

Status of antioxidant and homocysteine-lowering vitamins related to cardiovascular diseases in hemodialysis patients

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Abstract

Background and aim: Cardiovascular disease is the major cause of mortality in hemodialysis patients. Oxidative stress and hyperhomocysteinemia may contribute to an increased risk of CVD. Therefore, we assessed the status of antioxidant and homocysteine-lowering vitamins related to cardiovascular disease in hemodialysis patients at Vasei hospital in Sabzevar.

Methods: In this cross-sectional study, we enrolled 75 hemodialysis patients by using census method at Vasei Hospital in Sabzevar (Iran) in 2014. After measuring height and body weight, food intake was assessed by a 24-hour dietary recall questionnaire for at least two days (a non-dialysis and dialysis day), and food frequency was recorded with Nutritionist IV software. Data were analyzed by SPSS version 16, using descriptive statistical tests, one sample t-test and independent samples t-test and $p < 0.05$ was considered statistically significant.

Results: This study was carried out on 75 patients. Mean age and BMI of patients were 49.95 ± 17.22 years and 20.04 ± 3.38 kg/m², respectively. Intake of all vitamins with the exception of vitamin B12 in hemodialysis patients studied, were less than the recommended dietary allowance (RDA) ($p < 0.05$).

Conclusion: According to the survey, consumption of antioxidants and B-vitamins related to cardiovascular disease was less than RDA in hemodialysis patients.

Keywords: Antioxidant, B- vitamin, Hemodialysis

1. Introduction

Chronic renal failure, is the progressive and irreversible destruction of nephrons, and is treated by dialysis or transplantation (1, 2). The number of individuals with kidney failure treated by dialysis and transplantation, is more than 320,000 in the USA (3), and in Iran, over 11,000. There is approximately an 8% increase in dialysis patient annually (4). High mortality from atherosclerotic cardiovascular accidents has long been reported in patients on hemodialysis. Cardiovascular disease is the cause of death in about 34% of hemodialysis patients. Indeed, these individuals have a 10 to 20-fold increased risk of death from cardiovascular diseases (5, 6). Important risk factors for cardiovascular diseases are hypertension, hypercholesterolemia, diabetes mellitus, hyperhomocysteinemia, oxidative stress and consumption of cigarettes in these patients (7, 8). Evidence suggests that the increased lipid peroxidation and depletion of antioxidants in the body, may contribute to increased risk of atherosclerotic cardiovascular diseases. Oxidation of fatty acids in LDL-c cause the release of malondialdehyde and LDL oxidation by macrophages, and lead to the formation of foam cells in the vessel wall. Antioxidants such as vitamin C and E prevent oxidation of LDL-c. Studies indicate that concentration of malondialdehyde (peroxidation product of lipids)

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in plasma and red cells increased and concentration of antioxidants decreased in patients with renal failure (9, 10). Hyperhomocysteinemia or elevated homocysteine ≥ 15 Mmol / L, is the most common cardiovascular diseases risk factor in chronic renal failure, and occurring in 83 to 91% of patients (11). Homocysteine is produced during the analysis of amino acid lysine. In renal failure, high levels of serum homocysteine is due to lack of re-methylation that causes deficiency of folic acid and vitamin B12. Studies have shown an increase in the half-life of homocysteine in chronic renal failure patients caused by a significant reduction in the clearance of homocysteine by the kidney (11). Various studies have indicated that intake of folic acid and vitamin B12 decreases homocysteine levels and cardiovascular events rate in hemodialysis patients (8, 11, 12). Due to the lack of research and increased risk of cardiovascular disease in hemodialysis patients, and high prevalence of oxidative stress and hyperhomocysteinemia in these patients, we decided to determine the status of antioxidant and homocysteine-lowering vitamins related to cardiovascular disease in hemodialysis patients.

2. Material and Methods

In this cross-sectional study, we enrolled 75 hemodialysis patients by using census method at Vasei Hospital in Sabzevar, Iran in 2014. Patients on hemodialysis for at least 2 months were eligible to enter the study. All patients regularly received 3 to 5 hours of hemodialysis with cellulose or polyacrylonitrile dialyzing membranes two or three times a week. Following written informed consent by patients, after dialyzing, the height and weight were measured with tape and Seca scale, respectively, with 100g and 1cm accuracy recorded. Body mass index (BMI) using the formula weight (in kilograms) to squared height (in meters) was calculated. A questionnaire was used for data collection. Food intake was assessed by a 24-hour dietary recall questionnaire for at least two days (dialysis and non-dialysis day). Thus, all the patients were asked to take note of all foods and drinks that were eaten in the past 48 hours. To help patients to recall the exact amount of food eaten, a domestic scale in the form of dishes and cups were used. Amount of food eaten was converted to grams (13). Also, all food items were coded according to the Nutritionist IV program, and, to determine nutrients intake, were entered into this software. SPSS version 16 (SPSS Inc., Chicago, Illinois, USA) used for analysis data and demographic data, were reported as Mean \pm SD. We used one- sample t-test to compare means of vitamin intake to Recommended Dietary Allowance (RDA) (14) and independent samples t-test. $p < 0.05$ was considered statistically significant.

