Original Research Article

Correlation of Serum Zinc, Alkaline phosphatase and Ascorbic acid levels in Diabetes Mellitus

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Abstract

Introduction: Diabetes mellitus is a dangerous disease with complications and prevalence of mortality accounting for at least 10% of total health care A few published reports of both in vitro and in vivo studies on the interactions among Zinc (Zn), Alkaline- phosphatase (AP) enzyme activity, Ascorbic acid (AA) and glucose drew attention to their alterations in diabetic statesThe present work was aimed at evaluating the serum Zinc, Alkaline phosphatase and Ascorbic acid levels in Diabetes Mellitus and to statistically correlate the serum values of blood glucose with serum zinc, alkaline phosphatase [ALP] & Ascorbic acid [AA] for finding significance which could help in clinical outcome. **Methods**: The sample size taken was 94 having both males and females of 22-85 years of age. The study group was divided into the following six categories. Group A: - Control group of 20 normal subjects in the age group of 22-70 years, Group B: -14 IDDM without complication subject in the age group of 22-43 years.Group C: -20 IDDM with nephropathy subject in the age group of 41-85 years. Group D: - 20 NIDDM without complication subject in age group of 37-72 years.Group E:-10 NIDDM with nephropathy subject in age group of 45-65 years.Group F:-10 NIDDM with retinopathy subject in age group of 49-66 years. Some parameters were taken from each individual of this study like estimation of blood glucose [fasting and post prandial] by Asatoor and King method, determination of serum Zn was carried out using atomic absorption spectrophotometry, Serum alkaline phosphatase (AP) activity was determined by the method of King and Armstrong as modified by Kind and King, plasma ascorbic acid is determined using formulae **Results:**The decrease in serum AA levels and the increase in serum DHA were highly significant. However, no correlations could be demonstrated statistically among the above said parameters in healthy and diabetic subjects.. It is being speculated that the raised serum AP activity may be due to the de-inhibition of activity by lowered serum AA concentrations. Serum Alkaline Phosphatase activity is eliminated in diabetics. It is an indicator of liver function that may be hampered in long term in diabetics. Serum Ascorbic acid is an antioxidant and its levels are decreased in diabetics. Its values can be assayed for monitoring oxidative reaction in diabetics. The estimation of serum zinc is not needed as there is no statistical difference. The need for right eating, exercise and right thinking needs to be stressed, particularly for diabetics.

Keywords: NSAIDs, severe cutaneous adverse reactions (SCARs), cutaneous adverse drug reactions (CADRs), stevens johnson syndrome (SJS), fixed drug eruptions (FDEs), fixed dose combination (FDC), over the counter (OTC)

Introduction

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The prevalence of diabetes is rising all over the world due to population growth , aging, urbanization and an increase of obesity and physical inactivity. The urban-rural divide in prevalence is narrowing as urbanization is spreading widely, adversely affecting the lifestyle of populations. Unlike in the West, where older persons are most affected, diabetes in Asian countries is

disproportionately high in young to middle-aged adults . At present, 80% of the worlds' population with diabetes lives in low- and middle-income countries[1,2]. Diabetes mellitus is primarily a metabolic disorder arising from a lack of or resistance to insulin, which results in the impairment of uptake and storage of glucose and its reduced glucose utilization for energy purposes leading to the condition called hyperglycemia. Even the continuous insulin administration may not be as efficient as the functioning β-cells and complications often arise during long periods of time; these may be due to insulinopenia, hyperglycemia or other factors acting alone or in concert. Diabetes mellitus is also associated with premature micro vascular disease which contributes importantly to complications such as retinopathy and nephropathy[3,4].A few published reports of both in vitro and in vivo studies on the interactions among Zinc (Zn), Alkaline- phosphatase (AP) enzyme activity, Ascorbic acid (AA) and glucose drew attention to their alterations in diabetic states. These were reviewed and since relatively few reports existed with special reference to diabetes it was proposed to carry out a preliminary study of their levels in the blood of the diabetic as well as healthy subjects for their likely correlations and implications. The present work was aimed at evaluating the serum Zinc, Alkaline phosphatase and Ascorbic acid levels in Diabetes Mellitus and to statistically correlate the serum values of blood glucose with serum zinc, alkaline phosphatase [ALP] & Ascorbic acid [AA] for finding significance which could help in clinical outcome.

Materials and methodology

This study on serum zinc, alkaline phosphatase activity and ascorbic acid levels in diabetes was conducted in sample size of 94 of which a control group and experimental groups were divided.

