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Effect of Vitamin C on Blood Glucose & Serum Lipids in Type 2 Diabetes Patients.

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Abstract

Background & objectives: *The prevalence of diabetes is rising at an alarming sign through out the world & is one of the major metabolic disorders that cause micro & macro-vascular complications. Dyslipidaemia is considered as risk factor for cardiovascular disease & it is higher risk in diabetes subjects than normal. The control of glycemic & lipid profile status can reduced the risk of micro & macro-vascular complications. As vitamin C is anti oxidant vitamins so we aimed to evaluate the beneficial effects of its on blood glucose & serum lipids in T2DM patients.*

Materials & methods: *A total of 46 patients with T2DM were included in this study. They received 1000 mg of vitamin C for eight weeks. Fasting blood sugar (FBS), triglyceride (TG), total cholesterol (TC), low & high density lipoprotein (LDL & HDL) and glycated haemoglobin (HbA1c) were measured before & after vitamin consumption and the results were analyzed.*

Results: *A significant decrease in TG, TC, LDL, and HbA1c was seen in the group supplemented with 1000 mg vitamin C. In case of FBG & HDL there was no significant difference.*

Interpretation & conclusions: *Our results indicate that daily consumption of 1000 mg supplementary antioxidant vitamin-C may be beneficial in decreasing glycemic status and lipids in patients with type 2 diabetes and thus reducing the risk of complications.*

Keywords: *T2DM, Dyslipidaemia, Antioxidant,Vitamin-C.*

Introduction

Vitamin C, E & beta carotene are important antioxidants. n human & are capable of scavenging oxygen-derived free radicals. Within that's vitamin C is structurally similar to glucose and can replace it in many chemical reactions, and thus is effective in prevention of non-enzymatic glycosylation of proteins[1]. In addition, vitamin C acts as a regulator of catabolism of cholesterol to bile acid and has been demonstrated to be an important factor in lipid regulation[2]. Antioxidant vitamins also causes prevent lipid per-oxidation in vivo and improved the lipoprotein fragments that's associated with cardiovascular diseases[3].Several studies showed decreased basal vitamin C level in diabetic patients and also it is suggested that oxidative stress is increased in diabetes[4]. Most patients with diabetes have lipid

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metabolism disorders; most prevalent forms are decreased high density lipoprotein (HDL) and increased triglyceride[1,5]. High doses of ascorbic acid (2 g/day) have been shown to improve blood glucose regulation and reduce serum cholesterol and triglyceride in type 2 diabetes patients[6]. Sargeant et al[7] found an inverse relationship between plasma vitamin C and glycated haemoglobin (HbA1c) levels, in such a way that mean plasma vitamin C was significantly higher in individuals with HbA1c < 7 percent than in those with self reported or prevalent undiagnosed hyperglycemia (HbA1c > 7%).We performed this study to evaluate the effects of vitamin C supplement on blood sugar, serum lipids and levels of HbA1c in patients with type 2 diabetes.

Material & Methods

This study was performed at department of biochemistry in kumudini womens medical college during january 2012 - july 2012. From 398 type 2 diabetic patients visited diabetic care center in kumudini hospital, a total of 46 subjects(group A) whose fasting blood sugar (FBS),triglycerides (TG) and cholesterol levels were in the ranges that did not need to change their treatment plan, were selected by simple random sampling method. American Diabetes Association (ADA) criteria were used for diagnosis of diabetes[8]. Patients with complications of diabetes including nephropathy (72 patients), retinopathty (88 patients), history of renal stones (2 patients), hypoglycaemia (34 patients), blood glucose higher than 250 mg/dl (56 patients), serum levels of triglycerides >400 mg/dl (42 patients), total cholesterol >400 mg/dl (34 patients) and who were on insulin therapy (24 patients), were excluded from the study. Following values were considered normal; FBS < 126 mg/dl8, triglyceride < 200 mg/dl, total cholesterol < 200 mg/dl, HDL-cholesterol > 35 and LDLcholesterol < 100[9]. Age, sex, weight, height, duration of diabetes, blood pressure (BP) were examined and recorded. Blood samples (5000 µl) were drawn from the patients and FBS, total cholesterol (TC), LDL, HDL, TG, HbA1c were measured before the initiation of supplementation with vitamin C. HbA1c was measured by ion-exchange chromatography using test kit from whole blood immediately after obtaining the sample. Subjects enrolled in the study received 1000 mg of vitamin C (four tablets containing 250 mg of vitamin C) daily for eight weeks. The treatment, diet and physical activity of the patients remained unchanged during the course of study. Patients' compliance to the prescribed drug was monitored by a dairy checklist and continuous contact by phone. After eight weeks of supplementation with vitamin C, 41 patients (group B) were examined again and the tests repeated. The rest 5 patients were excluded from the study as they missing the supplementation. All patients were informed about the study and a written consent was taken from all participants.

