients with HbA1c more than 7 percent and Group II (50 patients): Type 2 Diabetic patients with HbA1c less than 7 percent after taking an informed consent. Patients with history of hepatic diseases, renal diseases, alcoholism or critically ill patients or those on mineral supplementation were excluded from the study. A proforma containing the general information of the patient like name, age, sex,

socioeconomic status, and relevant history pertaining to diabetes mellitus like duration of the disease, complications if any, treatment taken, etc. was asked from the patient. Institutional Ethical Committee clearance was obtained before the commencement of the study.

During sample collection, 5ml of venous blood was drawn under aseptic precautions in red capped vacutainers, grey capped vacutainers and purple capped vacutainers. Then, serum was separated by centrifugation and was used for analysis of serum zinc by colorimetric method based Nitro-Paps method. Plasma was used for analysis of blood glucose by GOD-POD Method and whole blood for HbA1c estimation based on Immunoturbidity method.

Statistical analysis

The data was collected, recorded and analyzed statistically to determine the significance of different parameters by using SPSS package for windows version 23.0.

RESULTS

A case control study was conducted with 100 type 2 Diabetic patients who were divided into 2 groups consisting of 56 Type 2 Diabetic patients with HbA1c more than 7percent in Group I and 44 Type 2 Diabetic patients with HbA1c less than 7percent in Group II (Table 1).

Table 2 shows that the mean values of serum zinc and HbA1c levels. Mean serum zinc was lower in the diabetic group whose HbA1c more than 7 (p value – 0.000) when compared to the diabetic group whose HbA1c less than 7.

Table 3 shows Serum Zinc has a strong negative correlation ($r = -0.391$) with HbA1c in the Type 2 diabetic patients with HbA1c >7 (p = 0.001). Scatter diagram showing correlation between HbA1c and serum zinc is shown in Figure 1.

DISCUSSION

The present study was conducted with the aim to correlate the serum zinc levels with the glycated haemoglobin in type

Table 1: The baseline characteristics of the study groups

	T2 DM patients with HbA1c >7 (n = 56)	T2 DM patients with HbA1c <7 (n = 44)
Age	49 ± 14.5	53 ± 13.7
Sex	M = 35 F = 21	M = 30 F = 14
Blood sugar	FBS = 175 ± 21.4 PPBS = 258 ± 44.1	FBS = 118 ± 19.0 PPBS = 185 ± 18.4
HbA1c	10.5 ± 2.5	5.9 ± 0.59
Serum Zinc	46.06 ± 17.28	62.94 ± 16.34

2 diabetic patients. The diabetic patients were divided into 2 groups. Group I comprised of type 2 diabetic patients with HbA1c level more than 7 and consisted of 56 diabetic patients in number with 35 male and 21 female patients. Group II consisted of type 2 diabetic patients whose HbA1c was less than 7 with 44 patients -30 male and 14 female patients. The mean values of serum zinc were significantly higher in Group II as compared to Group I (p value 0.001). The 2 groups were correlated for glycated haemoglobin and serum zinc level. It indicated a statistically significant negative correlation (r value = -0.338). These findings were in accordance with the study done by Santosh K. Naik et al., in 2019 where there was a significant negative correlation between serum zinc and HbA1c.¹⁷ In a study done by Jyothirmayi B et al.,¹⁸ they identified significant decrease in serum concentrations of Zinc in study group (type 2 DM) when compared to control group consisting of healthy individuals. Similarly in a study done by Ramesh

Dasarathan et al., in 2017¹⁹ also suggested that zinc has strong negative correlation with HbA1c. In a study done by Sunthari K et al.,²⁰ in South India concluded that there is significant reduction of serum Zn in Type 2 Diabetes Mellitus patients in relationship with high HbA1c. In a study done by Sunita Pujar et al.,²¹ demonstrated a negative correlation in the serum levels of zinc and magnesium with HbA1c in diabetics.

Zinc, an essential element is useful in the synthesis, storage and secretion of insulin. Estimating the level of serum zinc becomes important to know the status of insulin resistance in diabetic patients.. Zinc supplementation to the diabetic patients can help in better glycemic control and prevent diabetes related complications as well as bone ailments.

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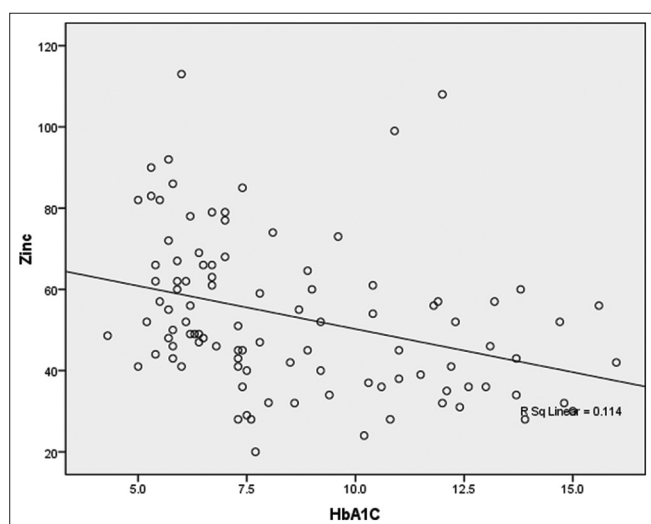


Figure 1: Scatter diagram showing correlation between HbA1c and serum zinc

Table 2: Compare the mean values of HbA1c and Serum Zinc between the 2 groups

	T2 DM patients with HbA1c >7 (n = 56)	T2 DM patients with HbA1c <7 (n = 44)	P value
HbA1c	10.5 ± 2.5	5.9 ± 0.59	0.001**
Serum zinc	46.06+17.28	62.94 +16.34	0.001**

** - highly significant (p value - <0.001)

Table 3: Correlation between HbA1c and Serum Zinc

	Serum Zinc	
HbA1c	Pearson's correlation	-0.338**
	Sig 2 tailed	0.001
	N	100

** - Correlation is significant at the 0.01 level (2 tailed)

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Author's contribution:

PM-Concept and design of the study; prepared first draft of manuscript; **SD** - Interpreted the results; reviewed the literature and manuscript preparation; **GP**- Concept, coordination, review of literature. **MP and VI** - Statistically analysed and interpreted, preparation of manuscript and revision of the manuscript.

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