

Combined Effect of Vitamin C and E Dose on Type 2 Diabetes Patients

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Abstract Diabetes is a metabolic disorder that causes vascular complications. As vitamin C and E is known for its beneficial effects on blood sugar, serum lipids and glycated haemoglobin (HbA1c). In the present study, we assess the combined effect of vitamin C and E on blood sugar (FBS), serum creatinine (SC), total cholesterol (TC), low and high density lipoprotein (LDL, HDL), and glycated haemoglobin (HbA1c) in type 2 diabetes mellitus patients. A total of 50 patients with type 2 diabetes referred to Rama Hospital (NCR), India, were included in the study. They received 500 mg daily twice of both vitamin C and E for 4 months. Fasting blood sugar (FBS), serum creatinine (SC), total cholesterol (TC), low and high density lipoprotein (LDL, HDL), and HbA1c were measured before and after vitamin C and E consumption and the results were analyzed. A significant decrease in FBS, TC level and non-significant decrease in SC, LDL, and HbA1c level was seen in the patients supplemented with 500 mg of both vitamin C and E twice in a day for 4 months. Results indicate that daily consumption of 500 mg of vitamin C and E for 4 months may be beneficial for decreasing the FBS, TC, SC, LDL, and HbA1c and slight raise in HDL and calcium level in patients with type II diabetes and thus reducing the risk of complications.

Keywords Diabetes Mellitus, Vitamin C and E

1. Introduction

Pandit and Pandey [1]; Awasthi et al. [2] proposed that diabetes mellitus is a multi-factorial metabolic disorder and forthcoming epidemic all over the globe that caused due to ineffective secretion of insulin. Prajapat and Bhattacharya [3]; Zhaolan et al. [4] proposed that diabetic patient numbers will possibly rise up to 300 million by 2025 in India. Seyed Hosseini et al. [5] and Rahman Hassan et al. [6] also estimated that 346 million diabetic patients will be increase up to 439 million in 2030 worldwide.

In another study, Khabaz et al. [7] and Manzella et al. [8] explained that, vitamin E supplementation could improve glycemic control. Afkhani-Ardekani et al. [9] and Dakhale et al. [10] proposed that, vitamin C and glucose show structural similarities, and thus they are effective in prevention of non-enzymatic glycosylation of proteins. Chambial et al. [11] proposed that, vitamin C is an antioxidant that protects body from damage caused by free radical and also used as therapeutic agent for diseases and disorders. In the study, Simom [11] proposed that, vitamin C acts as regulator of catabolism of cholesterol and Ness et al. [13] proposed beneficial effects on lipids regulation.

In another study, Battisi et al. [14] and Manjunath et al. [15] proposed that, most of patients with diabetes have lipid metabolism disorders; most prevalent forms are decreased high density lipoprotein (HDL) and increased triglyceride. Errikson and Kahvakka [16] proposed that, high doses of ascorbic acid (2gm/day) improved blood glucose regulation and reduce serum cholesterol and triglyceride in type 2 diabetes patients. In another study, Sargeant et al. [17] proposed that, in year 2000 scientist reported an inverse relationship between mean plasma vitamin C and HbA1c levels.

We undertook this study to evaluate the effects of vitamin C and E supplement on fasting blood sugar (FBS), serum creatinine (SC), total cholesterol (TC), low and high density lipoprotein (LDL, HDL) and HbA1c in patients with type 2 diabetes.

2. Materials and Methods

Present study was performed at the Rama Hospital, Rama Medical College (NCR), UP (India), as a randomized controlled trial and with parallel design. According to ADA [18], the whole study size was fifty patients with type 2 diabetic of mean age 52.3 ± 9.62 years were selected for the study.

The sex, age, weight, height, duration of diabetes, blood pressure were examined ($\geq 130/\leq 80$ mm Hg) and recorded.