Materials: - The sample size taken was 94 having both males and females of 22-85 years of age. The study group was divided into the following six categories.
Group A: - Control group of 20 normal subjects in the age group of 22-70 years, Group B: -14 IDDM without complication subject in the age group of 22-43 years.
Group C: -20 IDDM with nephropathy subject in the age group of 41-85 years. Group D: - 20 NIDDM without complication subject in age group of 37-72 years.
Group E:-10 NIDDM with nephropathy subject in age group of 45-65 years.
Group F:-10 NIDDM with retinopathy subject in age group of 49-66 years.
METHODOLOGY:- Some parameters were taken from each individual of this study like estimation of blood glucose [fasting and post prandial] by Asatoor and King method, determination of serum Zn was carried out using atomic absorption spectrophotometry, Serum alkaline phosphatase (AP) activity was determined by the method of King and Armstrong as modified by Kind and King, plasma ascorbic acid is determined using formulae, Plasma AA in (mg/dl)= (OD of Ta-OD of Tb)/(OD of S2)×47.5 and plasma dehydroascorbic acid is determined using formulae,

Plasma DHA in (mg/liter)=(OD of Tb)/(OS of S)×47.5

Observations and results

A total of 20 healthy adult subjects' and74 diabetic subjects could be studied during the period of this study.

Table 1: correlation coefficients between glucose, serum zinc, alkaline phospate, ascorbic acid and dehydroascorbic acid parameters in controls group.
(Control Group)

		Blood Glucoses	Serum Zn	Serum AP	Plasma Ascorbic Acid	Plasma Dehydroascorbic Acid
Blood glucose	Pearson Correlation	1				
	P*-Value					
Serum zinc	Pearson Correlation	.173	1			
	P*-Value	.466				

Serum alkaline phosphateses	Pearson Correlation	.135	.121	1		
	P*-Value	.571	.610			
Plasma sscorbic acid	Pearson Correlation	.212	-.104	-.067	1	
	P*-Value	.369	663	.778		
Plasma dehydro ascorbic acid	Pearson Correlation	-.187	.145	.014	-.528*	1
	P*-Value	.430	.541	.954	.017	

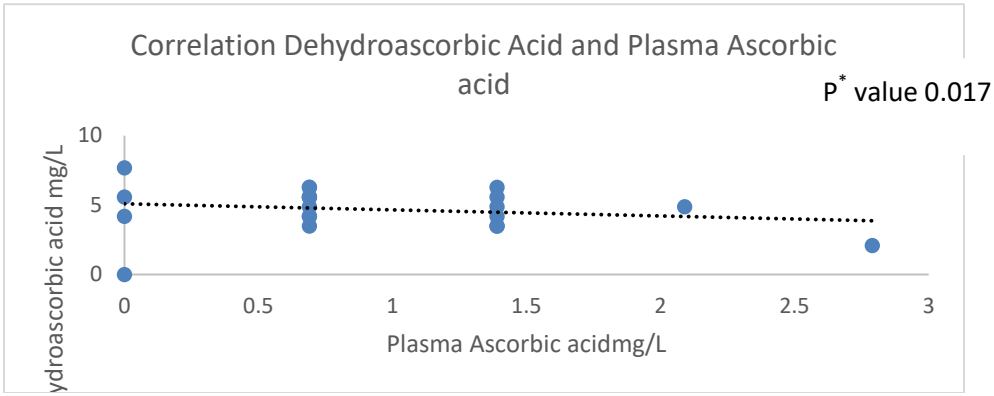
P* value >0.05 – Not Significant (NS)
<0.05 – Significant (S)
<0.001 – Highly Significant (HS)

Table 2:correlations coefficients between glucose, serum zinc, alkaline phospate, ascorbc acid and dehydroascorbic acid paramitars in diabetics group.
(Test Group)

