

Oxidative stress and antioxidant vitamins status in coronary heart disease patients

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Abstract

Elevated serum Homocysteine may be an important cause for atherosclerosis formation. The present study was undertaken to assess oxidative stress and antioxidant status in patients with Coronary Artery Disease, and their contribution to the risk of cardiovascular disease. The present series of study was conducted on 50 patients of coronary heart disease and 50 persons as control healthy subjects between the age group 25-70 years of both sexes the following parameters were assessed to elucidate the oxidant-antioxidant status in patients with Coronary artery disease. Serum malondialdehyde (MDA) levels which serve as an index of extent of lipid peroxidation, serum ascorbic acid and vitamin E serve as non enzymatic antioxidant parameters. The increase level of MDA in CHD patients was statistically highly significant as compared to that of normal control group 1.51 ± 0.50 nmoles/ml, as evident by P-value ($P < 0.0001$), The Vitamin C level was found to be significantly decreased to $(0.21 \pm 0.10$ mg%) in Coronary Heart Disease patients ($P < 0.0001$). The vitamin E level was found to be decreased significantly to $(0.20 \pm 0.10$ mg%) in Coronary Heart Disease Patients subject as compared to that of normal controls (1.03 ± 0.31 mg%) as shown by P-value ($P < 0.0001$). The results may be significant in understanding the possible contribution of serum MDA, antioxidant vitamin C and vitamin E in the pathophysiological process of developing the strategies for prevention and early diagnosis.

Keywords: Malondialdehyde, Coronary artery disease, Antioxidant, Free radical, Lipid peroxidation

Introduction

Coronary Artery Disease is the major cause of mortality and morbidity worldwide^[1]. It is associated with various risk factors such as age group (41 – 60 years), male gender, smoking habit and hypertension. Lipid peroxidation which is mediated by free radicals is considered to be the major mechanism of cell membrane destruction and cell damage^[2]. The uncontrolled

production of free radicals is considered as an important factor in the tissue damage induced by several pathophysiological^[3]. The effects of lipid peroxides i.e. endothelial cell damage, uncontrolled lipid uptake, decreased prostaglandin synthesis and associated thrombogenicity, are strongly implicated in the pathogenesis of atherosclerosis. Alteration in the oxidant - antioxidant profile is known to occur in

Coronary Artery Disease^[4]. Oxidative stress due to damage, brought about by free radicals, is also known to influence the response of these patients to therapy. Antioxidants are compounds that dispose, scavenge, and suppress the formation of free radicals or oppose their actions^[5].

Materials and methods

The present series of study was conducted on 50 patients of coronary heart disease and 50 persons as control healthy subjects between the age group 25-70 years of both sexes, in Biochemistry department of S. P. Medical College, Bikaner. A thorough physical examination was carried out on all the patients. 50 patients of coronary artery disease were selected from cardiology OPD and Acute Coronary Care Unit ward, diagnosed by cardiologist.

Analytical grade chemical, kits, standard were used and the following estimations were done:-

1. Estimation of Malondialdehyde (MDA)
2. Estimation of Vitamin C (Ascorbic Acid)
3. Estimation of Vitamin E (tocopherol)

Malondialdehyde was estimated by thiobarbituric Acid (TBA) assay method described by Buege and Aust (1978)^[6]. Serum ascorbic acid was estimated by Roe and Kuethe (1943) using 2,4-dinitrophenylhydrazine^[7]. Estimation of vitamin E was done by spectrophotometric method as described by Barker and Frank (Varley, 1976) using Dipyrindyl reagent^[8].

Statistical analysis: All the values calculated as mean \pm standard deviation. The two groups were analyzed by comparing each parameter by students- t test. The diagnostic statistics namely, sensitivity, specificity, positive predictive value, negative predictive value, accuracy, odds ratio and kappa were calculated for finding the diagnostic values of CHD risk factors. P values were computed using 'chi square' distribution.

Results

Table 1 shows that the comparative amount of MDA, Vitamin C and Vitamin E in control subjects and Coronary Heart Disease Patients.

The mean serum MDA concentration was found to be increased to 3.81 ± 1.0 nmoles/ml with a range of 1.14-5.94 nmoles/ml in Coronary Heart Disease patients. The increase level of MDA in CHD patients was statistically highly significant as compared to that of normal control group 1.51 ± 0.50 nmoles/ml, while it ranged from 0.75-2.85 nmoles/ml as evident by P-value ($P < 0.0001$), The Vitamin C level was found to be significantly decreased to (0.21 ± 0.10 mg%) in Coronary Heart Disease patients as compared to that of normal controls (0.97 ± 0.29 mg%) as shown in by P-value ($P < 0.0001$). The vitamin E level was found to be decreased significantly to (0.20 ± 0.10 mg%) in Coronary Heart Disease Patients subject as compared to that of normal controls (1.03 ± 0.31 mg%) as shown by P-value ($P < 0.0001$).

Table 1: The comparative amount of MDA, Vitamin C and Vitamin E in control subjects and Coronary Heart Disease Patients.