Blood samples (10 ml) were drawn from the patients and FBS, serum creatinine (SC), total cholesterol (TC), LDL, HDL, and HbA1c were measured before the initiation of supplementation with vitamin C and E.

Subjects enrolled in the study received randomly 500 mg of vitamin C and 500 mg of vitamin E daily twice for 4 months. The patients were examined and tests were repeated after the duration of 15 days of supplementation with vitamin C and E.

2.1. Laboratory Methods

The blood sugar (FBS), creatinine, total cholesterol, high density lipoprotein (HDL), low density lipoprotein (LDL) and levels of HbA1c were measured by using Erba kits (Erba Lachema S.R.O., CZ) in the basal state and after the duration of 15 days of treatment. Venous blood (10 ml) was collected from each patient by a certified phlebotomist using standard laboratory methods at each study point. In the study, Powers [19]; Barham and Trinder [20] proposed that, after clotting, blood was centrifuged at 2500 rpm for 30 minutes. The Serum glucose, creatinine (Myers et al. [21]), total cholesterol (Kannel et al. [22]), HDL (Castelli et al. [23]), LDL (Nauck et al. [24]) and HbA1c (Jeppsson et al. [25]) were assayed by colorimetric using Erba Reagent kits with EM 200-Automated Random Access Clinical Chemistry Analyzer [Erba Lachema S.R.O., CZ].

Total cholesterol, triglycerides, LDL, and HDL cholesterol were tested at baseline, subsequently monthly till next 4 months visits. Blood pressure was measured in the baseline and after every 15 days. It was measured in three positions (supine, sitting and upright) in 5 minutes intervals and the mean of them was calculated.

2.2. Statistical Analysis

Statistical analysis was performed using Statistical Package for Social Sciences (SPSS 12.0, Chicago IL). Numerical normally distributed data and categorical data were compared using independent t-test. Significance was considered to be $P < 0.05$. Results were given with their 95% CIs. Data were presented as means \pm SD. Numerical normally distributed data and categorical data were compared using independent t-test.

3. Results and Discussion

According to Boshtam et al. [26], vitamin E could improve blood sugar in diabetic patients. According to Gazis et al. [27], the alpha tocopherol supplementation [1600 IU] in diabetic patients considerably reduced HbA1c levels. In the study, Paolisso et al. [28] proposed that, the HbA1c levels could be reduced by supplementation of 100 IU vitamin E in type 1 diabetic patients. Afkhami-Ardekani and Shojaoddiny-Ardekani [29] proposed significant decrease in

FBS, TG, LDL, HbA1c and serum insulin was observed in diabetic patients supplemented with 1000 mg vitamin C. Forghani et al. [30] proposed significant decrease in serum HbA1c and LDL levels observed in diabetic patients supplemented with 1000 mg/day of vitamin C for 6 weeks but according to Bishop et al. [31] supplementation only 500 mg/day vitamin C resulted in no significant changes observed in FBS, TC, TG and HbA1c level. Therefore, in present study, the combined doses of vitamin C and E [500 mg/ day twice] were supplemented to diabetic patients for 4 months and change in the level of FBS, serum creatinine (SC), total cholesterol (TC), HDL, LDL and levels of HbA1c were measured (Table 1).

A significant decrease for FBS (from 162.78 ± 4.82 to 147.09 ± 7.05 , $p = 0.00001$) and total cholesterol (TC) [from 196.11 ± 9.83 to 188.75 ± 2.88 , $p = 0.00001$] was observed at 4 months in the 500 mg/day of vitamin C and E supplementation. The multiple comparisons analysis showed a borderline, not significant decrease in serum creatinine (SC) for the 500 mg group [vitamin C and E] at 4 months (from 1.32 ± 0.28 to 1.19 ± 0.13 mg/dl, $P = 0.00183$), low density lipoprotein (LDL) was (from 128.02 ± 4.97 to 123.03 ± 1.40 , $p = 0.00001$) and also in HbA1c level non-significant decline observed at 4 months (from 6.62 ± 2.404 to 5.14 ± 1.17 , $P = 0.00411$). Non-significant raise observed in high density lipoprotein (HDL) [from 44.95 ± 8.13 to 47.83 ± 0.74 , $p = 0.00802$] and also in calcium level (from 8.91 ± 0.438 to 9.35 ± 0.31 , $P = 0.00203$) at 4 months in vitamin C and E [500 mg/day twice] supplemented diabetic group (Table 1, Figure 1).