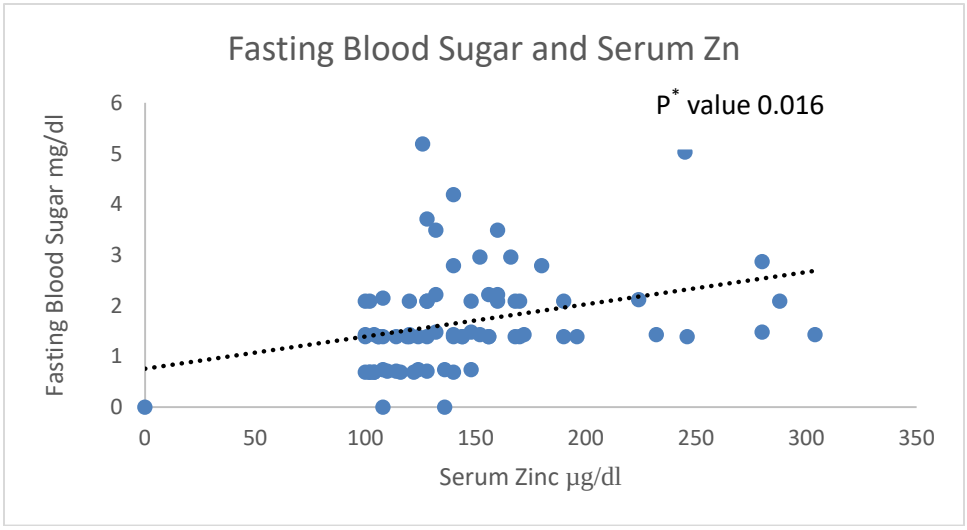
	Fasting Blood Glucoses	**Post Prandial Blood Glucoses**	**Serum Zn**	**Serum AP**	**Plasma ascorbic acid**	**Plasma dehydroascorbic acid**
Pearson Correlation	1					
P*-value						
Pearson Correlation	.641**	1				
P*-value	.001					
Pearson Correlation	.279*	.099	1			
P*-value	.016	.402				
Pearson Correlation	.137	.203	-.009	1		
P*-value	.243	.083	.941			
Pearson Correlation	.271*	.297*	.301**	.104	1	
P*-value	.019	.010	.009	.380		
Pearson Correlation	.167	.002	.225	-108	.021	1
P*-value	.156	.985	.054	358	.856	

P* value >0.05 – Not Significant (NS)
<0.05 – Significant (S)
<0.001 – Highly Significant (HS)

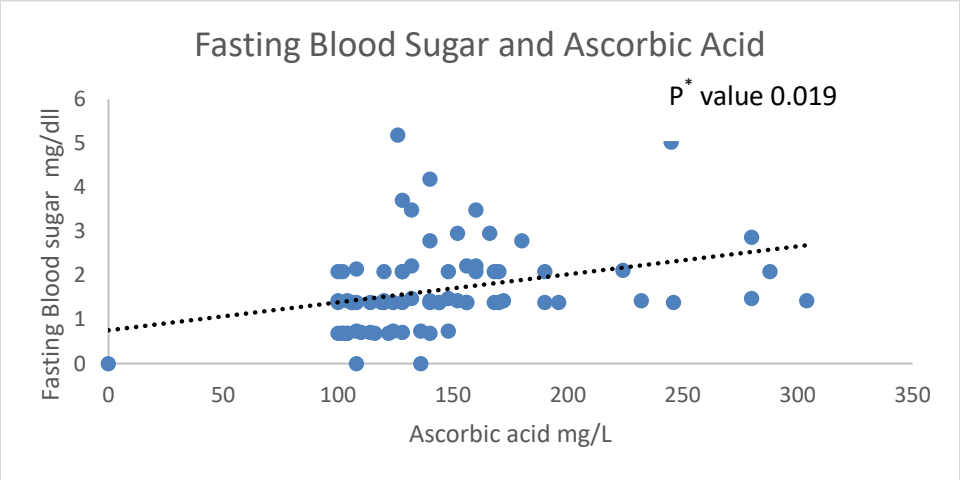
Graph 1:-Correlation of Dehydroascorbic Acid and Plasma Ascorbic acid in Normal Control group.



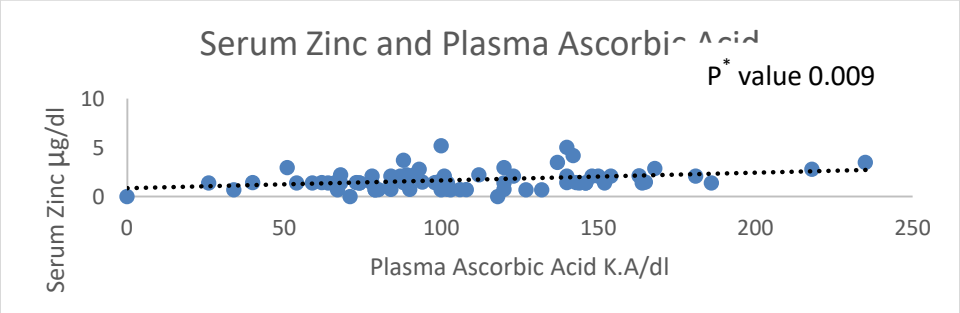
Graph 2:- Correlation Fasting Blood Sugar and Serum Zinc in Diabetic group.



