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Original Research Article

Comparison of Antioxidant Vitamins and Enzymes in Patients with Alcohol Liver Diseases

Raghuram Chikkala[1], Mohammad Kareemulla Shaik[2], C. S. Umamaheshwara Reddy[3]

[1]Associate Professor, Department of General Medicine, St. Peters Medical College, Hosur, Tamil Nadu, India

[2]Associate Professor, Department of General Surgery, St. Peters Medical College, Hosur, Tamil Nadu, India

[3]Associate Professor, Department of General Medicine, Swami Vivekananda Medical College, Trichangode, Tamil Nadu, India

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Corresponding author: Dr. Mohammad Kareemulla Shaik

Conflict of interest: Nil

Abstract

Background: Alcohol is a hepatotoxic substance. In alcoholic liver patients, there are variations in oxidant and antioxidant profiles, which minimize the damage to liver tissue. By evaluating these parameters, we can study the prognosis of liver damage, morbidity, and mortality of alcoholic liver disease patients.

Method: 65 alcoholic liver disease patients were compared with the same number of healthy (controlled) groups. Clinical and laboratory investigations were carried out using venous blood plasma vitamin E levels by the Baker-Hatal method, ascorbic acid by the Teitz method, and SVD by the Beers-Seizer method.

Results: The comparison of non-enzymatic oxidant parameters. Ascorbic acid, vitamin E, and the comparison of antioxidant enzymes SOD and GPX in both groups were statistically highly significant ($p<0.00$).

Conclusion: It is observed that increased antioxidant enzymes except catalase and decreased non-enzymatic oxidants have diagnostic value in alcohol liver disease patients. These findings will help clinicians to treat such patients efficiently to avoid morbidity and mortality.

Keywords: Antioxidants, Enzymes, SOD, ROS, Hepatotoxic.

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Introduction

Liver damage due to alcohol consumption is one of the major problems globally because alcohol is a hepatotoxin associated with liver injury, including simple steatosis or fatty liver, alcoholic hepatitis, fibrosis, and cirrhosis [1]. Excessive or harmful alcohol use is ranked as one of the top five risk factors for death and disability, with 2.5 million deaths and 69.4 million annual disability-adjusted life years [2].

It alters metabolic pathways and leads to the production of reactive oxygen species (ROS), which have high oxidant properties and are also called free radicals. These free radicals cause lipid peroxidation, and it is considered to be the major mechanism of cell membrane destruction and damage to the liver [3]. In both physiological and pathological conditions of human tissues, free radicals are formed. The uncontrolled production of free radicals plays an important role in tissue damage induced by several patho-physiological conditions. Under such a scenario, there is a variation in oxidant and antioxidant profiles because these oxidants and antioxidants minimize the damage to the liver tissue. Evaluation of these parameters indicates the gravity and degree of liver tissue damage [4]. Hence, an attempt is made to study the concentration of antioxidants, vitamins, and antioxidant enzymes to know the prognosis of patients with alcoholic liver diseases.

Material and Method

65 (sixty-five) adult patients regularly visited the Medicine Department of St. Peters Medical College, Hosur, Tamil Nadu-635130 were studied.

Inclusion Criteria: Alcoholic liver disease patients aged between 25 to 50 years who gave their consent in writing were selected for study.

Exclusion Criteria: non-alcoholic liver disease patients, malignancy of the liver, and patients with renal, cardiovascular, and other systemic diseases. Immunocompromised patients were excluded from the study.

Method

A detailed clinical examination and laboratory investigations were done in both 65 controlled patients (group A) and 65 alcoholic liver disease patients (group B). The venous blood samples were taken from each patient and used for the estimation of ascorbic acid, SOD (superoxide dismutase), GPX (glutathione peroxide), catalase, and MDA (malondialdehyde) in erythrocytes and vitamin E in plasma. The venous blood samples for the analysis were taken in a fasting state and under aseptic conditions. Plasma was separated by centrifugation at 100 rpm for 15 minutes. Separated plasma was used for the measurement of the activity of vitamin E. Ascorbic acid levels were estimated in plasma by the method of Teitz.

