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Assay of Physiological Levels of Superoxide Dismutase & Glutathione Peroxidase in Alcoholic Cirrhosis of Liver

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Abstract

Oxidative stress is generated by disturbed equilibrium of prooxidant/antioxidant enzymes levels & is involved in liver diseases such as viral & alcoholic hepatitis & cirrhosis etc. A particularly destructive aspect of oxidative stress is the production of reactive oxygen species (ROS), whichinclude free radicals & peroxides. The enzymeSuperoxide Dismutase (SOD) has an important role in the defensive mechanisms against the O2 toxicity in the cells. Another antioxidant enzymeGlutathione Peroxidase (G-Px) is important for detoxifying peroxides in most of the cells. Therefore a study was conducted to assay the physiological levels of these markers (SOD & G-Px) of oxidative stress in alcoholic cirrhosis of liver. The study group consisted of patients of alcoholic cirrhosis of liver classified as compensated & decompensated cirrhosis having 50 patients in each group. The control group included healthy adult males weighing above 50 Kgs. The present study showed significant decrease in the levels of SOD & G-Px both in compensated as well as decompensated cirrhosis as compared with control groups.

Key Words : Superoxide Dismutase, Glutathione Peroxidase, Cirrhosis.

Introduction

Superoxide dismutase (SOD, EC. 1.15.1.1), shown to be present in almost every O_2 metabolizing cells, are a group of metalloenzymes that are found in all kingdoms of life. It catalyses the dismutation of most dangerous free radicals, the superoxide radicals by H_2O_2 & molecular O_2. Superoxide is produced as a by-product of oxygen metabolism and, if not regulated, causes many types of cell damage [1]. It constitute a very important antioxidant defence against oxidative stress in the body. The enzyme acts as a good therapeutic agent against reactive oxygen species-mediated diseases. Thus, SOD is an important antioxidant defence in nearly all living cells exposed to oxygen where it provides a front line of defence against reactive oxygen species (ROS)-mediated injury[6].

Glutathione peroxidase (G-Px,EC. 1.11.1.9), is the general name of an enzyme family with peroxidase activity whose main biological role is to protect the organism from oxidative

damage [7]. It catalyses the reduction of H_2O_2 to water & O_2 as well as catalysing the reduction of peroxide radicals to alcohols & O_2 [8].

The levels of SOD & G-Px activities in patients with hepatitis infection has been reported in recent times [2, 3]. Biological variability of these enzymes in blood has also been reported [4, 5].

Materials & Methods

The present study was carried out in the Department of Biochemistry, Govt.Medical College& Hospital, Nagpur. The subjects for the study were selected from the Outdoor Patients Department&Indoor wards, Govt.Medical College& Super Speciality Hospital, Nagpur.

Selection of subjects in general : - The study group consisted of patients of alcoholic cirrhosis of liver who were classified into two groups viz: Compensated & Decompensated cirrhosis, on the basis of Child-Pugh scoring after clinical & laboratory investigations [9]. The control group included healthy adult males weighing above 50 Kgs with good diet, non smokers, non alcoholic & having no history of cirrhosis of liver.

Determination of Enzyme activity

The quantitative in vitro determination of Superoxide Dismutase was performed from Randox Laboratories based on Woolliams, Wiener, Anderson& McMurray[10, 11] while that of Glutathione Peroxidase was performed from Randox Laboratories based on Paglia & Valentine [12,13].

Results & Observations

The following Table : 1 & Fig. 1 (a) & (b) shows observed values of erythrocyte SOD & G-Px levels in compensated & decompensated cirrhosis with control groups. These markers of oxidative stress were found to be more pronounced in decompensated liver cirrhosis as compared with compensated cirrhosis & control groups. The difference is statistically significant in both the cases of SOD & G-Px. ($P < 0.0001$).

