Original Research Paper

Volume-7 | Issue-10 | October-2017 | ISSN - 2249-555X | IF : 4.894 | IC Value : 79.96

Biochemistry

Comparison of Blood Glucose, Serum Zinc, Alkaline Phosphatase, Ascorbic Acid in Diabetes and Normal Healthy Controls

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ABSTRACT Diabetes mellitus (DM) comprises a group of metabolic disorders presenting with hyperglycemia resulting from insulin deficiency or decrease glucose utilization and increased glucose production. The present work was aimed at evaluating the serum Zinc, Alkaline phosphatase and Ascorbic acid levels in Diabetes Mellitus and to compare their levels in normal and individuals.
The decrease in serum AA levels and the increase in serum DHA were highly significant. Moderate elevations in the serum AP activity in all the subgroups were observed except that it failed to achieve statistical levels of significance in NIDDM with nephropathy and NIDDM with retinopathy. Serum Alkaline Phosphatase activity is decreased 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 needfor right eating, exercise and right thinking needs to be stressed, particularly for diabetics

KEYWORDS : Diabetes mellitus Blood Glucose Serum Zinc Alkaline Phosphatase Ascorbic Acid

INTRODUCTION:-

Diabetes mellitus (DM) comprises a group of metabolic disorders presenting with hyperglycemia resulting from insulin deficiency or decrease glucose utilization and increased glucose production.[1] Type- I diabetes is the consequence of an autoimmune – mediated destruction of pancreatic β-cell, leading to insulin deficiency. Type- II diabetes is characterized by insulin resistance and relative, rather than absolute, insulin deficiency.[2,3] 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. Prolonged exposure to elevated glucose induces repeated acute changes in intracellular metabolism and cumulative long-term changes in the structure and function of biological macromolecules.[4,5] 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 compare their levels in normal and individuals.

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)= $\frac{OD\ of\ Tn - OD\ of\ Tb}{OD\ of\ S2} \times 47.5$ plasma dehydroascorbic acid is determined using formulae,

Plasma DHA in (mg/liter)= $\frac{OD\ of\ Tb}{OS\ of\ S} \times 47.5$

OBSERVATIONS AND RESULTS:

A total of 20 healthy adult subjects' and74 diabetic subjects could be studied during the period of this study. The results of the individual parameters for all the diabetic and control subjects are appended in a chart form.

TABLE-1 Levels of various parameters in controlled [healthy] subjects

Sl. No.	PARAMETERS	NO.OF CASES	MEAN ± S.D
1.	GLUCOSE (mg/dl)	20	87.70 ± 8.90
2.	SERUM ZINC (µg/dl)	20	103.50 ±32.90
3.	ALKALINE PHOSPHATASE (K.A. units/dl)	20	9.31 ± 1.10
4.	ASCORBIC ACID (mg/dl)	20	4.91 ± 1.29
5.	DEHYDROASCORBIC ACID(mg/L)	20	0.97 ± 1.58

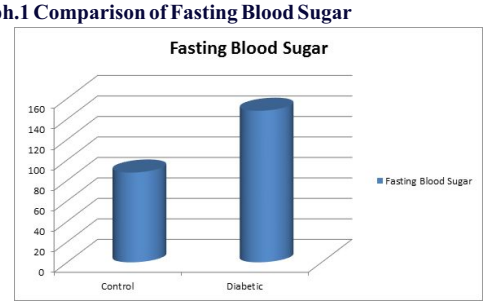
TABLE-2 Levels of various parameters in diabetic [unhealthy] patients.

SI. NO.	PARAMETERS	MEAN ± S.D.	P value
1.	GLUCOSE FASTING (mg/dl)	148.00 ± 47.65	0.001*
2.	GLUCOSE POSTPRANDIAL (mg/dl)	228.71 ± 63.73	0.001*
3.	SERUM ZINC (µg/dl)	106.70 ± 41.51	0.695

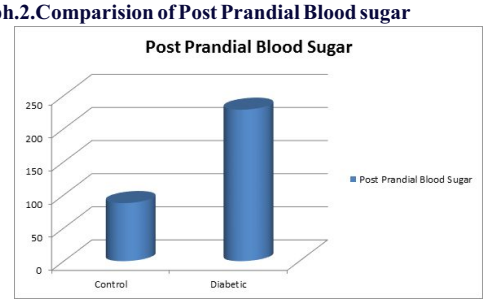
4.	ALKALINE PHOSPHATASE (K.A. units/dl)	11.46 ± 3.15	0.002*
5.	ASCORBIC ACID (mg/dl)	1.70 ± 0.99	0.001*
6.	DEHYDROASCORBIC ACID (mg/L)	3.47 ± 0.69	0.002*

