



Correlation of Serum Zinc and Glycated Hemoglobin (HbA_{1C}) of Newly Diagnosed Type 2 Diabetes Mellitus Patients in a Tertiary Hospital of Chidambaram

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Abstract

To analyse the FBS, PPBS, HbA_{1C} and serum Zinc in patients with Type 2 DM. The study was carried out on 50 newly diagnosed patients of Type 2 DM and controls in the Department of Medicine, RMMCH, Annamalai University, Chidambaram. Analysis of FBS, PPBS, Serum Zinc, HbA_{1C}, Serum Urea, Serum Creatinine were done by standard methods. FBS, PPBS values were statistically higher in diabetic group than control group. ($P < 0.001$) and the mean HbA_{1C} % was also higher in cases (8.73 ± 1.52 % & $p = 0.001$). The average serum Zn level in cases was lower than controls (77.98 ± 11.02 vs 115.08 ± 23.91) and $p < 0.001$ with correlation coefficient $r = -0.689$. Our study revealed a negative relationship between HbA_{1C}% and serum Zinc in patients with type 2 DM.

Keywords: Chidambaram, serum Zn, HbA_{1C} %, Type 2 DM.

Introduction

Diabetes Mellitus is a chronic pan metabolic disorder caused by acquired or an inherited deficiency in insulin or by the ineffectiveness of the insulin secreted.. So deficiency of insulin results in increased level of blood glucose, damage many of the systems, in particular, heart, blood vessels and nerves. It is the major health issue in developing countries like our country.

In modern era of public health morbidity and mortality due to infectious disease has fallen

markedly. Yet paradoxically, a marked increase in prevalence of Non Communicable Diseases such as,

Type 2 DM, CAD, Hypertension, Stroke and Cancer and they become major causes of morbidity and mortality.

In 2015, 1.6 million deaths were due to Diabetes mellitus and most of all deaths occur before the age of 70 years. According to WHO data the Diabetes will be the 7th leading cause of mortality in 2030.⁽¹⁾

According to IDF 425 million adults are affected by DM, a total that is set to reach 629 million by 2045. Diabetes is one of the major causes of cardiovascular disease with 1 out of 4 Diabetes in patient costs a consequence of cardiovascular complications, Diabetic retinopathy is the major cause of vision loss in working age adults. The occurrence of ESRD is 10 times higher in people with Diabetes. Gestational diabetes mellitus women are at risk of maternal and fetal complications. Losing a limb is one of the most dreadful complications of DM following a diabetic foot ulcer and a major medical problem worldwide.⁽²⁾

It is studied that, Zinc plays a role in conformational integrity of insulin, as well as synthesis, storage and secretion of insulin. The decreased Zn which affects the ability of the islets of pancreas to synthesis and secrete insulin, lead to insulin resistance particularly in Type 2 DM.⁽³⁾ Studies by Rai et al.,⁽⁴⁾ Tripathy et al.,⁽⁵⁾ and Oh and Yoon⁽⁶⁾ have reported zinc deficiency in Type 2 DM by demonstrating low zinc in serum. Diabetes affects homeostasis of zinc in various ways, most probably hyperglycemia, rather than primary lesions related to Diabetes which is responsible for the decrease in total body zinc. So blood glucose monitoring is an ideal part of Management. Direct measurement of blood glucose level is limited value, because long term blood glucose control cannot be measured, and is also highly influenced by diet. Pearson's mean blood glucose level over 6-8 weeks of period can be measured by HbA_{1C}⁽⁷⁾ concentration in blood. It is most reliable indicator of long term hyperglycemia.⁽⁸⁾ It is useful parameter to monitor long term blood glucose, thereby identifying the developing risk as early as possible. So we have done this study with aim to evaluate the serum Zn in Type 2 Diabetes Mellitus patients of OPD patients of RMMCH Chidambaram and to find out any correlation between serum Zn and HbA_{1C}% in study group.

Present study was undertaken on newly diagnosed patients of Type 2 Diabetes Mellitus in the department of Internal Medicine and CDC lab,

RMMCH, Annamalai University, Chidambaram, from May 2016 to August 2018. After getting approval from institutional human ethic committee, 50 patients were selected on the basis of clinical history, examination and lab investigations. All these 50 cases were more than 30 years of age and selected irrespective of sex and socio economic status. 50 voluntary healthy subjects with age and sex matched were taken as control. Patients receiving Oral anti-diabetic drugs or on Insulin therapy, pregnant woman or persons suffering from chronic diseases were excluded from the study.

