Research Article

Protective Effect of Alpha Tocopherol on Phenol Induced Oxidative Damage in Liver of Freshwater Catfish Heteropneustes Fossilis

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ABSTRACT

During the past number of years the value of antioxidant therapy, has been investigated thoroughly. In the present investigation, elucidate the effect of alpha-tocopherol in liver of freshwater catfish Heteropneustes fossilis under oxidative stress. As is well known, Liver is the vital organ of the body and not only performs a large number of functions but it also play a crucial role for detoxification. Phenol implicated in respiratory tract (Budavari, 1996) Dermatitis (Lin 2006).Oxidative Stress (Dubey et al 1997).It is a common powerful liquid used in work place. Present investigation, increase lipid peroxidation level in liver after phenol exposure is indicative of liver damage caused by free radical toxicity. However, supplementation of alpha-tocopherol decrease level of lipid peroxidation.May arrest the free radical formed during phenol induced oxidative stress in freshwater catfish Heteropneustes fossilis.

Key Words: Oxidative damage Lipidperoxidation, alpha-tocopherol,liver Heteropneustes fossilis.

INTRODUCTION

Environmental pollutant, lead causes adverse effects such as the production of reactive oxygen species (ROS), disruption of tissue oxidant, alteration of lipid metabolism (Ahmad and Siddiqui, 2007).ROS play an important role in the etiology of diverse human pathologies such as carcinogenesis (Ames, 1983; Frenkel, 1992, Halliwell et al 1992), irradiation injury (Ewing, 1983), nephrotoxicity (Yaman, 2010; Sharma et al., 2011) and the normal process of Ageing (Harman, 1981). Liver is the vital organ of metabolism for detoxication of xenobiotics, environmental toxicant, and liver damage is associated with distortion of several metabolic functions; hence liver disorder is serious health problem. Literature related to temperature dependent in lipid peroxidation, ascorbic acid in respiratory organs (Parihar and Dubey,1995), lipid peroxidation, superoxide dismutase, ascorbic acid and phospholipids content in liver (Parihar et al., 1996) and antioxidant defenses in gill of freshwater catfish Heteropneustes fossilis (Parihar et al., 1997).Antioxidant enzyme activities in aquatic animals (Palace and Klaverkamp 1993;Viarengo et al., 1991; Ribera et al., 1991 ,Dubey 1994,Dubey et al 1997).

One class of xenobiotic that has received a considerable attention is phenol. Its vapors are corrosive to eye, skin and the respiratory tract (Budavari 1996).Prolonged skin contact may cause dermatitis, or even second and third degree burns due to its caustic and defeating properties (Lin et al., 2006). Occasionally, a large amount of phenol gets into the waste water treatment plant in the phenol discharging industries creating shock loading conditions on activated slug system.

Therefore, in the present investigation to elucidate the protective effect of alpha- tocopherol against phenol induced oxidative damage in liver of freshwater catfish Heteropneustes fossils.

MATERIALS AND METHOD

Adult freshwater catfish Heteropneustes.fossilis (weight 50+1.8 g, length 17+1.2 cm) were obtained from local vicinity of Ujjain (MP) and acclimatized in laboratory conditions for two weeks in dechlorinated tap water at room temperature. After acclimatization fish were then transferred to separate exposure glass aquaria. Eight groups were maintained .First group was kept as control .Second group treatment with alpha-tocopherol.(8 mg/ Kg body weight), Third, fourth and fifth groups were exposed with phenol at 5 ppm, 10ppm and 15ppm respectively. Sixth, seventh and eighth group were exposed with phenol along with alpha-tocopherol for 15 days. Fish were sacrificed after 15 days exposure. Liver were dissected out for the biochemical estimation. Lipid peroxidation measured by the method of Okhawa et al., 1979 as described by Parihar et al., 1996 .Protein content was estimated by the Folin phenol reaction as described by Lowry et al., 1951 using bovine serum albumin as a standard.

RESULT

The effects of different concentrations of phenol (5, 10 and 15ppm) and supplementation of alpha-tocopherol on lipid peroxidation in liver of Heteropneustes.fossilis were shown in table 1. The

lipid peroxidation level enhanced in liver after exposure 5ppp, 10ppm and15ppm concentration of phenol. The values were statistically significant ($p<0.001$).However, alpha-tocopherol supplemented group did not showed statistically significant with respect to control. The alpha tocopherol supplementation prevents the phenol induced oxidative stress lipid peroxidation in the liver as statistically there is no significant difference between control and alpha-tocopherol treated group.

