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Study of serum zinc alkaline phosphatase and ascorbic acid level in diabetes mellitus

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Abstract

Diabetes mellitus (DM) comprises a group of metabolic disorders presenting with hyperglycemia resulting from insulin deficiency or 1decrease glucose utilization and increased glucose production. 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. 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. 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

key words: Diabetes, Mellitus, Alkaline, phosphatase, Zinc etc.

Introduction

Diabetes is a group of metabolic disorders characterized by chronic hyperglycemia resulting from disorders of secretion or the action of insulin. This hyperglycemia is associated with long-term complications, dysfunction of various organs, especially the eyes, kidneys, nerves, heart and blood vessels. There is a high degree of reciprocity of the relationship between diabetes and minerals, especially in the case of uncontrolled chronic hyperglycemia, which can cause remarkable alterations in the state of these nutrients, and vice versa. Some of these substances,

particularly those that have been characterized as micronutrients, can directly modulate glucose homeostasis. Zinc is one of the important essential trace elements that are required for many cell events as cofactor of numerous enzymes. Indeed zinc is present in the catalytic site of many enzymes; if zinc is removed, the catalytic efficiency drops to zero. Zinc-containing enzymes belong to all six classes of enzymes: hydrolases (alkaline phosphatase), isomerases, ligases (DNA ligases), lyases (aldolase), oxidoreductases (lactic dehydrogenase), and transferase (cobalamin-dependent methionine synthase). These enzymes are involved with the metabolism of proteins, carbohydrates and lipids. A relationship between zinc and insulin storage is also suggested by the findings that acute stimulation of insulin secretion in rats also reduces the zinc content in B cells of the pancreas. In other words, during the secretion of insulin, it is necessary to be stored in vesicles or granules, where two Zn2+ ions coordinate six insulin monomers to form the hexameric structure, which is the basis of the insulin maturation under crystal forms. Thus, zinc deficiency is always related to certain disorders such as metabolic syndrome and diabetic complications, which characterized by an abnormally high concentration of blood glucose (hyperglycemia). The later leads to diabetes development . It was also documented that inadequate zinc seems to be associated with the pathogenesis of type 2 diabetes mellitus (DM), supporting the notion that Zn deficiency may result in the exacerbation of insulin resistance . Diabetes usually leads to hypozincemia and a decrease in tissue zinc stores. The possible reasons for decreasing serum zinc concentration in diabetic patients are malabsorption and excessive urinary excretion. So there are several reasons for suspecting that an abnormal zinc metabolism could play a role in the pathogenesis of diabetes mellitus and some of its complications

Diabetes Mellitus is most common endocrine disease. It is a group of metabolic disease which is characterized by hyperglycaemia, various clinical manifestations and systemic complications and is caused by either deficiency in the secretion or action of insulin or both. The metabolic derangement is frequently associated with permanent and irreversible functional and structural changes in the cells of the body, those of the vascular system, being particularly most susceptible. The chronic hyperglycaemia of diabetes is associated with long term damage, dysfunction and failure of different organs, and these changes in turn lead to development of well-defined clinical entities, the so called complications, which may affect especially the eyes, kidneys, heart, blood vessels, the skin and the nervous system. Interest in trace elements has

been steadily increasing over the last 25 years. Trace elements are accepted as essential substances for optimum human health, because of their diverse metabolic characteristics and functions. They serve a variety of catalytic, structural and regulatory functions in which they interact with macromolecules such as enzymes, pro hormones, pre secretory granules and biological membranes. Direct association of minerals, trace elements and vitamins in the pathogenesis and natural course of both type 1 and 2 diabetes mellitus has been observed in many research studies. An alteration in the metabolism of these minerals and vitamins has been demonstrated. Diabetes mellitus is a heterogeneous disease associated with an absolute or relative deficiency of minerals as well as insulin resistance

Effect of ascorbic acid supplementation on fasting blood and post prandial blood sugar levels in type 2 diabetes mellitus experimental patients

Vitamin C supplementation decreases oxidative stress and also aids in lipid metabolism regulation. Hence the current study also evaluated the impact of ascorbic acid supplementation on lipid profile in type 2 diabetic subjects. Important lipid biomarkers include triglycerides, total cholesterol, low density lipoproteins as well as high density lipoproteins. In the present study, we observed a significant progressive reduction in the serum level of the triglycerides, total cholesterol and low density lipoproteins across glibenclamide treated only as well as both glibenclamide treatment supplemented with ascorbic acid in groups 2, 3 and 4 at the end of 3rd, 6th and 9th compared to baseline though there was no significant difference in between the treatment groups as regards the three lipid biomarkers. However, the observed results was not applicable to high density lipoproteins as there was no significant difference in the serum level of all experimental subjects at the end of the third and sixth weeks compared to baseline. Group 4 patients who received 1.8g (1,500mg) of ascorbic acid had a significantly reduced serum HDL compared to the three other treatment groups at the end of the ninth week.

In a similar study, 500mg and 1000mg of vitamin C were administered on type 2 diabetes mellitus patients for six weeks. Those patients who received 1000mg of vitamin C daily in the study recorded no significant decrease in the serum triglyceride level, while there was a significant decrease in the serum LDL level of the same patients.

Effect of ascorbic acid supplementation on inflammatory biomarkers in type 2 diabetes mellitus experimental patients

Chronic inflammation is closely related to insulin resistance in type 2 diabetes. Therefore, with attention to extensive anti-inflammatory effects of ascorbic acid on downstream markers of inflammation, we used the effect of ascorbic acid supplementation on attenuation of inflammation in type 2 diabetes patients. We used inflammatory biomarkers like C - reactive protein, leptin and Adiponectin. Increasing level of C Reactive protein as an inflammatory marker is known to be associated with great cardio-vascular diseases risks. In addition, CRP is often suggested as a reliable laboratory biomarker for risk of cardio-vascular disorders in patients with diabetes mellitus .

A new adipocyte-specific protein called adiponectin has been implicated to play an important role in the development of atherosclerosis and insulin resistance. In as much as adiponectin are found in high concentrations, its levels are reduced in obese subjects compared to lean subjects. Adiponectin levels are correlated correlations with measures of adiposity . Adiponectin levels have been reported to also be lowered in patients with insulin resistance and type 2 diabetes . In the present study, we observed no significant difference in the serum level of adiponectin in both the ascorbic acid supplemented and non supplemented groups at the end of the third week compared to their respective base line values. However, there was a significant reduction in the serum level of adiponectin protein in the patients administered with oral ascorbic acid supplementation at the end of the 6th and 9th weeks compared to the other patients who received only 5mg of glibenclamide (group 1) daily for the 6th and 9th weeks respectively.

conclusion

The paucity of reports in literature and the object and scope of this study on serum Zn, AP activity, AAand DHAinter 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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