Effect of Vitamin E on Blood Glucose, Lipid Profile and Blood Pressure in Type 2 Diabetic Patients

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ABSTRACT

OBJECTIVE: Type 2 diabetes is associated with elevated oxidative stress and decline in antioxidant defense. Vitamin E supplementation reduces oxidative stress level in diabetic patients. Purpose of this study was to evaluate the effect of vitamin E supplementation on glycemic control and lipid profile in type 2 diabetic patients.

MATERIAL AND METHODS: In this study 31 type 2 diabetic patients with Fasting blood Sugar (FBS):140-200 mg/dl, Triglyceride (TG): 200-400 mg/dl, Cholesterol (TC): 200-300 mg/dl and mild hypertension were selected. Subjects received vitamin E 800 IU/day for 3 months. At the baseline and end of the study FBS, TC, TG, LDL, HDL, Glycated hemoglobin and fasting insulin level were measured.

RESULTS: In this study 31 type 2 diabetic patients (19 female, 12 male) with mean age 53.03 ± 8.87 years were studied. Vitamin E supplementation for 3 months had no positive effect on type 2 diabetic patients. As FBS, TG and fasting insulin decreased but this decline was not significant. Also total Cholesterol, systolic and diastolic blood pressure changes were not remarkable.

CONCLUSION: Results of this study showed that 800 IU vitamin E administration for 3 months could not improve blood glucose, lipids , HbA1c, fasting insulin, systolic and diastolic BP in type 2 diabetic patients.

KEY WORDS: Type 2 diabetes, Vitamin E, Insulin, Glycated hemoglobin.

INTRODUCTION

Diabetes mellitus is a common disease worldwide. The prevalence and incidence of diabetes are increasing in most populations, being more prominent in developing countries (1). The number of diabetic patients in Iran is estimated around 1.5 million now (2).

The diabetes control and complication trial has convincingly shown that complication of diabetes can be delayed and reduced by maintaining tight glycemic control (3). Over the last decade, there has been a significant interest in oxidative stress and its role in the development of complications in diabetic patients (4).

Several studies have shown increasing of stress oxidative in diabetic patients especially individuals with poor glycemic control (5). Recently hyperglycemia has been shown to be the most important factor in free radicals production in diabetes that increase super oxide radicals in mitochondria (9,10 and 11).

It was reported that the level of serum alpha tocopherol is lower in type 2 diabetic patients compared to healthy subjects (12,13). Administration of alpha tocopherol can delay chronic complications (14). Also alpha tocopherol has beneficial effects on metabolic control due to its antioxidant activity which influences lipid oxidation, protein glycation and insulin sensitivity (15).

Several researches revealed that vitamin E

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supplementation could improve glycemic control (16,18). Nevertheless, some randomized clinical trials could not approve these effects (19,21). Accordingly this study was performed to recognize the effects of vitamin E on metabolic responses in type 2 diabetic patients.

MATERIALS AND METHODS

Thirty one type 2 diabetic patients aged 30-70 years with Fasting Blood Sugar (FBS) 140-200 mg/dl, 2 hour post prandial blood glucose (2hpp), 250 mg/dl, triglyceride (TG) <400 mg/dl, Total Cholesterol (TC) ≤300 mg/dl and mild hypertension (22) were recruited from Yazd Diabetes Research Center.

Exclusion criteria included: cigarette smoking, current treatment with anti-inflammatory or other medications except oral hypoglycemic agent, diabetic complications, using antioxidant supplements, renal failure, coronary artery disease, congestive heart failure, hypercalemia, uncontrolled hypertension, history of CVA, chronic liver disease, pulmonary infection, pregnancy and lactation (23,24). Patients who had changed dosage or types of medications were excluded. The included patients received 400 IU vitamin E twice a day for 3 months. Demographic information was recorded for each patient.

Laboratory methods: FBS, TG, TC, HbA1c and HDL were measured in the basal state and after 3 months of treatment. Serum glucose and lipids were measured by colorimetric methods (GPO-PAP) with Photometer 5010 and Parsamon lit (Iran). HbA1c was measured using DS5 analyzer and DS5 Pink Reagent kit. Fasting serum insulin was measured by Elisa and Q-1-Dia Plus lit (USA).

