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HsCRP And Serum Zinc Levels In Type 2 Diabetes Mellitus And Their Correlation With GLYCEMIC Status

Dr .Mamatha B.V[1], Dr. Leela P[2*], Dr. Chandrakanth K.H[3], Dr. Kashinath R.T[4]
[1](Assistant Professor,Department of Biochemistry, Subbaiah institute of Medical sciences, Shimoga, Karnataka, India)
[2](Assistant Professor,Department of Biochemistry, Subbaiah institute of Medical sciences, Shimoga, Karnataka, India)
[3](Professor and Head ,Department of Biochemistry, Subbaiah institute of Medical sciences, Shimoga, Karnataka, India)
[4](Professor, Department of Biochemistry, Subbaiah institute of Medical sciences, Shimoga, Karnataka, India)
Corresponding Author: Dr. Leela P

Abstract: ***Background:*** *Type 2 diabetes mellitus (T2DM) is a chronic metabolic disorder in which prevalence has been increasing steadily all over the world. Type 2 DM represents a significant global health problem. Metabolically triggered inflammation has been proposed as a key step in the pathogenesis of this disease and accelerate atherosclerosis and premature death in subjects. C-reactive protein is an acute phase reactant protein., which is found elevated and serum zinc levels are lower in T2DM.*
Objectives*: To estimate hsCRP (high sensitivity C reactive protein) and serum zinc levels in cases and controls and to compare and analyze the levels of these parameters between two groups.*
Methods: *A case control study conducted on 80 patients with clinically diagnosed T2DM and age and sex matched 80 apparently healthy subjects as controls from the general population. 3ml of venous blood was collected to study hsCRP and serum zinc levels in each subject. The data was analyzed and expressed in terms of mean ± SD.*
Results: *There was statistically highly significant increase in the levels of hsCRP ($p < 0.0001$) and statistically highly significant decreased levels of serum zinc ($p < 0.0001$) in cases and there was highly significant positive correlation between hsCRP – HbA_1c levels in cases. There was highly significant negative correlation between serum zinc – HbA_1c levels in cases.*
Interpretation & Conclusion: *It can be concluded that hsCRP which had diagnostic utility and correlated well with HbA_1c, could be used as a good diagnostic tool and serum zinc could be considered as a supportive diagnostic tool in T2DM.*
Keywords: *T2DM; hsCRP; serum Zinc ; inflammation ; Oxidative stress.*

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I. Introduction

Type 2 Diabetes Mellitus (T2DM) is the most common form of DM characterized by hyperglycemia, insulin resistance, and relative insulin deficiency. T2DM results from interaction between genetic, environmental and behavioral risk factors.People living with T2DM are more vulnerable to various forms of both short- and long-term complications.[1] It is estimated that 366 million people had DM in 2011; by 2030 this would have risen to 552 million.[2]

Within the last decade, hypotheses have been proposed to explain the pathogenesis of T2DM that connects the disease to a state of subclinical chronic inflammation.[3] Metabolically triggered inflammation has been proposed as a key step in the pathogenesis of the disease which accelerate atherosclerosis and premature death in patients.[4]

Insulin resistance is the primary event and it is followed by increasing degree of β-cell dysfunction in T2DM . Insulin resistance often associated with excess visceral adiposity, dyslipidemia, hypertension, impaired fibrinolysis, increased platelet aggregation, vascular inflammation, endothelial dysfunction and premature atherosclerosis.[5]

All these events may lead to thromboembolic manifestations in the body. Liver produces certain protein collectively known as the acute phase response, early in inflammation.

CRP, a pentameric protein produced by the liver has emerged as the ' golden marker for inflammation'.[1] CRP , is an extremely sensitive marker of systemic inflammation.[4,5] It is proposed that chronic

low grade inflammation as evidenced by elevated high sensitivity C reactive protein (hsCRP) might potentially be a cause underlying the etiology and manifestation of T2DM.

The metabolism of several minerals have been reported to alter in diabetes mellitus and these elements might have specific roles in the pathogenesis of this disease. Zinc, an essential element, is useful in synthesis, storage and secretion of insulin. Zinc , is a component of many enzymes. Zinc has been found to enhance the effectiveness of insulin in vitro. It has an important role in modulating the immune system . [6] Many studies have shown that serum zinc levels are lower in T2DM.[5]

The aim of this study is to estimate the serum levels of hsCRP and zinc and their association with glycemic status in diabetic and non-diabetic subjects .

II. Material And Methods

This was a case control study. The study was conducted on 80 randomly selected , clinically diagnosed and confirmed cases of T2DM without any complications attending the medicine outpatient department. Detailed history and clinical examination of the selected subjects was carried out.