Statistical analysis: The data were analyzed statistically by SPSS for Windows (version 11.5). Chi-square & unpaired T-test were done and P<0.05 was considered significant.

Results

Mean age of 46 patients (group A) (27 male, 19 female) was 53.2 ± 8.62 yr (range: 30-70 yr). Of these, 41 (25 men and 16 women) patients underwent treatment with 1000 mg (group B). Mean duration of disease was 5.62 ± 5.54 yr (ranged from 1-23 yr) (Table I).

Characteristics	Group - A	Group - B
Total number	46	41
Age range yr	30 - 70	30 - 70
Mean age yr	53.2±8.62	52.8±9.2
Male	27	25
Female	19	16

Table -I Age and sex distribution of study subjects

Statistical analysis did not show any differences between the two groups in the age, sex and duration of diabetes. Consumption of 1000 mg vitamin C (group B) resulted in significant changes in serum levels of TG, TC, LDL, HbA1c (P<0.05), But there was no significant change in the serum levels of HDL & FBG in both the groups (Table II).

Parameter	*Group - A*	*Group - B*	*P - value*
FBG	154.58±34.54	157.32±40.32	>0.05
TG	210.02±65.1	186.56±54.00	<0.001
TC	198.28±38.10	178.72±31.20	<0.05
LDL	132.90±36.4	121.65±26.76	<0.001
HDL	41.72±12.40	43.35±11.60	>0.05
HbA1c	8.72±1.6	7.60±1.90	<0.05

Table-II Mean values (± SD) of FBG, TG, TC, LDL, HDL (mg/dl), HbA1c (%) before & after supplementation of vitamin-C with P-value.

(FBS, fasting blood sugar; TG, triglycerides; TC, total cholesterol; LDL, HDL, low and high density lipoprotein; HbA1c, glycated haemoglobin)

Discussion

In our present study, we compared in between two groups before & after supplementation of vitamin C (1000 mg) that showed a significant reduction in serum TG, TC, LDL as well as serum HbA1c after consumption of 1000 mg/day of vitamin C. In previous studies as a clinical trial (before and after) there was a significant decrease in FBS, LDL and HbA1c levels after usage of 1000 mg of vitamin C in type 2 diabetic patients but our study don't match with FBG, this discrimination may be due to short duration of supplementation[10] or due to distinct pathophysiology which needs further evaluation. In a study by Chen et al[11], daily consumption of 800 mg ascorbic acid for 4 wk by T2DM patients caused no significant changes in FBS and serum insulin. This may be due to lower dose used compared to our study. Forghani et al[12] showed a significant decrease in serum HbA1c and LDL levels in patients supplemented with 1000 mg/day of vitamin C for 6 wk that is consisting with our study. The study showed that, 1000 mg/day dose of vitamin C did not cause significant change in FBG & HDL while Errikson et a[l6] using 2 g of vitamin C for 90 days, showed a significant change.

This difference may be due to a longer duration of dose used by them. LDL particles are small and dense in T2DM and are susceptible to oxidation. -tocopherol is a lipid soluble antioxidant and protects LDL particles from oxidative attack. Vitamin C is required for regeneration of -tocopherol and may thus prevent LDL oxidation[13]. In another study performed by Bishop et al[14] on 50 hyperlipidaemic diabetes patients, supplementation with 500 mg/day vitamin C resulted in no changes in FBS, TC, TG and HbA1c in comparison with placebo that did not consist with us & that might be due to lower doses. Endothelial dysfunction is a hallmark of type 2 diabetes related to hyperglycaemia and oxidative stress. This endothelial dysfunction may worsen insulin resistance[11]. It may be possible that vitamin C as anti-oxidant can probably reduce insulin resistance by improved endothelial function and lowering oxidative stress.

Conclusion

Supplementation with 1000 mg/day of vitamin C in addition to the normal diet and treatment schedule may help in improving plasma glucose status and lipid profile in patients with type 2 diabetes.

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