Blood pressure was measured in the baseline and after 3 months. It was measured in three positions (supine, sitting and upright) in 5 minutes intervals and the mean of them was calculated.

The homeostasis Model Assessment (HOMA) index of insulin sensitivity was calculated as follows: HOMA = fasting insulin × fasting glucose/22.5 (23).

Statistical analysis: Statistical analysis was performed using Statistical Package for Social Sciences (SPSS 12.0, Chicago IL). To compare before and after metabolic responses paired T-test was used. Significance was considered to be $P < 0.05$. Results were given with their 95% CIs. Data were presented as means ± SD.

RESULTS

In this study 31 type 2 diabetic patients (19 female, 12 male) with mean age of 53.03 ± 8.87 years and diabetes duration 2.16 ± 0.89 years were evaluated. Table 1 shows the mean variables before and after vitamin E.

Table 1- Mean variables before and after vitamin E

Variables	Before vitamin E	After vitamin E	*P* value
BMI (kg/m^2)	29.3 ± 4.26	29.22 ± 04.39	0.3
FBS (mg/dl)	162.58 ± 18.7	160.51 ± 43.86	0.7
HbA1C (%)	9.61 ± 1.80	10.09 ± 2.13	0.1
Tg (mg/dl)	240.09 ± 55.77	223.45 ± 75.92	0.1
Total Chol (mg/dl)	200.54 ± 33.71	198.87 ± 43.79	0.8
LDL (mg/dl)	10.5.87 ± 31.18	114.82 ± 43.38	0.2
HDL (mg/dl)	47.63 ± 16.58	41.43 ± 9.56	0.07
Systolic BP (mmHg)	134.51 ± 15.98	132.58 ± 15.43	0.4
Diastolic BP (mmHg)	82.41 ± 6.93	81.29 ± 8.36	0.3
Fasting insulin (µIU/ml)	15.23 ± 11.41	10.78 ± 6.85	0.06
HOMA	107.18 ± 77.96	85.49 ± 86.37	0.2

DISCUSSION

In this study FBS, Triglyceride and fasting insulin decreased, but this decline was not significant. Total cholesterol, systolic and diastolic blood pressure changes were not remarkable.

There are controversial points about effects of vitamin E on glycemic control. Some studies have shown vitamin E can improve blood sugar in diabetic patients. Gazis et al. showed 1600 IU alpha tochopherol supplementation significantly reduced HbA1c levels (25). Jain et al. have shown this reduction by 100 IU vitamin E in type 1 diabetic patients (26). Also this reduction was seen in the studies by Paolisso et al. (27) and Ceriella et al. (28).

In our study no significant changes in HbA1c were observed. It might be due to use of high dosage of vitamin E in other studies that could cause toxicity. Such these results were shown in other studies (14,29 and 30). In Ble Castilo's study, administration of 800 IU/day alpha tochopherol for 6 weeks has not beneficial effect on serum glucose and HbA1c in type 2 diabetic women (14).

High dose vitamin E supplementation can improve insulin activity and decrease fasting insulin with oxidative stress reduction. In one study it was seen that 900 IU/day vitamin E can improve insulin due to oxidative stress reduction (31). Manzella et al. showed 600 IU/day vitamin E supplementation reduced HbA1c, plasma insulin, HOMA and also oxidative stress indexes (16). Nevertheless, some studies did not accomplish to show the effect of vitamin E on HOMA and oxidative stress (23,32 and 17).

In our study HOMA decreased but this was not significant. It might be due to poor diabetes control in our patients.

Some studies have shown that vitamin E has beneficial effects on plasma lipids (17,26). In Paolisso's study vitamin E administration reduced triglycerides, total cholesterol and LDL (27). In another research 100 IU/day vitamin E in diabetic patients reduced serum triglycerides significantly (26). While some studies did not show the effect of vitamin E on lipids (20,31 and 32).