Ethical clearance was obtained from the Institutional Ethical Committee. Informed and written consent was taken from the cases and controls, respectively, after explaining the procedure.

Under aseptic precautions 3 ml of venous fasting blood sample was collected for estimation of fasting blood glucose, postprandial blood glucose, serum hsCRP ,serum zinc and HbA_1C. The tests were done on the same day after serum separation on Stat Fax 3300 Semi-automated analyser. HbA_1c was estimated by Nycocard reader II.

Inclusion criteria:

1. Patients diagnosed as T2DM on the basis of Clinical history and WHO criteria.
2. Age group between 30 years to 70 years.

Exclusion criteria:

1. Patients of diabetes having nephropathy, neuropathy, retinopathy and other microvascular complications.
2. Individuals with severe inflammatory diseases, infections , cardiac, hepatic or renal diseases and persons on drugs that would affect blood glucose levels were excluded from the study.
3. Patients with malabsorption or chronic diarrhea.
4. Pregnant and lactating women were excluded from the study.
5. Persons not willing to participate in the study.

Procedure methodology:

Blood glucose was estimated by glucose oxidase-peroxidase Method , Glycated haemoglobin using Nycocard Reader II, hsCRP by quantitative turbidimetric method (Euro Diagnostic Systems Kit) and Serum Zinc by NITRO- PAPS method (kits supplied by Tulip diagnostics).

Statistical analysis:

SPSS software was used for statistical analysis. Data was expressed in mean±SD. $p < 0.05$ was considered as statistically significant. Unpaired 't'-test was used to study the changes in the serum zinc, hsCRP levels. . Pearson correlation between the study variables is performed to establish the relationship.

III. Result

TABLE 1: A comparison of Fasting blood sugar(FBS), Postprandial blood sugar(PPBS) , HbA_1c , hsCRP and zinc between two groups.

Parameters	Cases	Controls	P value
Age in years	52.82±10.3	51.65±10.8	P = 0.48
FBS (mg/dL)	164.5±40	84.1±13.7	<0.0001
PPBS(mg/dL)	215.5±46.2	138.4±48.2	<0.0001
HbA_1c (%)	6.7±0.64	5.2±0.52	<0.0001
hsCRP (mg/dL)	0.34±0.06	0.1±0.05	< 0.0001
Zinc (µg/dL)	60.5±11.9	90.16±19.4	< 0.0001

TABLE 2: Correlation of hsCRP and serum zinc with HbA_1c in cases.

Correlation between	Pearson's Correlation Coefficient (r)	Significance	
hscrp and HbA_1c	+ 0.80	P < 0.0001	Highly significant positive correlation
Serum zinc and HbA_1c	- 0.57	P < 0.0001	Highly significant negative correlation

FIGURE 1: Correlation between hsCRP and HbA_1c levels in cases.

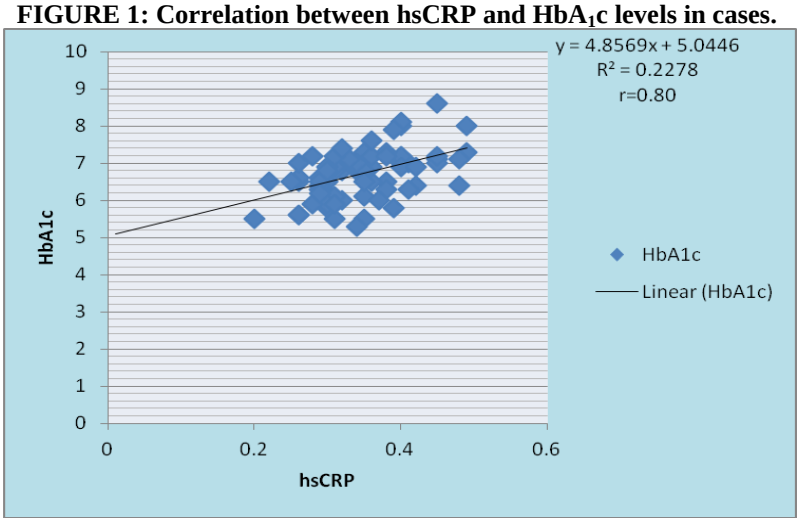
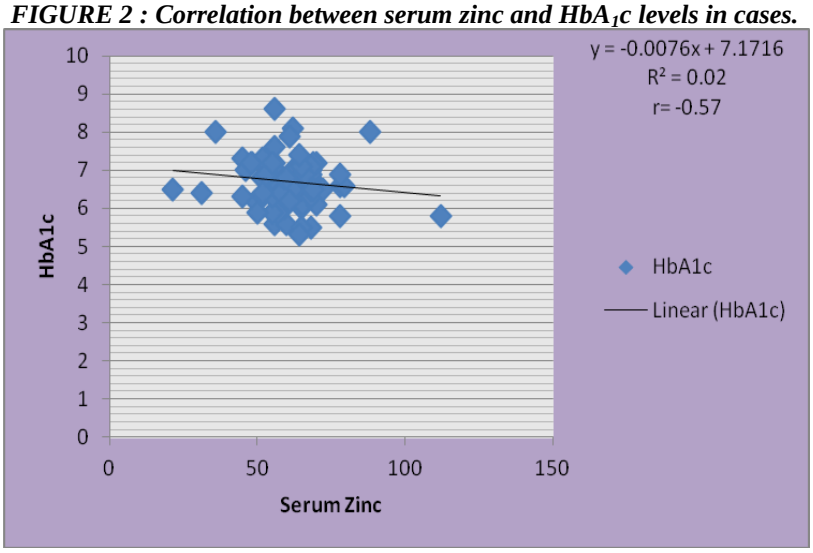