Plasma vitamin E levels were estimated by the method of Baker Hetal. SOD (EC1.15.1.1) activity was determined in the hemolysate by the method of Beers and Sizer. The activity of glutathione peroxidase (GPXEC) (1.11.1.9) was measured as described by Pagila and Valentine in erythrocytes. All reagents used were analytic reagents obtained from Sigma Chemicals, St. Louis, Missouri (MO).

The duration of the study was from November 2025 to June 2026.

Statistical analysis: The non-enzymatic oxidant values and antioxidant values in both groups were compared with the z test, and significant results were noted. The statistical analysis was carried out in SPSS software. The ratio of males and females was 2:1.

Observation and Results

Table 1: Comparison of values of non-enzymatic parameters in healthy controlled groups and alcoholic liver disease patients

- Ascorbic acid: 1.62 (± 0.22) in the controlled group, 1.45 (± 0.18) in the alcoholic liver disease patients group, t test 4.82 and p<0.001.
- Vitamin E: 1.75 (± 0.46) in controlled group, 1.38 (± 0.35) in alcoholic group, t test 5.16 and p<0.001.

Table 2: Comparison of antioxidant enzymes in both groups (controlled and alcoholic liver patients)

- SOD: 8.02 (± 0.52) in controlled group, 16.05 (± 0.75) in alcoholic group; t test was 70.9 and p<0.001.
- GPX: 26.06 (± 1.40) in the controlled group, 44.35 (± 1.25) in the alcoholic group, t test was 87.1 and p<0.001
- Catalase (n mole H_2O_2): 11.24 (± 0.32) in the controlled group, 8.64 (± 0.28) in the alcoholic group; t test was 49.2 and p<0.001.

Table 1: Comparison of values of Non-enzymatic parameters in healthy (controlled group) and alcoholic liver disease patients

Parameters of Non-Enzyme oxidants	Controlled group-A (No. of patients 65) Mean value with SD	Alcoholic liver disease patients group-B (No. of patients 65) Mean value with SD	t test	p value
Ascorbic Acid (mg/dl)	1.62 (± 0.22)	1.45 (± 0.18)	4.82	P<0.001
Vitamin E (mg/dl)	1.75 (± 0.46)	1.38 (± 0.35)	5.16	P<0.001

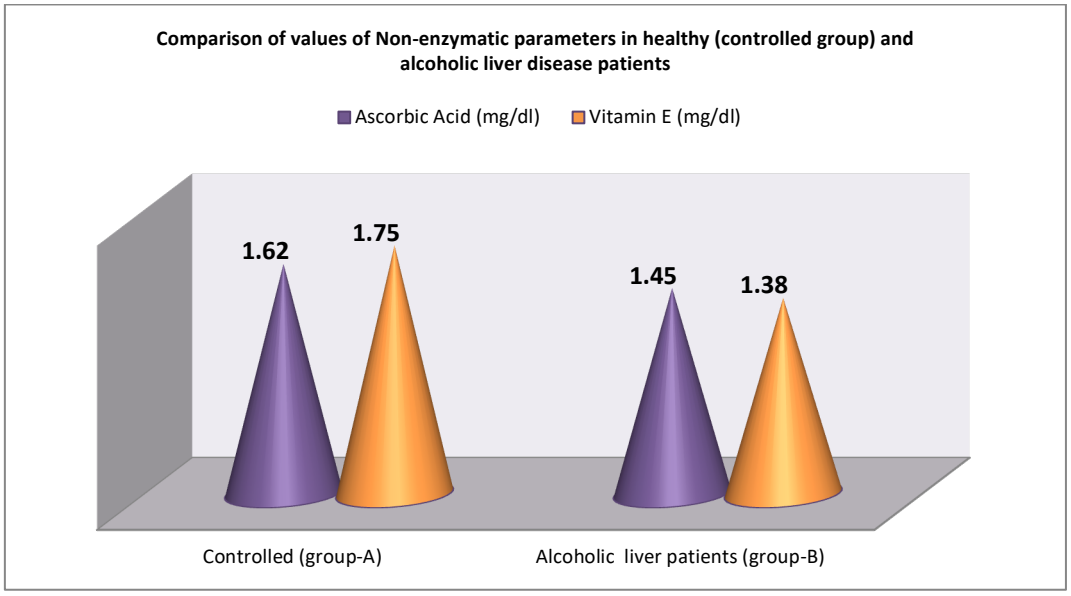

Figure 1: Comparison of values of Non-enzymatic parameters in healthy (controlled group) and alcoholic liver disease patients