DISCUSSION

Reactive oxygen species are essential for proper cell functioning and are widely produced during normal cell metabolism. It is well known that the exposure of biological membrane to oxidative stress result in the progressive degeneration of membrane structure and loss of activity. The measurement of lipid peroxidation is thus a convenient method to monitor oxidative cell damage (Esterbauer et al., 1988).In the present study, phenol exposure resulted in, an increase in lipid peroxidation in Liver. This finding was in agreement with (Parihar and Dubey 1995, Parihar et al., 1997, Dubey et al 1997) who reported that enhance lipid peroxidation under oxidative stress. Due to the lipophylic nature, phenol is accumulated on the hydrophilic lipid bilayer of biological membranes, where many enzymes and transport system that are important for the function of the whole cell are located this accumulation may be due to the reason for the overall toxicity of the chemical (Ahlers et al., 1988; 1991).Lipid peroxidation is believed to be an indicator of membrane damage resulting from the degradation of PUFS (Tam and McCay, 1970). As a result of their high accumulation potential, relatively low concentration of lipophilic xenobiotics in the aquatic environment may lead to a major change in the structural and functional properties of membranes, which result in severe effects can on the whole cell.

During the past number of years the value of antioxidant therapy, has been investigated thoroughly. Despite this, it is still questionable whether antioxidant supplementation is beneficial to the tissues during oxidative stress in fish or not. Dietary antioxidants have been reported to protect against lipid peroxidation in the rainbow trout in vitro (Bell et al., 1985).Vitamin C protect against oxidative stress (Tatli Seven, 2009). Tocopherol is the major fat – soluble antioxidant present in the membrane (Ribera et al., 1989). It reacts directly with oxyradicals and singlet oxygen (Machlin and Bendich, 1987). In the present investigation, decrease in lipid peroxidation level in liver after supplementation with alpha-tocopherol is indicative of its role in control of lipid peroxidation. The protection could be due to less reactive oxygen species formation. Information about the effect of xenobiotics on antioxidant enzymes and lipid peroxidation in other fish species is limited and some what variable (Winston and Digiulio, 1991).

Nutritional effects on antioxidant enzymes have been seen in fish but these have been very specific, e.g., glutathione peroxidase and superoxide dismutase activities in rainbow trout were reduced respectively by diets deficient in selenium (Bell et al. al., 1985). Less information is on the impact of dietary antioxidants on endogenous antioxidant enzymes in fish alpha-tocopherol deserves mention as it not only protects against oxygen radicals that might initiate lipid peroxidation of cell membranes but may also serve as a scavenger of chain-propagating free radicals such as lipid hydroperoxyl radicals (Niki et al., 1984).

CONCLUSION

In the present finding, increase level of lipid peroxidation is depend on concentration of phenol is a indicative of generation of reactive oxygen species resulting cell damage .Alpha tocopherol decreased the lipid peroxidation level is indicate protective role against oxidative damage caused by phenol exposure in liver of freshwater catfish Heteropneustes fossilis.

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Table 1: Effect of alpha-tocopherol (8mg/ Kg body weight) on phenol induced lipid peroxidation (n moles MDA /mg protein) in liver of freshwater catfish Heteropneustes fossilis

S.No	Treatment group	lipid peroxidation
1	Control	13.63 ± 0.76
2	alpha- tocopherol treatment	13.43 +0.72
3	5 ppm Phenol exposure	16.68* ± 0.77
4	10ppm Phenol exposure	22.31* ± 0.65
5	15 ppm Phenol exposure	30.28 * ± 0.65
6	5ppm Phenol + alpha-tocopherol	11.25** ± 0.48
7	10ppm Phenol + alpha-tocopherol	13.86** ± 0.82
8	15ppm Phenol + alpha-tocopherol	14.22** ± 0.63

*Stastically significant from control (I) and alpha-tocopherol treatment (II) at $p<0.001$.
**Stastically significant from group (III),(IV) and (V) but statistically insignificant from group (I) and (II) at $p<0.001$.
Values are mean = SE of six animals in each group

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