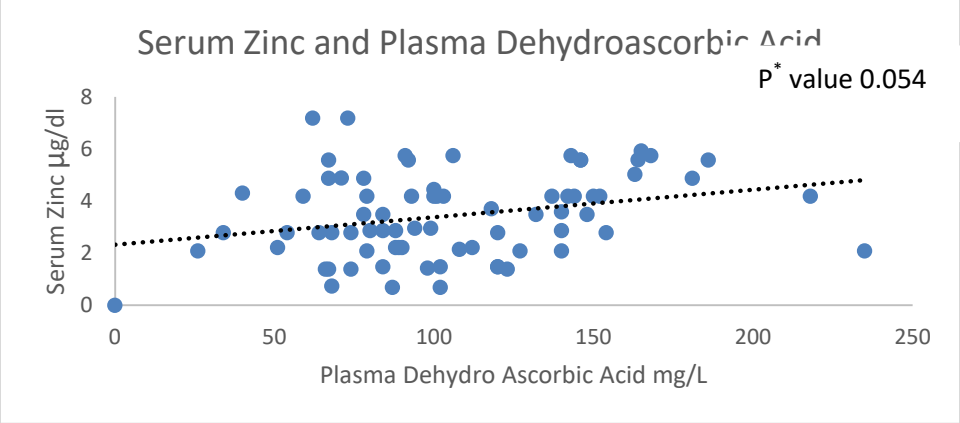
Graph. 3:- Correlation of Fasting Blood Sugar and Ascorbic acid.



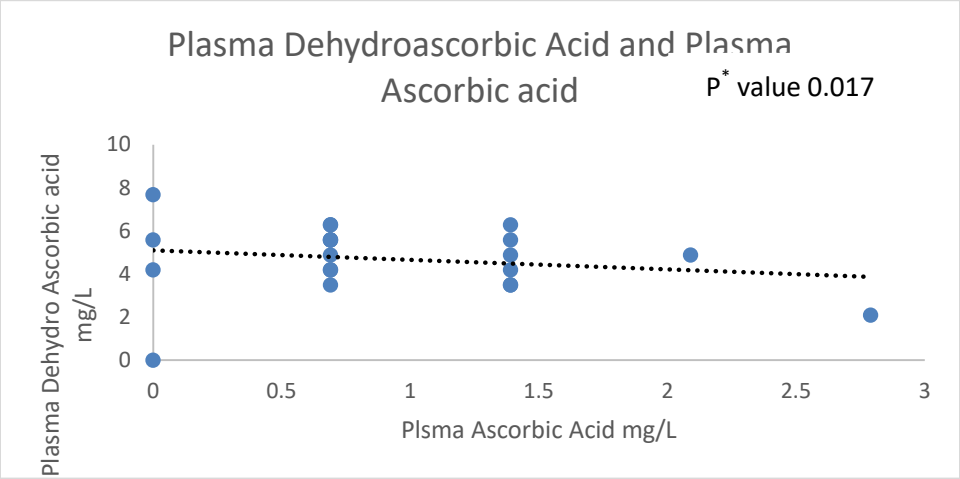
Graph. 4:- Correlation of Serum Zinc and Plasma Ascorbic Acid.



Graph 5:- Correlation of Serum Zinc and Plasma Dehydroascorbic Acid.



Graph 6:- Correlation Plasma Dehydroascorbic Acid and Ascorbic Acid in Normal Control Group.



