STUDY OF MDA, ANTIOXIDANT VITAMINS, LIPOPROTEINS SERUM LEVELS AND ANTHROPOMETRY PARAMETERS IN CORONARY ARTERY DISEASE PATIENTS

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SUMMARY: To compare the serum level of MDA (malondialdehyde), antioxidant vitamins, lipoproteins and anthropometry parameters, of 40 patients with coronary artery disease (CAD) and at least one vessel stenosis more than 70% and 40 healthy persons (control group) with mean age of 53.7±9.45 years were selected for this study. All patients and the healthy controls were evaluated in aspects of anthropometry parameters including weight, height, Basal Metabolic Index (BMI) and waist to hip ratio, angiographic status of coronary arteries (only in patient group), serum levels of triglyceride, cholesterol, LDL-C, HDL_2, HDL_3, MDA and vitamins E and C.

Results showed that BMI and waist to hip ratio in patients were significantly elevated in control group ($p<0.01$) whereas serum levels of antioxidant vitamins were lower ($p<0.001$). Serum levels of MDA in the patients were increased significantly in comparison with the control group ($p<0.001$). LDL/HDL ratios were higher and Vitamin E/Cholesterol ratios were lower of patients compared to the control group.

These results suggest that decrease of antioxidant vitamins and increase of MDA serum levels play important roles in the pathogenesis of CAD.

Key Words: Vitamin E, Vitamin C, lipoproteins, antioxidants, malondialdehyde.

INTRODUCTION

The evidence shows that the increase of low-density lipoprotein levels in serum is a major risk factor of atherosclerosis. Acetylated LDL and oxidized LDL form the initial stage of atheroma (1). It is believed that LDL is mainly oxidized in intima where antioxidant concentration is less (2). Different antioxidants inhibit LDL oxidation and therefore reduce atheromatous damages. These include probocol, α-Tochoferol, Hydroxy Toloene and N, N-Diphenyl Phenylen diamine (3).

Sofos and Raharjo reported that MDA is the important marker of lipid peroxidation (4). Belch *et al.* showed that progression of atherosclerosis is correlated with oxidative stress and can be followed up by MDA measurements (5). The study of the effect of food consumption enriched with vitamin E on MDA plasma levels, as final products of lipid peroxidation, confirms that increased concentration of vitamin E reduces MDA levels in the menopausal women (6). Antioxidant vitamins, especially vitamin E,

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prevent the rate of progression of atherosclerosis by metabolizing free radicals of lipid peroxidation (7). David *et al.* showed a meaningful relation between vitamin E and MDA in myocardial cells of hypertensive rats (8). Recently it was reported that vitamin E complement reduces vascular damages and prevents plaque progression (9). The results of Katalin and co-workers' studies show that the adequate or increased concentration of vitamin E reduces significantly the mortality risks generally in diseases, specifically in heart diseases (10). Statistical studies show a reverse relation between vitamin E consumption and CAD (r=-0.49), cerebrovascular diseases (r = -0.68) and mortality due to both diseases (r =-0.63). Hallfrisch *et al.* reported a direct relationship between HDL-C and especially HDL_2 with plasma level of vitamin C (11). Moreover, Horsey and co-workers suggest that the use of 1 gram vitamin C daily for six weeks till sixty months will increase HDL-C level to 8–15 mg/dl (12). The use of 2 grams vitamin C for six weeks increases HDL-C level to 3.4 mg/dl. Buzzard and co-workers reported similar results (13). The present study compared the level of antioxidant components, MDA, lipoprotein serum levels and anthropometry parameters in CAD patients with that of the control group.

MATERIAL AND METHODS

Patient selection

Forty patients (mean age of 53.7 years) with more than 70% stenosis of coronary arteries and 40 normal individuals were selected as a control group. All individuals had no organic dysfunction and were of similar age and sex. All patients and control group were evaluated by the following parameters:

1- Coronary arteries angiography (only for patients),

2- Anthropometry parameters (including weight, height, BMI and waist to hip ratio),

3- Serum levels of vitamins E and C,

4- Serum levels of Malon Di-Aldehyde, HDL_2 and HDL_3.

Sampling

Ten ml of blood was taken under fasting conditions from median-vein of each patient. Eight ml of this was transferred to one tube and the remaining 2 ml was transferred to a centrifuge tube containing 2 mg EDTA. Both tubes were covered by aluminum foil and then centrifuged in 150 g for 10 minutes to separate serum and plasma, respectively.

Plasma levels of vitamin C, vitamin E, MDA, HDL-C and its fractions were measured by 2,4 Di Nitrophenyl Hydrazine, HPLC, Saton and Heparin-Magnesium methods, respectively. Angiography was performed by percutaneous femoral approach method. All data were analyzed by using SPSSW, MINITAB and statistical methods of t-test, ANOVA, Paired t-test and Pearson correlation co-efficient.

