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Original Article

Effects of Antioxidant vitamin supplements on lipid profiles and antioxidant capacity in cardiovascular patients

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ABSTRACT

Objective

To assess effects of vitamin E and C supplements on lipid profiles and antioxidant capacity in cardiovascular disease (CVD) patients.

Subjects and Methods

Forty CVD patients with age 57.7±10.6 years were selected to consume vitamin C and E daily for two months. Plasma lipid profile concentrations and antioxidant capacity were measured.

Results

There was a decrease in cholesterol of 20%, triglyceride 21.9%, LDL 30.1%, and increase HDL 25.7% and an increase in antioxidant capacity of 62.8% (P<0.0001) .

Conclusion

The results showed that use of antioxidant supplements improved lipoprotein profile in parallel with increase in plasma antioxidant capacity. (Rawal Med J 2011;36:251-254).

Key words

Cholesterol, antioxidents, vitamin E, vitamin C.

INTRODUCTION

Many CVD risk factors interact physiologically in its etiology.[1] Serum cholesterol and triglyceride are well known risk factors for CVD,[2] and lipid peroxidation and LDL oxidation are considered to be the indicator of early atherosclerosis.[3] Oxidation of LDL is a process initiated and propagated by free radical and occurs mainly in the arterial wall where antioxidants may become depleted leading to oxidative stress.[4] Antioxidants are either produced in the body (endogenous) including enzymes or derived from vitamins in diet or supplements (exogenous).[5,6] A number of clinical studies indicate that supplementation with antioxidants such as vitamins E and C increase the resistance of LDL to oxidation although it is not clear in such short-term studies whether they reduce the severity of atherosclerosis.[6] Vitamin C works synergistically with vitamin E to quench free radicals and regenerate the reduced form of vitamin E.[7] These vitamins are known Reactive oxygen species (ROS) scavenger that can effectively prevent the initiation of lipid peroxidation and the formation of lipid peroxides.[5,7] Patients with CVD usually have dyslipidemia[8] and decreasing serum cholesterol also decreases heart disease mortality.[9] In vitro studies have shown that LDL oxidation does not occur appreciably until the endogenous vitamin E has been oxidized.[10]

Patients with atherosclerosis have an excessive increase in lipid peroxidation which depends on the generation of oxygen free radicals, the presence of lipid substrates, and the activity of antioxidants.[11] Once formed, lipid hydroperoxides can decompose into a specific metabolite which possess cytotoxic, mutagenic and genotoxic properties such as malondialdehyde (MDA), which is one of the most frequently used markers of lipid peroxidation in biological system.[12]

Vitamin E is a major lipophilic antioxidant that inhibits the free radical-mediated peroxidation of the polyunsaturated fatty acids in cell and organelle membranes.[7,12] Vitamin C is a hydro-soluble antioxidant which capable of completely inhibiting oxidative modification of LDL.[7,10] There are discrepancies in the efficacy of vitamins E and C either alone or in combination on parameters of lipid profiles and lipid peroxidation in CVD patients.[13,14] The present study was, therefore, undertaken to determine the potential impact of short-term consumption of vitamin E and C supplements on plasma antioxidant capacity, lipid profiles and lipid peroxidation in CVD patients.

SUBJECTS AND METHODS

The subjects included 40 CVD patients with age 57.7±10.6 years admitted to the intensive cardiac care units (CCU and Post-CCU) at Khatam-Al-Anbia Hospital of Zahedan University of Medical Science (ZUMS), Iran. The clinical criteria included chest pain lasting for up to 3 hours, echocardiographic changes and CPK and CKMB activities. The control group included 63 healthy persons with age 56.4±11.3 years, without any medical history. Both groups were not on vitamin supplements. The study protocol was approved by the Ethics Committee of ZUMS and informed consent was

obtained from all participants. All subjects were given vitamin C tablet 500 mg (Darou Pakhsh, Pharmaceutical Mfg. Co, Tehran, Iran) and vitamin E softgel 400 mg (Davie, FL 33317, USA) orally for two months. The food consumption of all subjects was same duration of study. They were allowed to take their regular medication.

After completion of two months, 7 ml of blood was taken from patients in fasting state. The anticoagulant heparin was used for measurement of total antioxidant capacity of plasma. Serum cholesterol, triglyceride and HDL levels were measured (Parsazmun, Tehran, Iran, RA-1000 auto-analyzer). LDL value was calculated by friedwald formula.[15] Total antioxidant capacity (TAC) of plasma was measured by the ferric reducing/antioxidant power (FRAP) assay.[15]

Statistical analysis: Data are presented as mean ± SD. Statistical analysis was performed by SPSS v 11.5. Paried student t tests were used to determine the significance of changes by the intervention. Pearson's correlation coefficient was used to determine the relationship between variables. P value of <0.05 was considered statistically significant.

RESULTS

Thirty-one patients completed the study. **S**ystolic and diastolic blood pressure in patients were higher as compared to controls ($P<0.0001$). After intervention, there was significant decrease in blood pressure ($P<0.0001$), though it still remained higher than controls ($P<0.0001$). There was not significant difference between BMI of subjects and controls too ($P>0.05$) (Table 1).

