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### RESEARCH ARTICLE

## CORRELATION BETWEEN SERUM ZINC AND GLYCOSYLATED HEMOGLOBIN LEVELS IN TYPE II DIABETES MELLITUS.

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#### Abstract

Correlation between serum zinc and glycosylated hemoglobin levels in type II diabetes mellitus.

#### Key words:-

serum zinc, glycosylated hemoglobin,  
type II Diabetes mellitus.

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#### Introduction:-

Diabetes mellitus (DM) is one of the major emerging health problem in developing countries resulting in morbidity and mortality of an individual and reducing the longevity of life. Although elaborate research works have been carried out to elucidate the multivarious aspects of this disease, many associated factors which will help to achieve better glycemic control are yet to be explored.[1] Universally there is a marked rise in type II DM cases and associated hypertension, stroke and renal problems and in turn they have become major contributors to morbidity and mortality. India being the second largest populated country in the world is also having 61.2 million cases in 2011 and is estimated to have 101.2 million type 2diabetic people by 2030.

Diabetes mellitus (DM) is a metabolic disorder with hyperglycemia and its related complications due to abnormality in insulin release, action or both. Insulin resistance plays a key role leading to all metabolic dysfunctions. Insulin resistance leads to increased visceral fat, dyslipidemia, hypertension, ,vasculopathy, increased platelet aggregation, endothelial dysfunction and accelerated atherosclerosis.[2] The altered metabolism of various minerals and trace elements has been implicated in diabetes mellitus and these elements may play a vital role in the itioopathogenesis and progression of the disease. Of these trace elements- magnesium, zinc and copper are important for various physiologic functions.[3] Oxidative stress caused by reactive oxygen species is the basis of pathogenesis of many diseases including DM. Trace elements play a role in production of oxygen free radicals.[4,5] .Zinc is a cofactor in the enzymatic pathways of production, storage and release of insulin. Zinc is also responsible for the structural stability of insulin, alteration of which leads to insulin resistance. Since glycosylated hemoglobin is an indicator of long-term glycemic control, HbA1c was measured and compared with serum zinc level.

#### Aim:-

To correlate between serum zinc and glycosylated hemoglobin levels in type II Diabetes Mellitus.

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### Materials and Methodology:-

The present study was undertaken in the Institute of Physiology, Madurai Medical College, Madurai. After obtaining Institutional Ethical clearance, 60 males in the age group of 40-60 yrs, newly diagnosed with type 2 DM were selected based on history, examination, and relevant investigations. 60 age- and sex-matched volunteers without diabetes mellitus were taken as controls. Persons on micronutrient supplementation, drugs which interfere with zinc metabolism, oral hypoglycemic agents, insulin therapy, pregnant women or chronic diseases were excluded from the study.

Patients were classified as diabetic based on the American Diabetic Association 2010 criteria for diagnosis of DM.[8]. After getting prior informed written consent, with strict universal precautions 5 mL of venous blood was collected from antecubital vein by venepuncture using a sterile disposable syringe. Serum Zinc was estimated by colorimetric method,[9,10], glycated haemoglobin by ion exchange resin method,[7,11,12], blood glucose (fasting and postprandial) by Glucose oxidase/Peroxidase method,[13,14]. Statistical analysis of the data was performed by using SPSS software. 'p' value of less than or equal to 0.05 was considered significant. Correlation was found out in SPSS by using regression equation.

### Results and Discussion:-

Age distribution of cases and controls was not statistically significant with  $p > 0.05$ . The mean fasting and postprandial blood glucose in newly diagnosed type 2 DM cases were found to be statistically significant than that of the controls with  $P < 0.001$ . Mean serum zinc was lower in cases ( $69.65 \pm 5.6 \mu\text{g/dl}$ ) vs controls ( $86.54 \pm 9.3 \mu\text{g/dl}$ ) with  $p < 0.001^*$ . Mean HbA<sub>1c</sub> was higher in cases ( $7.03 \pm 0.67\%$ ) than controls ( $5 \pm 0.29\%$ ), with  $p < 0.001^*$ . Williams *et al.*, [21] reported DM to be a condition most frequently associated with hypozincemia, where they observed 17% decrease in serum zinc concentration in diabetics, compared with controls.

**Table 1:-**

S.No	Cases	Controls	'p' value	Pearson's correlation coefficient
Mean S.Zinc	$69.65 \pm 5.6 \mu\text{g/dl}$	$86.54 \pm 9.3 \mu\text{g/dl}$	.001*	<b>Negative Correlation - 0.826</b>
Mean HbA <sub>1c</sub>	$7.03 \pm 0.67\%$	$5 \pm 0.29\%$	<0.001*	

Correlation between glycated hemoglobin (HbA<sub>1c</sub>)% and serum zinc concentration in cases reveal a negative correlation between s.zinc and HbA<sub>1c</sub> with Pearson's correlation coefficient - **0.826**.

The findings of the present study are consistent with Reefat *et al.*, [28] who showed negative correlation between serum zinc concentration and baseline HbA<sub>1c</sub>% value in cases. Marchesini *et al.*, [29] explained hypozincemia in diabetic population due to the low gastrointestinal absorption and high urinary excretion of zinc.

### Discussion:-

Diabetes mellitus is a multifactorial disease. The metabolic derangements in diabetes causes pathophysiologic changes in multiple organ systems due to micro vasculopathy.

Present study revealed significant decrease in serum zinc levels in diabetic patients. Zinc plays a key role in various enzyme systems in the body.[13] Zinc is a potent antioxidant. Chronic zinc deprivation may lead to increased oxidative damage. Pujar S *et al.*, [13] in their study also showed significant decrease in serum zinc levels in type 2 diabetic patients. The reason for decreased serum zinc in diabetics may be due to impaired absorption, increased urinary excretion due to altered renal function, or genetic factors or during infections in which zinc plays a role in defence.[26]

Hence it may be concluded that there is significant reduction of serum zinc in type 2 DM patients. Alterations in Zn homeostasis has adverse effect on carbohydrate metabolism. High renal tubular load of glucose in diabetics interfere with tubular reabsorption of zinc causing hyperzincuria. Zn also increases insulin sensitivity by increasing the

sensitivity of insulin binding to its receptors.[2].Disordered metabolism of zinc may interfere with achievement of glycemic control in DM and in turn leads to development of complications.

#### **Conclusion:-**

Present study revealed inverse relationship between serum zinc and glycemic control. Hence micronutrient supplementation with emphasis on zinc may pave the way for good glycemic control in Type II diabetes mellitus and reduce morbidity and mortality.

#### **Conclusion:-**

Our study shows a decrease in levels of serum zinc among the type 2 DM patients. This causes poor glycemic control in type 2 DM by the involvement of zinc in oxidative stress and increase. Increased levels of copper and decreased level of magnesium and zinc are associated with increased values of HbA1c. This shows that the impaired metabolism of these minerals may have a contributory role in the progression of DM and later development of complications. However further studies are needed to be carried out to determine the molecular role of zinc, magnesium and copper in the development of diabetic complications.

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