Table 2: Comparison of antioxidant enzymes in both groups (controlled group and alcoholic liver patients)

Parameters	Control group-A (No. 65)	Alcoholic liver patients group-B (No. 65)	t test	p value
SOD (U/mg of protein)	8.02 (± 0.52)	16.05 (± 0.75)	70.9	P<0.001
GPX (Gulta thione peroxidise)	26.06 (± 1.40)	46.35 (± 1.25)	87.1	P<0.001
Catalase (n mol H_2O_2) Decomposed/mg protein/I	11.24 (± 0.32)	8.64 (± 0.28)	49.2	P<0.001

All three parameters of anti-oxidant enzyme are highly significant (p<0.001), SOD= Super Oxidedismatase, GPX = Gluta-thioneperoxidase

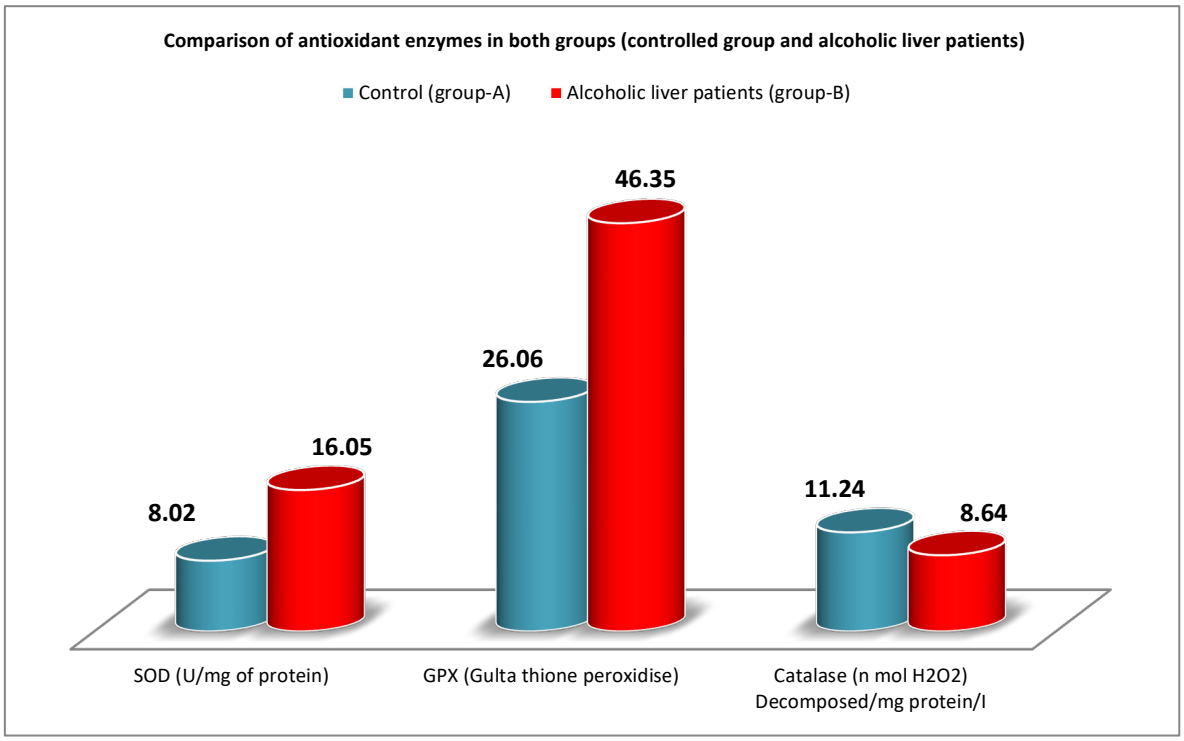

Figure 2: Comparison of antioxidant enzymes in both groups (controlled group and alcoholic liver patients)

Discussion

In the present, a comparative study of antioxidant vitamins and enzymes in alcoholic liver disease patients in the Tamil Nadu population was compared with the same number of healthy groups. Ascorbic acid (mg/dL) and vitamin E (mg/dL) were also compared in both groups, and the p-value was highly significant (p<0.001) (Table 1). Moreover, the antioxidant parameters superoxide dismutase (SOD), glutathione peroxidase (GPX), and catalase (mmol H_2O_2) were compared with the healthy (controlled) group, and the p-value is highly significant (p<0.001) (Table 2). These findings are more or less in agreement with previous studies [5,6,7].