Table : 1

Antioxidant Enzymatic Profile In Cirrhotic Patients

Enzymatic Assay	Control	Compensated Cirrhosis	Decompensated Cirrhosis	P Value
SOD	**820.10 ± 76.78**	**496.44 ± 65.49**	**349.78 ± 54.55**	**P < 0.0001**
G-Px	**13.04 ± 1.74**	**10.11 ± 1.29**	**8.88 ± 1.32**	**P < 0.0001**

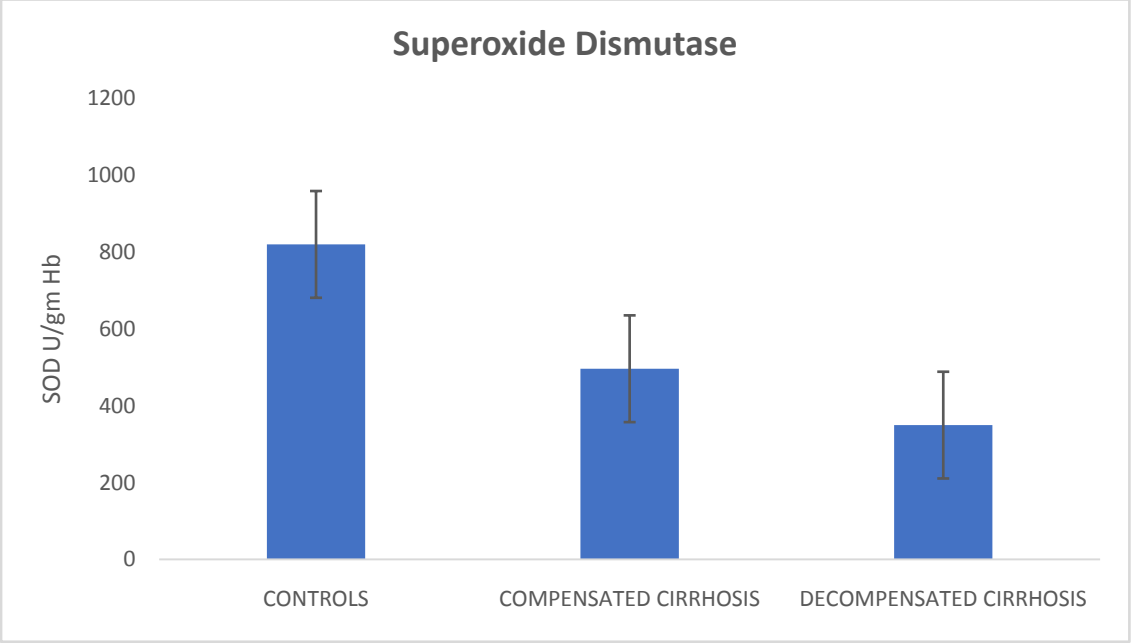

Fig. 1 (a) : Superoxide Dismutase levels in Compensated & Decompensated Cirrhosis.

Values were represented as mean ± S.D.