There is inverse relationship between serum vitamin E level and blood pressure (33). Some studies have shown that vitamin E reduces blood pressure (34). In Boshtam's study 70 subjects who had mild blood pressure randomly received 200 IU/day vitamin E or placebo. The results of this study showed that vitamin E administration can reduce blood pressure significantly (35). While another studies did not show the beneficial effect of vitamin E on blood pressure (36).

CONCLUSION

Overall, in our study FBS, fasting insulin and HOMA decreased, but it was not significant. Perhaps this was due to insufficient samples, dosage or short duration of research. So, further studies with longer duration and higher dosage are suggested.

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REFERENCES

1. Wild SH, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. Diabetes Care 2004;27(10):2569.
2. Larijani B, Zahedi F, Aghakhani SH. Epidemiology of diabetes mellitus in Iran. Shiraz E-Medical Journal 2003;4:4.
3. The Diabetes Control and Complications Trial Research Group. The effect of intensive treatment of diabetes on the development and progression of long-term complications in insulin-dependent diabetes mellitus. New Engle J Med 1993; 329: 977–986.

4. Baynes JW, Thorpe SR. The role of oxidative stress in diabetic complications. Current Opinion in Endocrinology 1996;3:277–284.
5. Giugliano D, Ceriollo A, Paolisso G. Oxidative stress and diabetic vascular complications. Diabetes Care 1996;19: 257–267.
6. Rosen P, Nawroth PP, King G, Moller W, Tritschler HJ, Packer L. The role of oxidative stress in the onset and progression of diabetes and its complications: a summary of a Congress Series sponsored by UNESCOMCBN, the American Diabetes Association, and the German Diabetes Society. Diabetes Metab Res Rev 2001;17:189–212.
7. Nishikawa T, Edelstein D, Brownlee M. The missing link: a single unifying mechanism for diabetic complications. Kidney Int 2000;58:26–30.
8. West IC. Radicals and oxidative stress in diabetes. Diabet Med 2000;17:171–180.
9. Paolisso G, Giugliano D. Oxidative stress and insulin action. Is there a relationship? Diabetologia 1996;39:357–363.
10. Rudich A, Kozlovsky N, Potashnik R, Bashan N. Oxidant stress reduces insulin responsiveness in 3T3–L1 adipocytes. Am J Physiol 1997;35:E935–E940.
11. Brownlee M. Biochemistry and molecular cell biology of diabetic complications. Nature 2001; 414:813-820.
12. Ahmad M, Khan AS. Naturally occurring antioxidant vitamin levels in patients with type II diabetes mellitus. J Ayub Med Coll Abbottabad 2003;15:54-57.
13. Merzouk S, Hichami A, Madani S, Merzouk H, Berrouiguet AY, Prost J, et al. Antioxidant status and levels of different vitamins determined by high performance liquid chromatography in diabetic subjects with multiple complications. General physiology and biophysics 2003;22(1):15-28.
14. Watts GF, Playford DA, Croft KD, Ward NC, Mori TA, Burke V. Coenzyme Q10 improves endothelial dysfunction of the brachial artery in Type II diabetes mellitus. Diabetologia 2002;45(3):420-426.
15. O'Connel B. Select vitamins and minerals in the management of diabetes. Diabetes Spectrum 2001;14:133-148.
16. Manzella D, Barbieri M, Ragno E, Paolisso G. Chronic administration of harmacologic doses of vitamin E improves the cardiac autonomic nervous system in patients with type 2 diabetes. Am J Clin Nutr 2001;73:1052–1057.
17. Reaven PD, Herold DA, Barnett J, Edelman S. Effects of Vitamin E on susceptibility of low-density lipoprotein and low-density lipoprotein subfractions to oxidation and on protein glycation in NIDDM. Diabetes Care 1995;18:807-816.
18. Park S, Bong Choi S. Effects of α-tocopherol supplementation and continuous subcutaneous insulin infusion on oxidative stress in Korean patients with type 2 diabetes. Am J Clin Nutr 2002;75:728-733.
19. The Alpha-Tocopherol, Beta-carotene Cancer Prevention Study Group. The effect of vitamin E and beta carotene on the incidence of lung cancer in male smokers.N Engl J Med 1994;330:1029–1035.
20. Collaborative Group of the Primary Prevention Project (PPP). Low-dose aspirin and vitamin E in people at cardiovascular risk: a randomised trial in general practice. Lancet 2001;557:89–95.
21. GISSI-Prevenzione Investigators (Gruppo:Itallano per lo Studio della opravvivenzanell' Infarto miocardico). Dietary supplementation with n-3 polyunsaturated fatty acids and vitamin E after myocardial infarction:results of the GISSI-Prevenzione trial. Lancet 1999; 354:447–455.
22. American Diabetes Association. Standards of medical care in diabetes-2006. Diabetes Care 2006;29:4-42.
23. Manning PJ, Sutherland WHF, Walker RJ. Effect of High-Dose Vitamin E on Insulin Resistance and Associated Parameters in Overweight Subjects. Diabetes Care 2004;27:2166–2171.
24. Halliwell B. Vitamin E and the treatment and prevention of diabetes: A case for a controlled clinical trial. Singapore Med J 2002;43:479-484.
25. Gazis A, White DJ, Page SR, Cockcroft JR. Effect of oral vitamin E(alpha-tocopherol) supplementation on vascular endothelial function in Type 2 diabetes mellitus. Diabetic Medicine 1999;16(4):304-311.
26. Jain SK, McVie R, Jaramillo JJ, Palmer M, Smith T. Effect of modest vitamin E supplementation on blood glycated hemoglobin and triglyceride levels and red cell indices in type I diabetic patients. Journal of the American College of Nutrition 1996;15(5):458.
27. Paolisso G, D'Amore - Galzerano D, Balbi V, Giugliano D, Varricchio M, D'Onofrio F. Daily vitamin E supplements improve metabolic control but not insulin secretion in elderly type II diabetic patients. Diabetes Care 1993;16:1433–1437.