In the study, Afkhami-Ardekani [32] proposed that, the previous clinical trials showed a significant decrease in FBS, LDL and HbA1c levels after usage of 1000 mg of vitamin C or vitamin E separately in type 2 diabetic patients. According to Chen et al. [33] the daily consumption of 800 mg ascorbic acid for 4 weeks by type 2 diabetes patients caused no significant changes in FBS and serum insulin due to use of lower doses. Forghani et al. [34] proposed significant decrease in serum HbA1c and LDL levels observed in patients supplemented with 1000 mg/day of vitamin C for 6 weeks. Errikson and Kahvakka [35] proposed significant decrease in TC was observed by using 2 gm of vitamin C for 90 days.

In the study, Mullan [36] proposed that, vitamin C is required for regeneration of α -tocopherol and may thus prevent LDL oxidation in type 2 diabetes patients. Paolisso et al. [37] proposed that, supplementation with 500 mg vitamin C twice daily for 4 months reduced the plasma levels of LDL, TC, TG and insulin significantly. In another study Watts et al. [38] proposed that, administration of 800 IU/day alpha tocopherol for 6 weeks has not beneficial effect on serum glucose and HbA1c in type 2 diabetic women. Cinaz et al. [39] observed that 900 IU/day vitamin E can improve insulin due to oxidative stress reduction. Manzella et al. [40] proposed that, 600 IU/day vitamin E supplementation reduced HbA1c, plasma insulin and oxidative stress indexes.

According to Paolisso and Giugliano [41] administration of vitamin E reduced triglycerides, total cholesterol and LDL. In another study Jain et al. [42] observed that, 100 IU/day vitamin E in diabetic patients reduced serum triglycerides significantly. Cinaz et al. [43] and Boshtam et al. [44] did not show the effect of vitamin E on lipids.

According to previous findings, a low dose of single vitamin not causes any significant benefits in diabetes

patients. In present study, low combined doses of vitamin C and vitamin E [500 mg of both] twice daily for 4 months caused significant reduction in FBS, and TC level. There were no significant declines in SC, LDL and HbA1c level after supplementation of vitamin C and E [500 mg of both] twice daily for 4 months. A non-significant raise in HDL and calcium level was observed in patients with type 2 diabetes (Figure 1).

Table 1. The mean values of fasting blood sugar (FBS) serum creatinine (SC), total Cholesterol (TC) high density lipoprotein (HDL), low density lipoprotein (LDL), HbA1c (glycated haemoglobin) before and after supplementation with doses of vitamin C and E [(Data are mean \pm SD)]

Variable	Control Group Range (mg/ dl)	Diabetic Group				p value
		Before Treatment	After Treatment			
		N = 50	N = 50			
		Mean \pm SD	Mean \pm SD	Variance (SD)	Population SD	
FBS (mg/ dl)	70 - 110	162.78 \pm 4.82	147.09 \pm 7.05	49.73	6.10	0.00001
SC (mg/ dl)	0.6 - 1.2	1.32 \pm 0.28	1.19 \pm 0.13	0.02	0.11	0.00183
TC (mg/ dl)	185 - 190	196.11 \pm 9.83	188.75 \pm 2.88	8.31	2.49	0.00001
HDL (mg/ dl)	30 - 65	44.95 \pm 8.13	47.83 \pm 0.74	0.55	0.64	0.00802
LDL (mg/ dl)	80 - 150	128.02 \pm 4.97	123.03 \pm 1.40	1.96	1.21	< 0.00001
Calcium (mg/ dl)	9 - 11	8.91 \pm 0.438	9.35 \pm 0.31	0.09	0.26	0.00203
HbA1C (%)	4 - 5.6	6.62 \pm 2.404	5.14 \pm 1.17	1.37	1.01	0.00411