FIGURE 2 : Correlation between serum zinc and HbA_1c levels in cases.



IV. Discussion

The metabolic dysregulation associated with diabetes causes secondary pathophysiologic changes in multiple organ systems which cause a heavy burden of morbidity and mortality from macrovascular and microvascular complications [7].

Our analysis provides evidence for a positive association between hsCRP levels and T2DM. In our study the mean FBS (mg/dL) values were 164.5±40 and 84.1±13.7 in cases and in controls respectively which is statistically highly significant ($p < 0.0001$). FBS values were higher than the cut off value of 110mg/dL in cases which correlated well with the clinical diagnosis.

Similarly the mean PPBS(mg/dL) values were 215.5±46.2 in cases and 138.4±48.2 in controls. This increase in mean value of PPBS in cases as compared to controls is statistically highly significant ($p < 0.0001$).

Glycated hemoglobin is effective in monitoring long term glucose control in patients with diabetes mellitus. In our study the mean HbA_1c values were 6.7± 0.64 in cases and 5.2±0.52 in controls which is statistically highly significant ($p < 0.0001$). In cases HbA1c values were higher which correlated well with the clinical diagnosis. The values in this study are in accordance with the several studies[2,4,5,7,,8,9] which have shown increased in HbA_1c levels in diabetic patients compared to controls.

The novel risk factor like hsCRP is gaining importance as the predictor of vascular events beyond the blood glucose levels. hsCRP levels have been shown to be the markers of atherosclerosis in different studies . In our study, we found significantly high levels of hsCRP in the cases ($p < 0.0001$). Many previous studies[4,,8,10] found that median hsCRP levels were significantly higher in diabetic group as compared to their non diabetic counterparts ($p < 0.0001$) , which is in accordance with our study. However in contrast to our results, Luigi M. Biasucci et al [11]study showed no statistically significant difference in hsCRP levels in both the groups.

In the current study, we found highly significant positive correlation between hsCRP and HbA_1c levels. This is supported by many studies[9,12,13] which reported significantly higher hsCRP levels in diabetic patients with poor glycemic control compared to those with good glycemic control . Safiullah Amanullah[2] , in the year 2010 in Chennai studied the association of hsCRP with diabetic and non-diabetic individuals, and found that low HbA_1c levels are strongly related to low hsCRP levels.

Zinc has many antioxidant properties and it has been suggested that chronic zinc deprivation may result in increased sensitivity to oxidative stress . Oxidative damage is more pronounced in diabetics because of the defective function of superoxide dismutase due to zinc deficiency which leads to more pronounced lipid peroxidation. Highly Significant decrease in serum zinc was observed in patients with T2DM as compared to controls ($p<0.0001$) in our study . Previous studies by others[14,15,16,17,] also found similar results. In contrast to our results, Anthony .U. Emeribe[18] study stated higher serum zinc levels in diabetes group when compared to non diabetes group**.**

There was highly significant negative correlation between serum zinc and HbA_1c levels in our study . Gautom Kumar Saharia[19], study showed serum zinc levels correlated inversely with the glycemic status of the cases and $p < 0.005$.