28. Ceriello A, Giugliano D, Quatraro A, Donzella C, Dipalo G, Lefebvre PJ. Vitamin E reduction of protein glycosylation in diabetes. New prospect for prevention of diabetic complications? Diabetes Care 1991;14(1):68.
29. Gomez-Perez FJ, Valles-Sanchez VE, Lopez-Alvarenga JC, Choza-Romero R, Ibarra PJJ, Gonzblez OR, et al. Vitamin E modifies neither fructosamine nor HbA1c levels in poorly controlled diabetes. Rev Invest Clin 1996;48(6):421-424.
30. Lonn E, Yusuf S, Hoogwerf B. Effects of Vitamin E on Cardiovascular and Microvascular Outcomes in High-Risk Patients with Diabetes. Diabetes Care 2002;25: 1919–1927.
31. Cinaz P, Hasanoglu A, Bideci A, Bilberoglu G. Plasma and erythrocyte vitamin E levels in children with insulin dependent diabetes mellitus. J Pediatr Endocrinol Metab 1999;12:193-196.
32. Boshtam M, Rafiei M, Sarraf-Zadegan N. Effect of vitamin E supplementation on type II diabetic patients. Journal of shaheed Sadoughi University of medical sciences and Health services 2003;10:32-40.
33. Moor de Burgos A, Wartanowicz M, Ziemlanski S. Blood vitamin and lipid levels in overweight and obese women. Eur J Clin Nutr 1992;46:803-808.
34. Pezeshk A, Dalhouse AD. Vitamin E, membrane fluidity, and blood pressure in hypertensive and normotensive rats. Life Sciences 2000;67:1881-1889.
35. Boshtam M, Rafiei M, Sadeghi K, Sarraf-Zadegan N. Vitamin E can reduce blood pressure in mild hypertensives. Int J Vitam Nutr Res 2002;72:309-314.
Palumbo G, Avanzini F, Alli C, Roncaglioni MC, Ronchi E, Cristofari M, et al. Effects of vitamin E on clinic and ambulatory blood pressure in treated hypertensive patients. Am J Hypertens 2000;13:564-567.