Patients were considered as diabetic on the basis of WHO criteria and ADA 2015 criteria for diagnosis of Diabetes Mellitus⁽⁹⁾ Under strict aseptic precautions, 5ml of blood sample was collected from a peripheral vein, mostly antecubital vein by venipuncture using a sterile disposable syringe and divided into 3 vials. Fluoride vials were used for glucose estimation and EDTA vials were used for estimation of HbA_{1C}. Different parameters were estimated on Merck Microlab 300 Semi automated Analyser. All the reagents kits were manufactured by Coral clinical systems. Serum Zn was estimated by calorimetric method^(10,11), Glycated hemoglobin by ion exchange resin method^(8,12,13). Blood glucose (FBS, PPBS) by glucose oxidase/ peroxidase method^(14,15) blood urea by Modified Berthelot Method^(16,17) and serum creatinine by Alkaline Picrate Method^(18,19). Statistical analysis of data was performed by using Microsoft excel software. A p value of less than or equal to 0.001 was considered significant. Correlation was found out in SPSS -21 by using independent sample t test and chi-square test.

Results and Discussion

The present study aims to correlate the serum Zinc status and HbA_{1C} of newly diagnosed Type 2 Diabetes Mellitus patients. For this purpose, 50 diabetic and 50 gender and age matched controls were studied. The comparison of outcome measures is performed by independent sample "t" test. Distribution comparison (ordinal data) is

performed by chi- square test of independence. The entire statistical work is worked out by (SPSS-21) Statistical Packages of Social Science.

In my study, out of 50 cases, 36 were males and 14 were females and age distribution of the study is shown in table 1. It was observed the

mean FBS and PPBS in newly diagnosed DM patients were statistically higher than that of the controls. It is observed, that the mean serum Zn level in 50 cases of newly diagnosed DM is 77.98 ± 11.02 and that in 50 controls is 115.08 ± 23.91 and it is highly significant ($p < 0.001$).

Fig 1 Age Distribution

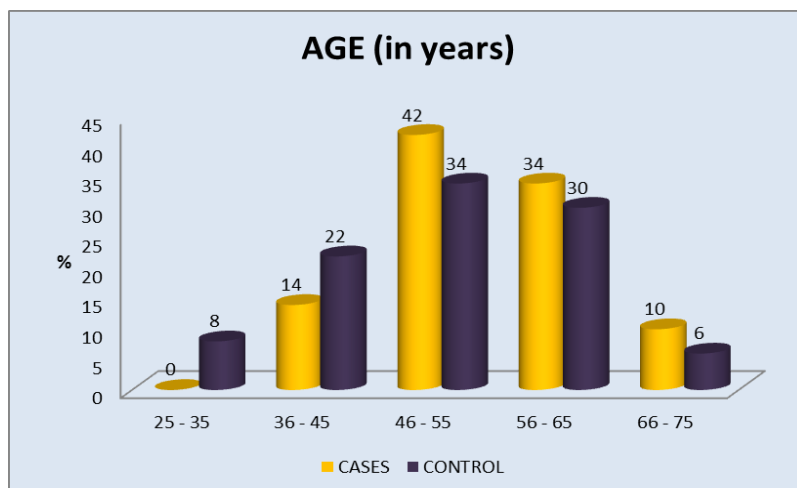


Table 1 Age Distribution

Age in years	Cases		Control		Chi-square test	'P' value
	N	%	N	%		
25- 35	-	-	4	8	10.20	0.59
36 – 45	7	14	11	22		
46- 55	21	42	17	34		
56- 65	17	34	15	30		
65- 75	5	10	3	6		
Total	50	100	50	100		
Mean	54.86		51.50			
S.D	8.31		9.45			

The mean age of Diabetes was 54.86 ± 8.31 years. the mean age of control was 51.50 ± 9.45 years. The age distributions is statistically insignificant

(chi- square = 10.20 $p = 0.59$.) hence the age of two groups is not differed significantly.