*** P < 0.0001 as compared to control group.

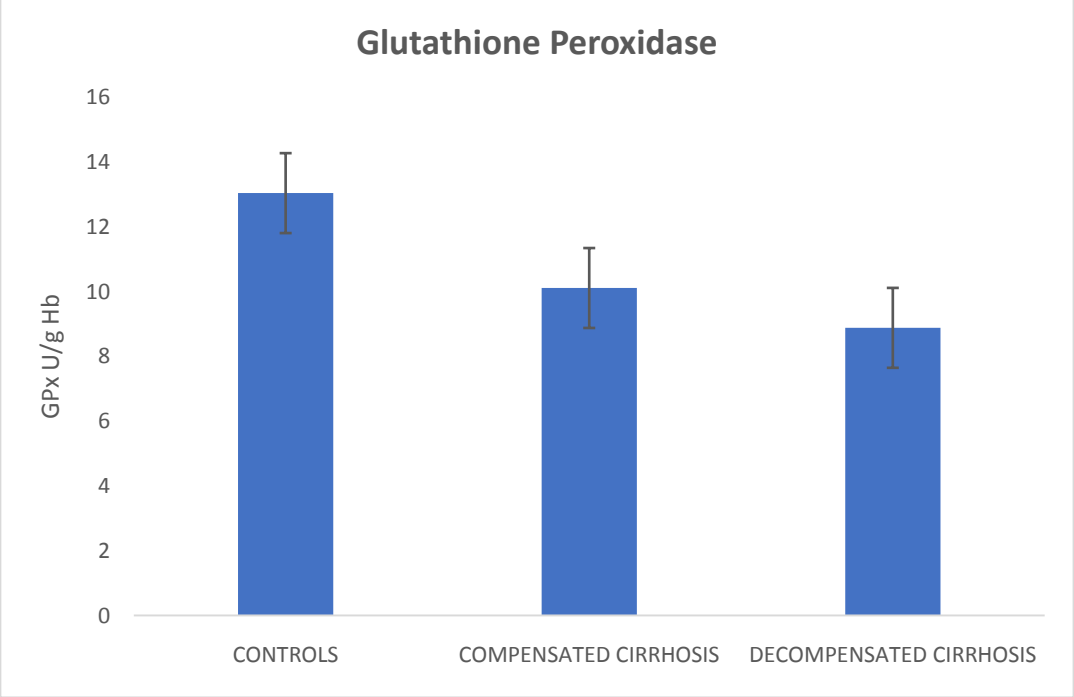

Fig. 1 (b) : Glutathione Peroxidase levels in Compensated & Decompensated Cirrhosis.

Values were represented as mean ± S.D.

*** P < 0.0001 as compared to control group.

Discussion

In view of the fact that oxidative stress has been increasingly implicated in pathogenesis & progression of cirrhosis, the present study highlights that oxidative stress is related with functional compromise of liver, as determined by Child-Pugh scoring, by measuring antioxidant (SOD & GPx) factors in patients with cirrhosis. This prompted us to state that there appears a steady decline in antioxidative stress markers across Child-Pugh class with rising oxidative stress. Earlier Bernard et al & Bhandari et al have demonstrated a co-relation between erythrocyte antioxidant enzymes such as superoxide dismutase (SOD), glutathione peroxidase (G-Px), glutathione & oxidative stress [14, 15].

The superoxide anion is generated by a wide range of enzymatic oxidation reactions in respiring cells as an intermediate of the reduction of oxygen. It has been reported that the superoxide anion radical may damage cell membranes, DNA & inactivate various enzymes. The enzyme superoxide dismutase (SOD) which catalyses the dismutation of the superoxide ion radicals to peroxide & oxygen, has an important role in the defensive mechanisms against the oxygen toxicity in the cells. Liver is regarded as the most superoxide dismutase rich organ [16]. It has been found out that total SOD activity in acute viral hepatitis, fatty liver groups were significantly lower than in non-specific reactive hepatitis group. The diffuse type of Cu/ZnSuperoxide Dismutase was observed in cases of less severe parenchymal lesion as in non-specific reactive hepatitis group & the focal type of Cu/ZnSuperoxide Dismutasewas noted in the cases of liver disease with severe parenchymal lesion. In conclusion they supposed that superoxide radical ion & its scavenger, superoxide dismutase (SOD) may play an important role in in the pathogenesis of liver necrosis. Glutathione Peroxidase (G-Px) is important for detoxifying H2O2 in most cells. This protein is a selenoprotein which catalyses the oxidation of reduced glutathione to its oxidised form in presence of H2O2 which is conveyed to the water molecule [17]. The glutathione peroxidase (G-Px) helps in reducing concentration of H2O2 which is a precursor hydroxyl radical. In the present study the activities of both these vital enzymes was found to be reduced.

Conclusion

The present study was carried out to justify the co-relation of alcoholic liver diseases with oxidative stress in Central Indian population. Therole of physiological levels of Superoxide Dismutase & Glutathione Peroxidase in patients with alcoholic cirrhosis of liver were evaluated& found to be significantly decreased both in compensated as well as decompensated cirrhosis as compared with control groups.

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