3. Results

Of 75 patients, 33 (44%) were men and 42 (56%) were women. Their mean age was 49.95 \pm 17.22 years. Table 1 shows demographic characteristics of the hemodialysis patients in the present study. Tables 2 and 3 show average of antioxidants and homocysteine-lowering vitamins intake in male and female hemodialysis patients compared with RDA. According to our findings, receiving all nutrients except vitamin B12 was less than RDA in hemodialysis patients. Intake of vit A, vit E, vit C and vit B9 in men were 29%, 7%, 52%, 32% respectively and in women were 32%, 7.5%, 76% and 33% respectively ($p < 0.05$), but intake of vit B12 in men was 90%, and in women, 80% ($p > 0.05$).

Table 1. Demographic characteristics of the hemodialysis patients in the present study

Variable	Mean \pm SD
Age (year)	49.95 \pm 17.22
BMI (kg/m ²)	20.04 \pm 3.38
Duration dialysis (month)	25 \pm 21
KV/t	1.5 \pm 0.7

Table 2. Average of antioxidants and B-vitamins intake in male hemodialysis patients compared to RDA

Variable	Mean \pm SD	Percent of RDA	p-value
Vitamin A	265.49 \pm 202.34	29%	<0.001
Vitamin E	1.09 \pm 0.58	7 %	<0.001
Vitamin C	47.34 \pm 42.9	52%	<0.001
Vitamin B ₉	127.89 \pm 105.70	32%	<0.001
Vitamin B ₁₂	2.16 \pm 2.48	90%	Non-significant

Table 3. Average of antioxidants and B-vitamins intake in female hemodialysis patients compared to RDA

Variable	Mean±SD	Percent of DRA	P value
Vitamin A	225.40±207.27	32%	<0.001
Vitamin E	1.16±0.56	7.5%	<0.001
Vitamin C	56.91±1.78	76%	<0.05
Vitamin B ₉	132.01±86.69	33%	<0.001
Vitamin B ₁₂	1.89±1.87	80%	NS

4. Discussion

Cardiovascular disease is the major cause of death in hemodialysis patients. Lipid peroxidation and antioxidant depletion is one of the major causes of increased risk of atherosclerosis disease in these patients (9, 10). Oxidative stress is caused by contact lymphocytes with dialysis filters, microbial contamination of dialysis solution, accumulation of peroxidants, loss of water-soluble oxidants such as vitamin C during dialysis, and use of drugs including erythropoietin and intravenous iron (15-17). Vitamin C reduces oxidative stress by inhibiting lipid peroxidation and free radical production. However, due to being dissolved in water and the lack of binding to plasma proteins, it easily passes through the dialysis membrane (18, 19). In these patients, 200 mg of Vitamin C per week is lost by dialysis (18). Different studies in hemodialysis patients have shown that antioxidant vitamins E and C levels are low (9, 10, 20, 21). In this study, mean of dietary intake of fruit and vegetables was 0.5 and 1.2 servings respectively. Hemodialysis decreased serum antioxidant vitamin E because of free radicals produced during the dialysis (10). It seems that low intake of vitamins A and E, is due to reduced oil consumption and high-fat dairy products. On the other hand, hypercholesterolemia and hyperlipidemia are common in hemodialysis patients (22-25). The dialysis outcomes and practice pattern study (DOPPS) showed a direct association between regular use of water-soluble vitamins and lower cardiovascular mortality in hemodialysis patients (12). Most studies are emphasized on the role of supplementation with folic acid and vitamin B12 in the treatment of hyperhomocysteinemia in renal failure patients (8, 11, 12). In this study, intake of folate was low because hemodialysis patients were limited to consuming folate rich vegetables because of limitations in potassium intake. But vitamin B12 intake was enough in these patients.

5. Conclusions

The present findings indicate that consumption of antioxidants and B-vitamins related to cardiovascular disease was less than RDA in hemodialysis patients. If further studies confirm, the results could have great public implication, as diets rich in B-vitamins and antioxidants are inexpensive means of targeting cardiovascular disease risk in hemodialysis patients.

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Conflict of Interest:

There is no conflict of interest to be declared.

Authors' contributions:

All authors contributed to this project and article equally. All authors read and approved the final manuscript.

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