

## Original Article

# Effect of antioxidant vitamins on lipid profile and total antioxidant capacity in hemodialysis patients

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## ABSTRACT

### Objective

To evaluate the effect of vitamins C and E combined on lipid profile and total antioxidant capacity (TAC) in hemodialysis patients.

### Methods

A total of 38 hemodialysis patients received orally a combination of vitamin C (250 mg) and vitamin E (200 I.U) thrice a week for 2 months. Serum cholesterol, LDL, HDL and triglyceride and plasma TAC were measured at baseline and at the end of experimental period.

### Results

A significant increase in the levels of TAC and HDL ( $P < 0.0001$ ) and a significant decrease in the levels of cholesterol, LDL and triglyceride was observed after 8 weeks of supplementation.

### Conclusion

The findings suggest low dose of vitamin C (250 mg) and vitamin E (200 IU) combined for short time are beneficial for improving lipid profile in hemodialysis patients. This improvement could be due to the synergistic effect of both the vitamins. (Rawal Med J 2010;35: ).

## **Key words**

Hemodialysis, lipid profile, total antioxidant capacity, vitamins C and E

## **INTRODUCTION**

Renal failure is a pro-oxidant state, which is characterized by elevated levels of reactive oxygen species (ROS) and defective or insufficient antioxidant protection.<sup>1</sup> Recent studies suggest that patients with end stage renal disease (ESRD) suffer from dyslipidemia resulting from modification in the composition and metabolism of serum lipid and lipoproteins, which are associated with high cardiovascular risk.<sup>2-4</sup> Cardiovascular disease (CVD) is a leading cause of mortality in the hemodialysis patients that can contribute in part, to free radical reactions and depletion of chain-breaking antioxidants.<sup>5,6</sup> Several factors contribute to the increased cardiovascular risk in the presence of renal disease, including smoking, hypertension, dyslipidemia, especially higher susceptibility of low density lipoprotein (LDL) to oxidation and decreased levels of high density lipoprotein (HDL), diabetes mellitus and malnutrition.<sup>7</sup> Since, these patients are at risk to develop CVD, treatment of all risk factors including serum lipids seems necessary.

Several reports have suggested that lower intake of some antioxidants may be important mechanisms in pathogenesis of CVD in the general population and hemodialysis patients.<sup>1,5</sup> A variety of micronutrient antioxidants are able to scavenge free radicals.<sup>8</sup> Among them vitamin E<sup>9,10</sup> and ascorbic acid<sup>11,12</sup> are potent antioxidants that are known to prevent LDL from oxidation. There is conflicting evidence of the efficacy of antioxidant vitamins, either alone or in combination on parameters of lipid oxidative

damage in hemodialysis patients. However, limited data is available in support of combined supplementation of vitamin C and E and their effect on lipid profile status in these subjects. Hence, the present study was undertaken to evaluate the effect of vitamins C and E combined on the serum concentrations of total cholesterol, triglyceride, LDL and HDL and plasma TAC in hemodialysis patients.

## **SUBJECTS AND METHODS**

The subjects included 38 hemodialysis patients (between the age group 22-80 years). All were regularly undergoing hemodialysis two to three times a week for 4 hours with polysulfone dialyzing membrane. The duration of hemodialysis ranged between 7-120 months. Initial causes of renal failure in these patients were: diabetes (n=7), hypertension (n= 7), diabetes and hypertension (n=8), severe glomerulonephritis (n=4), kidney stone (n=3), kidney polycystic (n=1), and unknown (n=8). The protocol of study was approved by the local ethical committee of the Zahedan University of Medical Sciences, Iran and the informed consent was obtained from all the participants. They were allowed to drop out at any time. During the experimental period, 3 patients had withdrawn.

All patients were given orally vitamin C (250 mg L-ascorbic acid) and vitamin E (200 IU, dl- $\alpha$ -tocopheryl acetate) simultaneously, thrice a week for 2 months. The diet was not changed from the previously prescribed for hemodialysis patients. They were allowed to take their regular medication without any antioxidant effect. Biochemical parameters (total cholesterol, HDL and triglyceride) were determined using the commercial available kits (Parsazmun, Tehran, Iran,). LDL values were calculated by friedwald formula.<sup>13</sup> Total antioxidant capacity of plasma was measured by the ferric reducing/antioxidant power (FRAP) assay.<sup>14</sup>

**Statistical analysis:** The results are shown as mean  $\pm$  SD. Statistical evaluation was performed by SPSS software (version 11.5) using paired t-test. Pearson's correlation coefficient was used to determine the relationship between variables. P values less than 0.05 were considered as significant.

## RESULTS

Baseline clinical characteristics of subjects have been shown in Table 1. There were 17 diabetic and 27 hypertensives.