Blood Parameters	Normal Control subjects. (n=50)		CHD Patients (n=50)		Significant	
	Mean \pm S.D.	S.E.	Mean \pm S.D.	S.E.	t	p
Malondialdehyde (MDA) nmol/ml	1.514 ± 0.508	0.071	3.812 ± 1.009	0.142	14.38	0.0001
Vitamin C (mg%)	0.977 ± 0.291	0.041	0.210 ± 0.106	0.015	17.47	0.0001
Vitamin E (mg%)	1.039 ± 0.317	0.0449	0.209 ± 0.101	0.014	17.62	0.0001

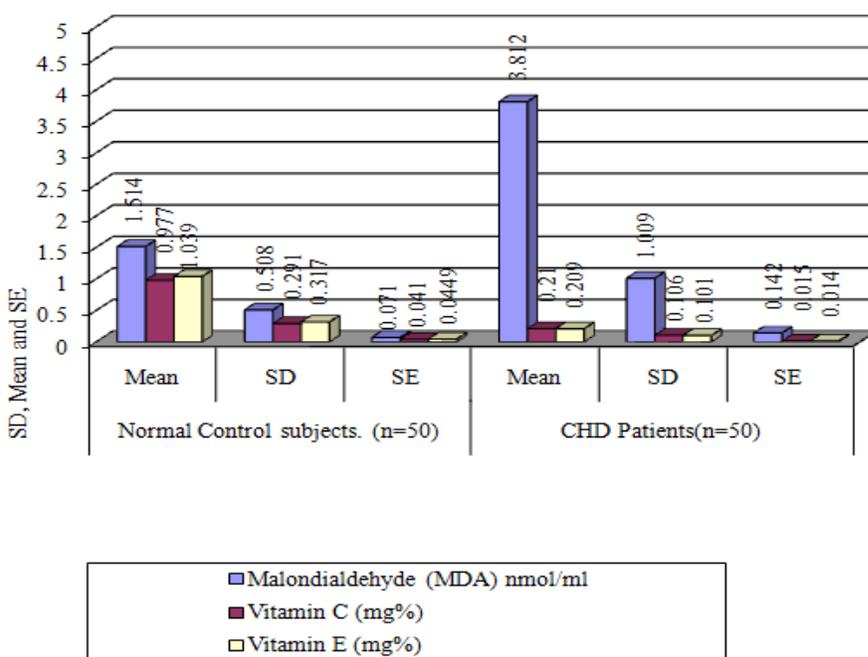


Fig. 1: Comparison of Mean Values of Blood Parameters in Normal Control Subjects with Coronary Heart Disease Patients

Discussion

Due to oxidative stress of lipid peroxidation free radical production increased along with increased formation of reactive oxygen species (ROS). Ascorbic acid act as an antioxidant to nullify the oxidative stress resulted decrease in its concentration in CHD Patients. Malondialdehyde (MDA) is the important marker of lipid peroxidation and progression of atherosclerosis is correlated with oxidative stress, elevated serum level of MDA increased the incident of CHD^[9]. MDA is a decomposition product of auto-oxidation of poly unsaturated fatty acids, which is used as an index of oxidative damage. The rise in MDA concentration indicates increased membrane lipid peroxidation, characterized by hyperlipidemia, specifically hypercholesterolemia, in these patients. Rise in MDA could be due to increased generation of reactive oxygen species (ROS), due to the excessive oxidative damage generated in these patients. .

Antioxidant vitamins influence atherogenesis by interfering oxidative process. Vitamin E is the major lipid soluble antioxidant preventing the formation of lipid hydroperoxides from PUFA, and reduce the risk of CHD^[10]. Vitamin C is the main water soluble antioxidant in human plasma and it have a protective role in the development of atherosclerotic heart disease, by inhibiting low -density lipoprotein oxidation^[11].

The vitamin E level was found to be decreased significantly to $(0.20 \pm 0.10 \text{ mg}\%)$ in Coronary Heart Disease Patients subject as compared to that of normal controls $(1.03 \pm 0.31 \text{ mg}\%)$ as shown by P-value $(P < 0.0001)$. Oxidative stress has been produced by MDA which in turn increased the production of free radical species and α -tocopherol act as free radical scavengers and act as an antioxidant and get itself oxidized to quinone form as reported by Vishnu Priya V, Surapaneni K M.(2008). This may lead to decrease the vitamin E concentration in CHD Patients compared to that of control. That the table-1 reveals that MDA

concentration significantly increased in CHD patients whereas the levels of Vitamin C and Vitamin E concentration significantly decreased in coronary heart disease Patients. Table-1 results were similar to results obtained by previous studies which suggested that MDA concentration significantly increased in CHD patients whereas the levels of Vitamin C and Vitamin E concentration decreased in Coronary heart disease Patients. The result resembled with finding of Masud Pazeshkian et al (2001)^[12], Vishnu Priya V et al (2008)^[13].

Conclusion

Higher prevalence of coronary heart disease was recorded in the non-vegetarian population belonged to higher socioeconomic status. Due to metabolic disorder and obesity, their sedentary lifestyle and lack of physical activity. Higher prevalence of coronary heart disease were recorded in the urban area population belonged to higher and middle socioeconomic status compare to the rural area population. Interestingly, variable serum MDA, Vitamin C and Vitamin E levels were found in coronary heart disease patients. A statistically significant increase in serum Malondialdehyde (MDA) was recorded in the present study in CHD patients as compared to that of control subjects. The result of present study showed that in coronary heart disease patients serum MDA was significantly increased and antioxidant vitamin C and vitamin E level were significantly decreased. Similar results were obtained in some studies done by other researchers. The mean serum antioxidant vitamin C level was found to be decreased significantly in CHD as compared to that of control group. The decrease in serum vitamin C level might be due to various oxygen radical stress have is also capable of directly scavenging radicals and peroxides by being oxidized to preventing cell membrane lipid peroxidation and subsequent

deleterious effects of cellular functions. The mean serum antioxidant vitamin E level was found to be decreased significantly in CHD patients as compared to that of control group. The decrease in vitamin-E level might be due to higher oxidative stress due to increased of lipid peroxidation. Thus, persons who developed coronary heart disease, had increased serum MDA and decreased serum antioxidant vitamin C and vitamin E levels as compared to control group. The results may be significant in understanding the possible contribution of serum MDA, antioxidant vitamin C and vitamin E in the pathophysiological process of developing the strategies for prevention and early diagnosis.

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