Table 1. Baseline characteristics of the patients.

Variables	**CVD patients**	**CVD patients**	**Control group n=63**
Parameters	Month 0 (n=40)	Month 2 (n=31)	
Age	57.7±10.6	-	56.4±11.3
BMI	27.4±4.9	26.9± 4.8	26.5±4.6
Blood pressure (mm/Hg) Systolic	146.3±17.2 [1,2]	125.3±17 [2]	113.1±12.7
Diastolic	93.3±12.6 [2]	78.9±11.6 [2]	72.6±9.4
CPK (U/L) Range	199.7±262.7[1,2] (40 - 1035)	122.2±124.8 (31- 651)	(34 - 189)
CKMB(U/L)	40.2 ± 23.3[1,2]	29.5 ±15.3 [2]	14.4 ± 4.8

Values are mean ± SD. [1]Month 0 vs. month 2 of CVD patients. P<0.0001. [2]Month 0, 2 of patients vs. control group P<0.05

After 2 months intervention, there was 14.3% and 15.4% reduction (P<0.05) in systolic and diastolic blood pressure in the patients respectively, but there was not significant reduction in BMI.

The antioxidant vitamins E and C resulted in a significant decrease in cholesterol, triglyceride, LDL, TC/HDL and increase HDL concentrations in CVD patients (P<0.0001) (Table 2). We found significantly correlation between cholesterol and LDL (r= 0.86, P<0.0001). It was also observed negative significantly correlation between HDL with cholesterol (r= -0.47, P=0.007) and LDL (r= -0.73, P<0.001)

Table 2. Lipid profiles and TAC before and after intervention.

Groups	**CVD patients**		**Control n=63**
Parameters	Month 0 (n=40)	Month 2 (n=31)	
Total cholesterol (mg/dL)	222.8 ±43.9 [1,2]	183.1±22.1	180.2 ±29.3
Triglyceride (mg/dL)	159.7 ±73.6 [1,2]	124.7 ±57.3	114.3 ±45.1
LDL (mg/dL)	145.9 ±51.1 [1,2]	101.9 ±32.6	99.4 ±27.2
HDL (mg/dL)	44.7 ±13.0 [1,2]	56.2 ±13.9	57.0 ±12.6
TC/HDL	5.0 [1,2]	3.3	3.2
TAC (µmol/L)	531.3 ±121.7 [1,2]	864.8±228.3	789.4 ±158.5

Values are mean ± SD. [1]Month 0 vs. month 2 of CVD patients P<0.0001. [2]Month 0, 2 of CVD patients vs. controls P<0.0001 TAC=Total antioxidant capacity

After 2 months intervention, there was decrease in MDA and an increase in serum antioxidant capacity significantly (P<0.001). But we failed to show correlation between MDA with lipid profile and TAC in this study. However, we observed significant correlations between them before intervention.

DISCUSSION

Results of this study showed that short term consumption of combination vitamin E and C supplements reduced lipid profile in the CVD patients. In coronary heart disease (CHD) patients LDL and TC/HDL are significantly higher and HDL levels lower than controls.[12,16] After 2 months intervention in the study group, the improvement in HDL suggests the efficacy of vitamin supplements. It was confirmed that negative correlation observed between HDL and LDL. It has been reported, that elevated of plasma LDL and triglyceride accompanied by reduced HDL levels are often associated with an increased risk of CAD.[17] Oxidized LDL is toxic to vascular cells and linked to lipid peroxidation products.[8,18]

Vitamin C has been shown to protect HDL from lipid peroxidation.[19] Besides, HDL assists in delivering tocopherol to the liver and other tissues.[20] The effect of long term supplementation vitamin E and C on serum HDL showed, vitamin E had no effect on HDL levels, whereas vitamin C tended to elevate HDL in men but not women. There is some prior evidence supporting a possible HDL elevating effect of vitamin C.[7] These discrepancies can be attributed to differences in dosages, duration of supplementation, host factors, medication use and genetic disposition.[21]

CVD patients have markedly high levels of MDA, a marker of lipid peroxidation.[23] In our study, after combination antioxidant supplements, there was decrease in MDA and an increase in TAC significantly ($P<0.0001$). High MDA levels before intervention is probably a reflection of either the overproduction of ROS or weak antioxidant status.[15] CVD patients are known to have weak antioxidant defense system resulting in increased levels of lipid peroxidation products.[12,22] Antioxidant supplementation such as beta-carotene, vitamins E and C may be useful in CAD patients by inhibiting LDL oxidation and improving the oxidative balance.[12,23] Ascorbic acid increases oxidation as it can reduce ions which lead to the generation of free radicals through fenton reaction.[5] Our findings showed 62.8% increase in TAC after supplementation, although plasma antioxidant capacity may be affected by non-antioxidant dietary constituents.[24]

CONCLUSION

The antioxidant supplements, vitamin E along with vitamin C decreased serum concentrations of cholesterol, triglyceride, LDL and MDA in parallel to increased HDL

and plasma antioxidant capacity. Nevertheless, further studies are necessary to confirm the physiological relevance of these results.

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