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CALCIUM IMPACT ON CADMIUM INDUCED ALTERATIONS IN SELECTED OXIDATIVE STRESS ENZYMES IN THE FRESH WATER TELEOST, *Oreochromis Mossambicus (Tilapia)*

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Abstract: Cadmium (Cd) is an important xenobiotic, non biodegradable cumulative pollutant in aquatic ecosystems. The present study was carried out to know the impact of calcium (Ca) on Cd induced oxidative stress enzyme alterations in the selected tissues of fresh water fish, Oreochromis mossambicus *(Tilapia)*. After acclimatization, fish were exposed to sublethal concentration of Cd ($1/10^{th}$ of LC_{50}/48h, i.e., 5ppm) for 7, 15 and 30 days (d) period. Then 15d Cd exposed fish were subjected to Ca supplementation (1ppm) for 7, 15 and 30d time intervals. After specific exposure periods tissues like gill, kidney and brain were isolated and used for Cd for the assay of glutathione-S- transferase (GST), glutathione peroxidase (GPx) and estimation of lipid peroxidation (LPO) levels in both control as well as experimental fish. Significant elevation in LPO levels were observed during Cd exposure and maximum elevation of LPO was found in 30d Cd exposed gill tissue (16.074±0.089 µ moles of MDA formed / gm wet wt. of the tissue). Further the activity levels of GST and GPx were significantly inhibited under Cd stress. However with Ca supplementation there was significant reduction in LPO levels and elevation in the activity levels of the GST and GPx. Maximum activity levels of GST and GPx were observed in 30d Ca supplemented fish kidney. Our findings elucidate the beneficial role of Ca as vital supplement in reducing the Cd burden in the fresh water fish, Oreochromis mossambicus *(Tilapia)*.

Key words: Cadmium, Oxidative stress, Calcium supplementation, Tilapia.

INTRODUCTION:

In aquatic ecosystem, heavy metals are considered as the most important pollutants, since they are present throughout the ecosystem and are detectable in critical amounts. Among heavy metals, Cd is considered as a major aquatic heavy metal pollutant in many parts of the world (Wu *et al.*, 2002). Cd is non biodegradable and once discharged into water bodies it can either be absorbed on sediment particles or accumulated in aquatic organisms. Fish may absorb Cd from surrounding water and food, which accumulated in various tissues in significant amounts (Mohamad, 2008). This metal buildup in food chain and are responsible for chronic illness and death in aquatic organisms, which probably move up to top of the food chain (Kosai et al., 2011). Therefore, fish might prove a better material for detecting metals contaminating the fresh water ecosystems.

Cd can enter fresh waters due to human activities such as mining and smelting of sulfide ores, fuel combustion and application of phosphate fertilizers or sewage sludge. It is taken up by algae, insects and passed through the food chain to fish, which can accumulate Cd in their tissues as gills, liver and kidney (Chowdhury et al., 2004; ASTDR, 2008). Consuming fish or other animals that have accumulated Cd may pose a threat to human health. Sub lethal and chronic concentrations of metals exerts their toxicity on fish by generating free radicals such as hydroxyl radical (OH), superoxide radical (O_2^-) and some non-radical reactive oxygen species (ROS) such as hydrogen peroxide (H_2O_2). These ROS can trigger oxidative damage to proteins, nucleic acids and lipids (Siwela et al., 2009).

To attenuate the negative effects of ROS, fish posses an antioxidant defense system like other vertebrates that utilizes enzymatic and non enzymatic mechanisms. The most important antioxidant enzymes are catalase (CAT), superoxide dismutase (SOD), glutathione peroxidase (GPx) and glutathione-S-tranceferase (GST). More oxidative state or any imbalance between production and degradation of ROS in animal tissues may cause lipid peroxidation, plasma membrane alterations and inactivation of enzymes (Vinodhini and Narayanan, 2009).

Micronutrients in the diet influences heavy metal toxicity (Peraza, 1998). Cd interacts with the essential micronutrients like Ca, zinc (Zn) and iron (Fe). It interacts with these elements and influences Cd bioaccumulation and the enzyme activities of metabolic pathways. It has been well demonstrated that Ca in the water and diet protects fish against the uptake of Cd (Wood et al., 2006). Cd is taken up at