It is widely accepted that oxidation stress plays a central role in alcohol-induced pathogenesis. The liver provides the primary site for alcohol metabolism; therefore, the effects of alcohol are more pronounced in the liver than in any other organ. Here, the detoxification of a variety of compounds in our ingested foods or drugs, including alcohol, by cytochrome P450 molecules uses molecular oxygen and generates ROS. The oxidative damage is further potentiated by an alcohol-induced decrease in antioxidant enzymes and chemicals, particularly glutathione. ROS, either directly or via their generation via mitochondria, are involved in the activation of oxidative stress; activation triggers the induction of inflammatory genes and plays a role in the initiation and progression of chronic inflammatory diseases. A significant decrease in non-enzymatic oxidant parameters, i.e., ascorbic acid and vitamin E, and an increase in the antioxidant enzymes (SOD GPX) clearly suggest an increase in defense against oxidant and non-oxidant damage to liver tissue [8]. It is reported that the level of erythrocyte MDA (malandialdehyde) was significantly higher in patients with alcohol-induced liver disease due to liver damage caused by excess dosages of ethanol, and ethanol toxicity reduces the catalase levels by generating excess ROS, leading to the production of oxidative stress. On the other hand,

acetaldehyde, the metabolic product of ethanol oxidation by alcohol dehydrogenase or by cytochromes, causes the consumption of antioxidants, the activation of antioxidants, and the increased generation of free radicals [9].

Chronic alcohol feeding increases AP1 (activator protein-1) expression in the liver. Activation of API by chronic alcohol is likely to be important in mediating the inflammatory phase of alcohol-induced liver injury, as API regulates the transcription of genes involved in the inflammatory response [10].

The decreased concentration of measured antioxidant enzymes in alcoholic hepatitis could probably be associated with oxidative stress and/or a decreased antioxidant defense mechanism [11]. GPX (glutathione peroxidase) activity was found to be decreased in alcoholic patients in comparison to healthy subjects. It clearly indicates an imbalance between oxidant and antioxidant defensive systems in the body under such a pathological scenario.

Vitamin E is a potent antioxidant, and its role as an inhibitor (chain breaker) of lipid peroxidation is well established. Alcohol appears to interfere with the body's normal vitamin E content; hence, patients with an alcoholic liver exhibit reduced vitamin E [12].

Hence, disease (ALD) can ultimately define the diagnosis according to the typical presence and distribution of hepatic steatosis, inflammation, and Mallory-Denk bodies. Because of the potential reversible nature of ALD with sobriety, regular screening of the alcoholics and early diagnosis are essential.

Summary and Conclusion

Present a comparative study of levels of antioxidants, vitamins, and enzymes in alcoholic liver disease patients and a controlled group. There was a significant increase in the values of antioxidants, vitamins, and catalytic activities in alcoholic liver disease patients as compared to the normal group because there is increased oxidative stress in alcoholic liver disease patients. To regulate the increased oxidative stress, these vitamins, antioxidants, and enzymes act in compensatory roles to normalize liver functions. Hence, there is a significant increase in the levels of vitamins, antioxidants, and enzymes. This study demands further pathophysiological studies in a large number of patients of both sexes at different age groups to confirm these positive findings with the latest biotechnological methods because the exact etiopathogenesis of alcoholic liver diseases is still unclear.

Limitation of study: Owing to the remote location of the research center, the small number of patients, and the lack of the latest techniques, we have limited findings and results.

This research work is approved by the ethical committee of St. Peters Medical College, Hosur, and Tamil Nadu-635130.

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