RESULTS

This study evaluated MDA, antioxidant vitamins, lipoprotein serum levels and anthropometric parameters in healthy persons (control) and coronary artery disease (CAD) patients. Table 1 shows anthropometry parameters, lipids, lipoproteins, antioxidant vitamins and MDA serum levels of patients and of control group. There was no significant difference between two groups with respect to age and weight. BMI of patients (>25 kg/m^2) was significantly different from BMI of the control group that shows grade one obesity ($p<0.001$). In addition, high ratio of W/H was observed among the patients with upper abdominal obesity. Cholesterol and LDL-C serum levels and ratio of LDL/HDL in patients were significantly different from control group ($p<0.001$). For example, cholesterol and LDL-C serum levels and ratio of LDL/HDL in patients were 33, 44, and 55% more than the control group, respectively. Mean of antioxidant vitamins C and E and MDA in patients were 0.91 mg/dl, 5.30 μg/ml, 4.19 μmol/l, respectively ($p<0.001$).

DISCUSSION

Lipid and lipoprotein changes in heart patients were studied comprehensively. The increase of cholesterol, triglyceride, LDL-C and the decrease in HDL-C, its fractions in the serum of CAD patients have been documented in different societies (14,15). Studies show that the serum levels of heart risk factors mainly depend on nutrition quality, muscular activity, geographical distribution, addiction to alcohol and tobacco, stress and mental position of persons throughout the world (16,17). Uiterwall and co-workers showed that HDL changes and its fractions are the early and major parameters for possible indications of atherosclerosis in the future (18). It is reported that the presence of α-tocopherol in HDL_3 particles will prevent the HDL-C oxidation of macrophages and by this action formation of initial plaque will be inhibited (19).

Table 1: Anthropometric and biochemical parameters in patients with CAD and controls.

Parameters	Controls (x±SD) (n=40)	Patients (x±SD) (n=40)
Age (year)	50.00±10.50	53.70±9.45
Weight (kg)	80.20±9.80	76.17±10.33
BMI (kg/m^2)	24.80±4.90	28.32±5.30**
W/H	0.82±0.11	0.96±0.15**
TG (mg/dl)	156.00±45.00	189.00±71.92*
Cholesterol (mg/dl)	185.00±22.00	245.35±46.13*
HDL-C (mg/dl)	37.30±4.20	33.64±8.07*
HDL_2 (mg/dl)	14.90±1.70	10.33±3.05*
HDL_3 (mg/dl)	23.90±2.50	23.54±6.08**
LDL-C (mg/dl)	123.00±14.30	177.32±39.80*
MDA (μmol/L)	3.20±0.40	4.19±0.59*
Vitamin E (μg/ml)	8.68±2.74	5.0±1.92*
Vitamin C (mg/dl)	1.39±0.18	0.91±0.13*
Vitamin E/Chol (μmol/mmol)	2.90±0.86	1.98±0.95*
LDL/HDL	3.43±0.26	5.34±1.26*

* Significant: $p<0.001$ (Tukey-HSD test)

** Non-significant: $p>0.01$ (Tukey-HSD test)

Raharjo and Sofos reported that MDA is the important marker of lipid peroxidation (4). The result of this study showed that there was a meaningful difference between lipid and lipoprotein serum levels in CAD patients and the control group. The ratio of patients LDL/HDL had significant increase when compared to that of the control group ($p<0.001$). On the other hand, the characteristic of anthropometry parameters in patients shows a significant increase in BMI and W/H when compared to control group. BMI equal to 28.32 indicates patients' overweight. The high rate of W/H in CAD patients in contrast with control group confirms the abdominal fat accumulation in the mentioned group. The result of MDA was also supporting other researches. The meaningful increase of MDA in CAD patients confirmed the increase of cholesterol and LDL serum levels and also decrease in HDL-C amount especially HDL_2. The reduction of serum level antioxidant vitamin is another cause for increase of MDA in studied patients.

Observational studies showed a negative relationship between vitamin C serum level with cholesterol and a positive relationship with HDL (20). It is also shown that vitamin C prevents the oxidation of lipid *in vitro* and *in vivo* conditions which may be accompanied by vitamin E (21). On the other hand, adequate consumption of vitamin E is followed by a reduction of coronary risk factors. Considering the antioxidant property of these vitamins can explain the reverse relation of vitamin E and serum level of MDA (22). This meaningful reduction of vitamins E and C in CAD patients is most likely because of reduced consumption of these vitamins. The reason of rising level of antioxidant vitamins in the old ages is probably secondary to increased heart risk factors. Moreover, serum level of vitamins, mentioned above, in control group was also a marker of inadequacy of vitamins E and C for prevention of lipid oxidation. Some researchers believe that the ratio of Vitamin E/Cholesterol is a clear index of vitamin E for showing the CAD in both groups (23). In this study in contrast with control group ($p<0.001$) the ratio of Vitamin E/Cholesterol of patients showed a meaningful reduction. It is, therefore, concluded that increasing mean levels of the anthropometric parameters, serum levels of lipids and lipoproteins and on the contrary the reduction of antioxidant vitamins are the indicators of aggravation of atherosclerosis and produce vascular stenosis. At the end these changes lead to the rise of serum MDA levels.

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