P* < 0.05 ** < 0.001 compared to before treatment

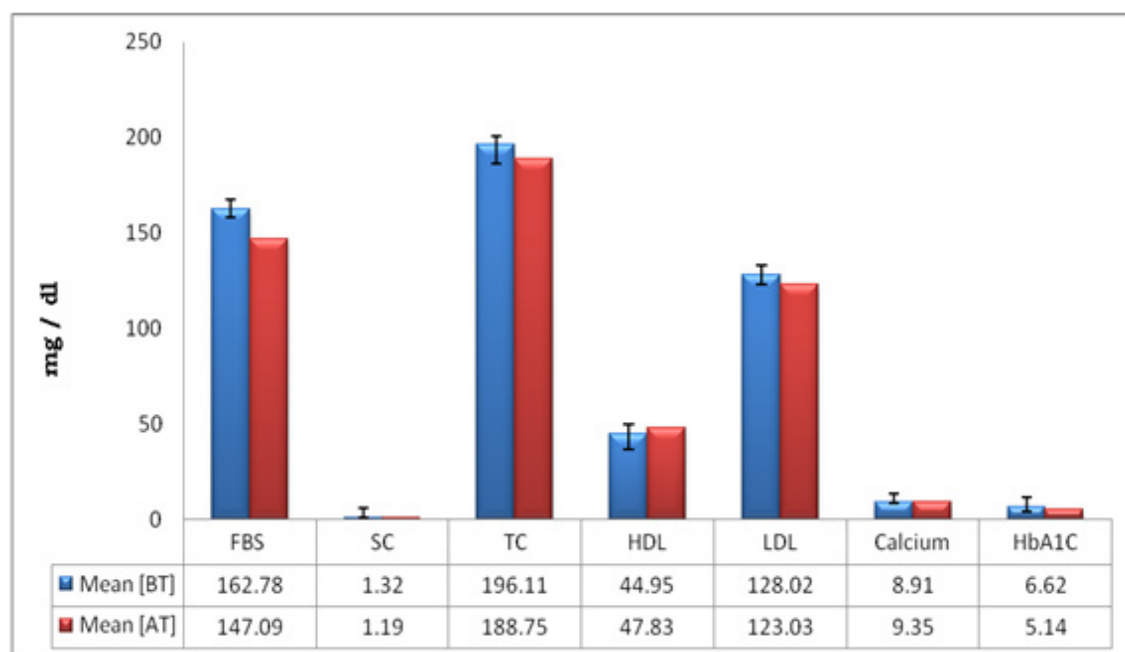


Figure 1. Standard Deviation graph showing mean values and positive, negative error of fasting blood sugar (FBS) serum creatinine (SC), total Cholesterol (TC) high density lipoprotein (HDL), low density lipoprotein (LDL), HbA1c (glycated haemoglobin) before [blue bars] and after [red bars] supplementation / treatment with doses of vitamin C and E [(Data are mean \pm SD)]

4. Conclusions

In conclusion, supplementation of combined doses [500 mg/day twice] for 4 months, of vitamin C and E in addition to the normal diet may improve plasma glucose (FBS) and lipid profile in patients with type 2 diabetes.

Overall, the significant reduction in FBS, and TC level was seen. There were no significant declines in SC, LDL and HbA1c level. A non-significant raise in HDL and calcium level was observed in patients with type 2 diabetes. Possibly this was due to insufficient samples, dosage or short duration of research. So, further studies with longer duration and higher dosage are suggested. The combined low doses of vitamin C and E twice in day may cause similar effect as caused by the higher doses of these vitamins individually.

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