Discussion

Diabetes mellitus is a dangerous disease with complications and prevalence of mortality accounting for at least 10% of total health care[5].Three fourth of the world population cannot afford the products of allopathic medicine and thus have to resolve to the use of anti-diabetic evidences reported for traditional mediums, which are being sourced from natural products of animals and plants[6].The results of a study showed that serum aspartate amino transaminase (AST), alanine amino transaminase (ALT) and alkaline phosphatase (ALP) activity in diabetic animal groups (Alloxan treated rats) showed significant increase compared to control group. Elevated level of the activity of AST, ALT and ALP in blood serum is a strong indicator of hepatic and cardiac damage. Vitamin C may play an important role in physiological reactions such as mixed function oxidation involving incorporation of oxygen into a biochemical substrate. Zinc (Zn) is an essential trace element which is involved in a multitude of intracellular processes of more than 300 different enzymes, acting as an essential requirement for the successful growth of many internal organs, stabilizing cell membranes, and modulating membrane-bound enzymes and insulin action[7-9]. In the present series of investigation, the healthy adults had a fasting blood glucose level of 87.70 ± 8.90 mg/dl (mean ± S.D.) which is in agreement with accepted normal range. All the other diabetic patients were found to lack a very good glycemic control in spite of being on regular treatment. The elevation of the levels has been statistically found to be highly significant. Corroborating the above, some authors have even considered that the activity levels of serum Zinc and plasma Ascorbic acid in man. In this study the mean serum zinc levels were found to be lower in NIDDM with retinopathy and higher in all the other diabetic groups when compared to the mean levels in controls. Normal plasma zinc levels in diabetic subjects and found no difference related to the type of diabetes or therapeutic modality being employed. Corroborating the above, some authors have even considered that the activity The normal serum zinc levels in patients with IDDM prior to initiation of insulin treatment and the post treatment levels were slightly lower but still within normal limits levels of plasma ascorbic acid and plasma dehydroascorbic acid could will be an indicator of Zn deficiency in man. Elevated growth hormone and glucocorticoid production have been reported in diabetic states and since endogenous production or exogenous administration of glucocorticoids and growth hormone have been shown to produce hyperzincuria it is worth considering this as an important factor in producing hyperzincuria in diabetic states. In this study the mean serum AP levels were found to be higher in all the different diabetic groups. Low levels of serum Zn or Mg or both and reported a positive correlation between their levels and the peak activity of serum AP by these metal ions. The elevated circulating activity of alkaline phosphatase in alloxan or streptozotocin diabetes has been attributed to an isoenzyme of intestinal origin.an abnormal increase in the activity of bone specific isoenzyme in 69% of

diabetic, an increase in intestinal and hepatic isoenzymes, without any appreciable change in skeletal AP in alloxan diabetics in rat. It was suggested that elevated serum AP in DM represented an intrinsic feature of the diabetic condition. In this study the mean plasma ascorbic acid levels were found to be lower in the group of diabetic patients. The values of controls and different diabetic groups are compared. All the diabetic groups showed a statistically significant decrease in plasma ascorbic acid levels. . Corroborating the above, some authors have even considered that the activity levels of serum Zn would be an indicator of Zn deficiency in man. In this study the mean plasma dehydroascorbic acid levels were found to be higher in all the different diabetic group. The values of control and different group of diabetics are compared. As compared to the controls all the different diabetic group showed a statistically significant increase in the plasma DHA levels. The decreased capacity to take up, reduce and store AA may contribute to increased ascorbate turnover among diabetics and the specific tissue AA deficiency might contribute to the tissue pathology of DM. It would have been profitable to assess the plasma insulin levels and the residual insulin secreting capacities in these patients under strictly controlled condition or known dietary intake of the nutrients, their whole body and tissue status and other parameters glycemic index, so that a realistic conclusion could be drawn. Further work is being proposed in this regard in our laboratory.

Summary and conclusion

The historical discovery of insulin and efficacy in sustaining the life of the diabetic patients are presented. The long term metabolic complication and the squealer of DM have also been stated along with the multiplicity of the factors interacting. Detailed review on Zn and its importance in metabolism with special reference to DM are stated. Also developed are the aspects on the serum AP activity, the metabolism of AA and DHA, their inter relationships with glucose in health and Disease. The decrease in serum AA levels and the increase in serum DHA were highly significant. However, no correlations could be demonstrated statistically among the above said parameters in healthy and diabetic subjects within the limitations of the present study. It is being speculated that the raised serum AP activity may be due to the de-inhibition of activity by lowered serum AA concentrations. The likely shortfall in the study for lack of demonstrable correlations is discussed. The right for eating, exercise and right thinking needs to be stressed, particularly for diabetics. Serum Alkaline Phosphatase activity is eliminated in diabetics. It is an indicator of liver function that may be hampered in long term in diabetics. Serum Ascorbic acid is an antioxidant and its levels are decreased in diabetics. Its values can be assayed for monitoring oxidative reaction in diabetics. The estimation of serum zinc is not needed as there is no statistical difference.

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Conflict of Interest: Nil

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