P* value significant

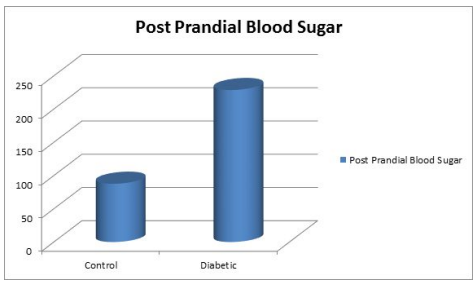
Graph.1 Comparison of Fasting Blood Sugar



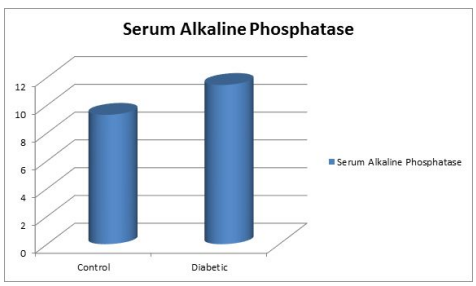
Graph.2.Comparision of Post Prandial Blood sugar



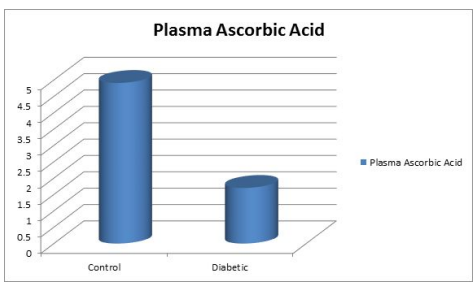
Graph 3:- Comparisionof Serum Zinc



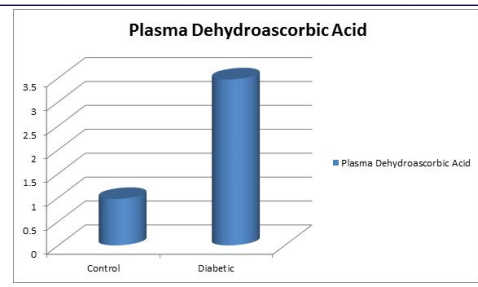
Graph 4:- Comparision of Serum Alkaline Phosphatase



Graph 5:- Comparisionof Plasma Ascorbic Acid



Graph 6:- Comparison of Plasma Dehydroascorbic Acid



DISCUSSION:

In India more than 50%of the diabetic cases have the onset below 50 year of age.[6]The nearly 30% of chronic renal failures in India are due to diabetic Nephropathy.[7] Elevated level of the activity of AST, ALT and ALP in blood serum is a strong indicator of hepatic and cardiac damage. These enzymes are usually liver makers whose plasma concentration above homeostatic limit could be associated with various forms of disorders which affect the functional integrity of the liver tissue.[8,9] The mutual connection between insulin and zinc has been clearly demonstrated. That zinc has a certain influence on the function of insulin has been rendered probable.Studies have shown that diabetes is accompanied by hypozincemia[10] and hyperzincuria.[11] In addition Zinc deficiency is more common in developing countries[12], where diabetes is also showing an exponential increase in prevalence.[13] Zinc is essential for the activity of amylase, aldolase[14,15], lac-Tate dehydrogenase, and alkaline phosphatase.[16,17] 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. 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 mean plasma ascorbic acid in the control group was 4.91 ± 1.29 mg/L with a range of 3.63 to 6.21 mg/L. 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. The mean plasma dehydroascorbic acid levels in the control group was 0.97 ± 1.58 mg/dl with a range of 0.28 to 1.66 mg/dl. A number of workers have studied the status of AA in experimental animals as well as in humans. Mammalian vitamin C and glucose physiology are inter related since both may be abnormal in persons with DM. of the human cells, at least RBC, WBC and cultured fibroblasts take up DHA and promptly reduce it to AA. D-glucose and its analogs were shown to competitively inhibit DHA uptake by RBC, WBC and in cultured fibroblasts.

CONCLUSION AND SUMMARY:

The paucity of reports in literature and the object and scope of this study on serum Zn, AP activity, AA and DHA inter relationships along with glucose in DM have been introduced.

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. Moderate elevations in the serum AP activity in all the subgroups were observed except that it failed to achieve statistical levels of significance in NIDDM with nephropathy and NIDDM with retinopathy. The needfor right eating, regular exercise and right thinking needs to be stressed, particularly for diabetics. Serum Alkaline Phosphatase activity is decreased 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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