Fig: 3 FBS/ PPBS- Comparison

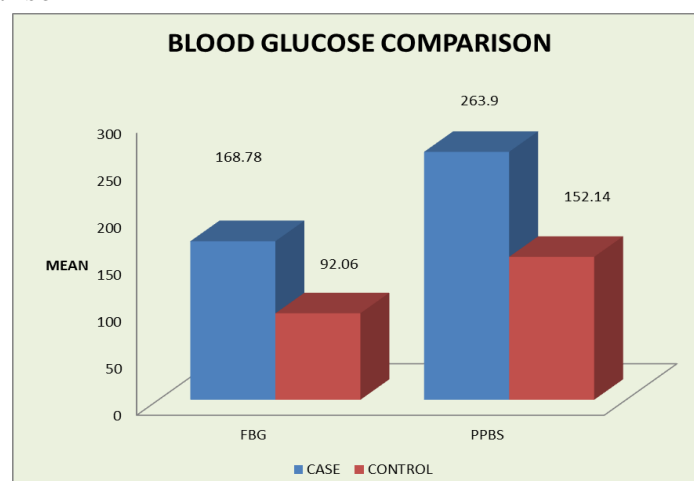


Table 3A- FBS-Comparison

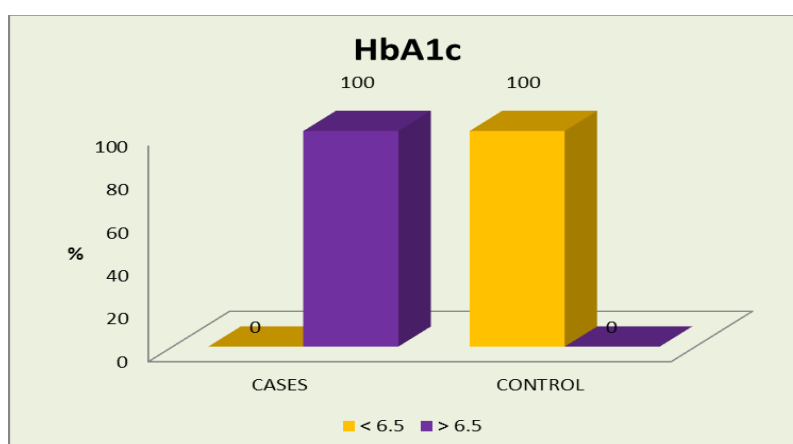
FBS	Cases		Control		Independent 't'	Sample Test 'p'
	N	%	N	%		
$\geq 126\text{mg\%}$	50	100	-	-	16.13	0.001
$\leq 126\text{mg\%}$	-	-	50	100		
Total	50	100	50	100		
Mean	168.78		92.06			
S.D	32.28		9.40			

Table 3B PPBS Comparison

PPBS	Cases		Control		Independent 't'	Sample Test 'p'
	N	%	N	%		
≥ 200	50	100	-	-	16.72	0.001
≤ 200	-	-	50	100		
Total	50	100	50	100		
Mean	263.90		152.14			
S.D	44.15		16.91			

The mean FBS of diabetes was 168.78 ± 32.28 where as it was 92.06 ± 9.40 for control. The difference is statistically significant. The mean

PPBS of diabetes was 263.90 ± 44.15 where as 152.14 ± 16.91 for controls. The difference is statistically significant.

Fig 3 HbA_{1C} %**Table 3 A HbA_{1C} Distribution**

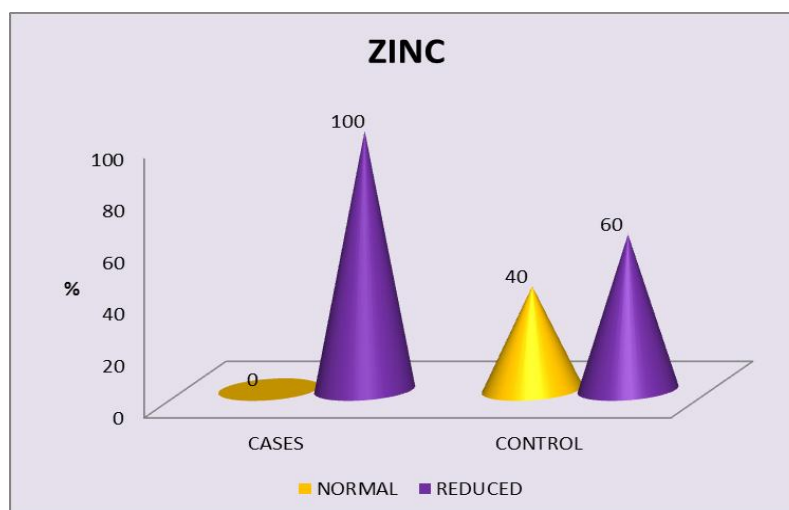
HbA _{1C}	Cases		Control	
	Number	%	Number	%
< 6.5	-	-	50	100
> 6.5	50	100	-	-
Total	50	100	50	100