V. Conclusion

Thus, it can be concluded that hsCRP and serum zinc which are increased in T2DM and correlated well with the HbA_1c, could be used as good diagnostic tool in prediction and prevention of complications of the disease

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References

[1]. Abdulfatai B. Olokoba, Olusegun A. Obateru, Lateefat B. Olokoba . Type 2 Diabetes Mellitus: A Review of Current Trends. Oman Medical Journal (2012) Vol. 27, No. 4: 269-273
[2]. Amanullah S, Jarari A , Govindan M , Basha MI and khatheeja S. Association of hs-CRP with Diabetic and Non-diabetic Individuals. JJBS 2010Jan;3(1);7-12.
[3]. Badawi A , Klip A, Haddad P, Cole DE, Bailo BG, Sohemy AE, Karmali M. Type 2 diabetes mellitus and inflammation: Prospects for biomarkers of risk and nutritional intervention, Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy 2010;3:173–86.
[4]. Pradhan AD, Manson JE, Rifai N, Buring JE, Ridker PM. C-Reactive Protein, Interleukin 6, and Risk of Developing Type 2 Diabetes Mellitus. JAMA 2001July;286(3).
[5]. Haque AF, Ekram AS, Islam QT, Jahan S, Haque Z. Evaluation of serum high sensitivity c -reactive protein (hs-CRP) in type-2 diabetic patient. J Medicine 2010; 11:20-3.
[6]. Yahya H, Yahya KM, Saqib A. Minerals and type 2 diabetes mellitus level of zinc, magnesium and chromium in diabetic and non diabetic population. JUMDC ; Jan-Jun 2011: 2(1) .
[7]. Pasupathi P , Farook J , Chinnaswamy P. Oxidant-antioxidant status, high sensitive C-reactive protein and homocysteine levels in type 2 diabetic patients with and without microalbuminuria. Int J Biol Med Res. 2010; 1(3); 04-8.
[8]. Mahajan A, Tabassum R, Chavali S, Dwivedi OP, Bharadwaj M, Tandon N and Bharadwaj D. High-Sensitivity C-Reactive Protein Levels and Type 2 Diabetes in Urban North Indians. J Clin Endocrinol Metab June 2009; 94(6):2123–7.
[9]. Shahid HS, Kurdi MI, Zohair AA. Serum high-sensitivity C-reactive Protein and Lipoprotein(a)Levels: A comparison between Diabetic and Non-diabetic Patients with Coronary Artery Disease. Med J Malaysia 2011June;Vol 66 (2).
[10]. Rajarajeswari D, Naidu JN and Sowjanya B. Association of dyslipidemia and inflammatory markers in type 2 diabetes mellitus.IJABPT 2011Jul-Sept; 29(3).
[11]. Biasucci LM, Liuzzo G, Bona RD, Leo M, Biasillo G, Angiolillo DJ. Different Apparent Prognostic Value of hsCRP in Type 2 Diabetic and Nondiabetic Patients with Acute Coronary Syndromes. Clin Chem 2009;55(2) :365–8.
[12]. Tajiri Y, Mimura K, and Umeda F. High-Sensitivity C-Reactive Protein in Japanese Patients with Type 2 Diabetes. Obesity Research 2005;Vol. 13(10).
[13]. Mohieldein A, Alzohairy M, Hasan M& Khan AA. Inflammatory Markers and Haptoglobin Polymorphism in Saudi with Non-insulin-dependent Diabetes Mellitus. Global Journal of Health Science 2013; Vol. 5(1).
[14]. Angeline T, Asirvatham AJ, Isabel W. Alterations in Serum Zinc and Erythrocyte Reduced Glutathione Status in Newly Diagnosed Type 2 Diabetes Mellitus. IJSR; June 2013: 2(6)
[15]. Abdalla BE, Diab AA, Zaki HY, Ali KE . Serum chromium, magnesium and zinc levels in sudanese type 2 diabetic patients. Gezira Journal of Health Sciences;2011 june:7 (1)
[16]. Yerlikaya FH, Toker A , Arıbaş A. Serum trace elements in obese women with or without diabetes. Indian J Med Res 2013Feb: 339-45.
[17]. Song Y, Li TY, van Dam RM, Manson JE, Hu FB. Magnesium intake and plasma concentrations of markers of systemic in-flammation and endothelial dysfunction in women. Am J Clin Nutr 2007;85:1068 –1074.
[18]. Rahim A, Iqbal K. To assess the levels of zinc in serum and changes in the lens of diabetic and senile cataract patients. JPMA 2011 ;(61):853.
[19]. Saharia GK, Goswami RK. Evaluation of Serum Zinc Status and Glycated Hemoglobin of Type 2 Diabetes Mellitus Patients in a Tertiary Care Hospital of Assam. Journal of Laboratory Physicians ;Jan-Jun 2013 :5(1).