**Table 1. Baseline clinical parameters of patients.**

Parameters	Patients (n=38)
Age (yr) †	52.8 $\pm$ 12.9
Body weight (Kg)†	57 $\pm$ 13
Duration of HD (months)	61.9 (7-120)
Diabetes (%)	44.7%
Hypertension (%)	71.1

† Values are  $\pm$  mean SD

Vitamins C and E supplementation caused a significant increase in total antioxidant status of plasma ( $P < 0.0001$ ). A significant reduction in the levels of cholesterol, LDL and triglyceride ( $P < 0.0001$ ) and a significant increase in HDL concentration ( $P < 0.0001$ ) was shown at the end of the experimental period (Table 2).

**Table 2. Total antioxidant capacity and biochemical data.**

Parameters	Before invention n=38	After invention n=35
TAC ( $\mu\text{mol/l}$ )	1128.5 $\pm$ 246.2*	1302.6 $\pm$ 226
TC (mg/dl)	187.9 $\pm$ 42.8 *	<b>148.9 <math>\pm</math> 33.3</b>
LDL (mg/dl)	116.4 $\pm$ 49.9 *	70.4 $\pm$ 41.2
HDL (mg/dl)	39.1 $\pm$ 11.7 *	53.2 $\pm$ 13.4
TG (mg/dl)	162.1 $\pm$ 78.9 *	125.7 $\pm$ 49.6

TAC: Total antioxidant capacity; TC: Total cholesterol; LDL: low-density lipoprotein; HDL: High-density lipoprotein; TG: Triglyceride. Values are mean  $\pm$  SD. \* $P < 0.0001$  before vs. after intervention

Negative significant correlation between TAC with LDL ( $r = -0.25$ ,  $P=0.02$ ) and HDL with LDL ( $r = -0.57$ ,  $P < 0.0001$ ) was demonstrated after intervention.

## **DISCUSSION**

Total antioxidant capacity (TAC) is considered to be a useful indicator of the system's ability to regulate damage due to ROS.<sup>15</sup> The significant increase in plasma TAC levels by 15.4% after supplementation of vitamins C and E indicates an improvement in the antioxidant status of the body.<sup>10,16</sup> Several studies have demonstrated alterations of LDL and/or HDL, marginally elevates levels of lipid peroxidation products in hemodialysis patients.<sup>1,17</sup> HDL is considered as one of the protective factors against arteriosclerosis, which potentially reduces oxidation of LDL.<sup>18</sup> Thus, HDL, by controlling the level of LDL, can probably reduce the severity of the oxidative stress towards the development of atherosclerotic and/or CVD complications.

Since, oxidation of LDL is mostly a free radical mediated process which is inhibited by antioxidants<sup>3,5</sup>, it has been suggested that an appropriate antioxidant might result in the synergistic inhibition of lipid oxidative damage and retards progression of CVD.<sup>17</sup>

Vitamin E is a well-known peroxy scavenger, which breaks the chain reaction of lipid peroxidation and prevents oxidation of LDL in the cell membrane.<sup>10</sup> Vitamin C, a water-soluble antioxidant, acts as an important factor in lipid regulation,<sup>19</sup> increases HDL levels and protects against LDL oxidation, thus reduces the risk of cardiovascular disease.<sup>3</sup>

There are also conflicting reports regarding the ability, dose amount and time duration of vitamins C and E supplementation individually or combined on lipid profile in hemodialysis patients.<sup>1,9,10,12,20,21</sup> Our findings showed a significant increase of HDL

(36.6%) concentration, significant decrease in cholesterol (20.8%), LDL (39.5%) and triglyceride (22.5%) levels and also reduction of LDL/HDL ratio (3.46 to 1.6,  $P < 0.0001$ ), an important risk factor, for progression of CVD after 8 weeks of combined supplementation of vitamins C and E in these patients suggests the existence of synergistic effect between them.

Though, vitamin E itself is a potent antioxidant, yet its effect is magnified when taken with other antioxidants, especially vitamin C and beta- carotene.<sup>17</sup> Vitamin C regenerates vitamin E from its radical form after it has neutralized free radicals.<sup>17,22</sup> This observation has led to the hypothesis that vitamin C serves to maintain vitamin E in the reduced form, thereby enhancing the in vivo antioxidant potency of  $\alpha$ -tocopherol.<sup>17</sup> Our findings suggest that the increased levels of TAC and improvement of lipid profile especially decreased LDL/HDL ratio might contribute to preventing/slowing the progression of CVD in these subjects. It is confirmed by the negative correlation obtained between TAC and LDL levels.

## **CONCLUSION**

The present study showed that low dose of vitamins C and E combined for short time had favorable effects on lipid profile. This improvement can be considered as a preventive strategy in the progression of CVD in HD patients.

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