HbA_{1C} Comparison

HbA _{1C}	Mean	S.D	Independent sample test	
			't'	'P'
Cases	8.73	1.52	12.89	0.001
Controls	5.92	0.20		

HbA_{1C} distribution shows that all the Diabetic patients had the values ≥ 6.5 where as in control all of them had ≤ 6.5 of HbA_{1C}. The average or mean HbA_{1C} of Diabetic was 8.73 ± 1.52 where

as it was 5.92 ± 2.0 for controls. The difference is statistically significant. ($t = 12.89$ $p = 0.001$) Hence the HbA_{1C} of Diabetics is significantly greater than controls.

Fig 4 Serum Zinc**Table 4A** Zinc Distribution

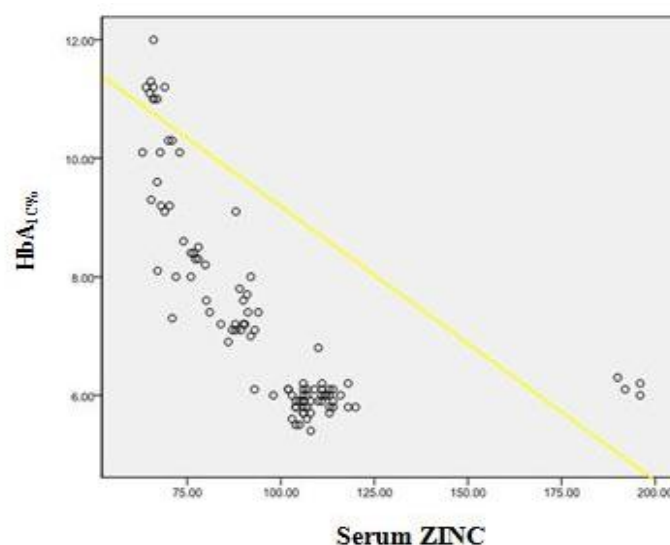
Serum Zinc	Cases		Controls	
	N	%	N	%
Reduced	50	100	30	60
Normal	-	-	20	40
Total	50	100	50	100

Table 4B Zinc Comparison

Zinc	Mean	S.D	Independent sample test	
			't'	'P'
Cases	77.98	11.02	9.96	0.001
Controls	115.08	23.91		

Zinc distribution shows that all the diabetic had reduction in zinc values where it was reduced in 60% of controls. The average or mean zinc of diabetic was 77.98 ± 11.02 where it was 115.08 ± 23.91 for controls. The difference is

statistically significant ($t = 9.96$, $p = 0.001$) therefore zinc values are significantly reduced in diabetic patients.

Fig 5- HbA_{1C} and Zinc Correlation

In the present study, it is observed that the mean HbA_{1C} concentration in newly diagnosed type 2 DM patients have negative relationship with serum zinc concentration and vice versa. The Pearson Correlation Coefficient *r* is found to be – 0.689 which also revealed the negative correlations between these parameters. Tripathy et al.,⁽⁵⁾ found a negative correlations among the serum zinc and HbA_{1C}% with *r* value of- 0.408 in diabetic subjects. The findings of the present study were consistent with Reefat et al.,⁽²⁹⁾ who found significant negative correlation between serum zinc concentration and baseline HbA_{1C}% value in the diabetic and found correlation coefficient *r* to be - 0.33.

It may be concluded that there is significant reduction of serum Zn in Type 2 Diabetes Mellitus patients. There is an evidence that high blood glucose level interferes with the active transport of zinc back into renal tubular cells leading to hyperzincuria. Moreover zinc also increases insulin sensitivity at receptor level.⁽³⁾

Our data in the study group population of chidambaram, the serum Zn level is decreased and it would be useful, in subsequent studies, to see the effectiveness of any intervention (zinc supplementation) undertaken in this population.

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