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ANTIOXIDANT VITAMINS IN DIABETES

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ABSTRACT

The study included nineteen control subjects and fifty-nine diabetic patients. The diabetic patients were divided according to the treatment they received. Fasting blood glucose was markedly increased in all three groups, while low serum vitamin A, C and E levels were observed in diabetic patients as compared to control subjects.
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INTRODUCTION

Diabetes mellitus is a chronic disorder of carbohydrate, fat and protein metabolism, characterized by an inappropriate elevation of the blood glucose level, for which a relative or absolute lack of insulin is reponsible.[1]

The role of oxidant stress in the causation of chronic tissue damage is being recognized. Oxidant stress is usually countered by an abundant supply of antioxidants. Vitamin E and C levels are markedly lower in diabetic patients. There is a paradoxical rise in catalase and glutathione peroxidase (Gpx) in diabetic patients with retinopathy. This may be a compensatory mechanism by the body to prevent tissue damage by increasing the levels of the two alternative antioxidant enzymes.[2] Vitamin A blood concentration was significantly decreased in type-I and increased in type-II diabetic patients as compared to control subjects.[3]

In pathologic conditions such as diabetes, oxidative stress causes the level of antioxidants to fall below normal.[4] Treatment with antioxidants can reduce both oxidative stress and protein glycation and may help to reduce the risk of developing diabetic complications. Ascorbate has both pro-oxidant and antioxidant effects *in vivo*.[5] Chronic vitamin C administration has a beneficial effect upon glucose and lipid metabolism in aged non-insulin dependent diabetic patients.[6] Vitamin E and C levels are markedly lower in diabetic patients.[2]

Vitamin E delays the oxidative process which turns cells "rancid" and it prevents oxygen from combining with other substances to form the deadly hydrogen peroxide which hastens the death of a cell. Vitamin E administration is useful for the prevention of diabetic complications.[7]

MATERIAL AND METHODS

Blood samples from pre-diagnosed diabetic patients were collected after 12 hours of fasting and discontinuation of antidiabetic drugs. For control, the blood samples were obtained from healthy individuals having no symptoms or history of diabetes. Blood was analyzed for glucose,[8] ascorbic acid,[9] β-carotene, serum retinol and serum α-tocopherol.[10]

RESULTS

The study included 19 controls (10 male, 9 female) having a mean age of 24.5 ± 0.6 years and mean weight of 60.5 ±2.2 kg; the prediagnosed 59 diabetic patients (29 male, 30 female) had a mean age of 49.6 ± 1.7 years and mean weight of 65.7 ±2.3 kg.

The diabetic patients showed higher levels of blood glucose and lower levels of blood ascorbic acid and serum β-carotene, retinol and vitamin E as compared to normal control subjects (Table I). The diabetic patients were further categorized as patients on diet control, patients on oral hypoglycemic drugs, and patients on insulin therapy. All three groups of diabetic patients showed a higher level of blood glucose and lower level of serum β-carotene, retinol and vitamin E, and blood vitamin C as compared to control patients (Table II).

DISCUSSION

The most common and diagnostic character of diabetic patients is a high fasting blood sugar level, i.e. hyperglycemia,

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Table I. Blood glucose, β-carotene, retinol, vitamin C and vitamin E levels in control and diabetic patients.

Group	Blood glucose (mg/dL)	b-Carotene (mg/L)	Retinol (mg/L)	Vitamin C (mg/dL)	Vitamin E (mg/L)
Control	87.05 ±5.42 (19)	1.43 ±0.10 (19)	0.66 ±0.01 (19)	2.96 ±0.23 (19)	10.31 ±0.24 (19)
Diabetics	262.52* ±16.01 (59)	0.61* ±0.03 (59)	0.33* ±0.01 (59)	1.23* ±0.05 (59)	5.77* ±0.21 (59)

* $p<0.05$, statistically significant as compared to control subjects.

Table II. Blood glucose, β-carotene, retinol, vitamin C and vitamin E levels in control and diabetic patients according to the method of blood sugar control.

Group	Blood glucose (mg/dL)	b-Carotene (mg/L)	Retinol (mg/L)	Vitamin C (mg/dL)	Vitamin E (mg/L)
Control	87.05 ±5.42 (19)	1.43 ±0.09 (19)	0.66 ±0.09 (19)	2.96 ±0.23 (19)	10.31 ±0.24 (19)
Patients on diet control	242.0* ±43.31 (6)	0.70* ±0.09 (6)	0.36* ±0.03 (6)	1.14* ±0.15 (6)	6.10* ±0.86 (6)
Patients on oral hypo-glycemic drugs	263.37* ±27.06 (27)	0.66* ±0.04 (27)	0.32* ±0.02 (27)	1.35* ±0.08 (27)	6.12* ±0.29 (27)
Patients on insulin therapy	249.07* ±17.93 (26)	0.57* ±0.04 (26)	0.34* ±0.02 (26)	1.13* ±0.03 (26)	5.41* ±0.27 (26)

* $p<0.05$ as compared to control.

caused by insufficient availability of insulin or inadequate insulin activity in the body.[11]

The majority of diabetic patients suffer with neuropathy, nephropathy, and ocular complications. Vitamin A, E and C are antioxidants and their lack may cause many of such complications. Salonen[12] reported that free radical stress has a role in the causation of non-insulin dependent diabetes mellitus.

Martinoli[13] showed that plasma retinol is significantly decreased in insulin dependent diabetic patients while α-tocopherol is significantly altered in diabetic patients with nephropathy. Cabellero[14] reported that vitamin E supplementation produced a significant improvement in glucose utilization and the hepatic response to insulin in normal and diabetic subjects. The vitamin A level was also significantly lowered as compared to control subjects, comparable to the results of Martinoli.[13]

In the present study vitamin C and E levels in the blood were lower in diabetic patients as compared to control subjects. Rema et al.[2] had also found similar results. The reason may be that the high glucose concentration reduces D-α-tocopherol binding through mechanisms independent of osmotic effects of sorbitol accumulation in the cell. A glucose mediated reduction in D-α-tocopherol binding could diminish the beneficial effects of D-α-tocopherol on the vascular toxicity of hyperglycemia in diabetes mellitus.[15]

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It is concluded that diabetic patients having elevated fasting blood glucose levels are at risk of lack of antioxidant vitamins, and the deficiency of these vitamins may lead to further complications. It is therefore recommended that diabetic patients consume diets which are rich in antioxidant vitamins.

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