Calcium impact on cadmium bio-accumulation in different tissues of fresh water teleost *Oreochromis mossambicus (Tilapia)*

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ABSTRACT: Among the myriads of pollutants cadmium (Cd) is a ubiquitous, non essential heavy metal that possesses high toxicity to both human and aquatic organisms. Chronic exposure to Cd results in accumulation of the metal majorly in liver and kidney and in other tissues of the body. The present study was designed to measure the levels of Cd concentrations in different tissues such as liver, kidney, muscle, brain and gill of fresh water fish, *Oreochromis mossambicus (Tilapia)* subjected to 15days(d) Cd exposure and after supplementation with trace element calcium (Ca) for 30d duration. Cd concentrations in the selected tissues were measured by using Atomic Absorption Spectrophotometer (AAS Shimadzu – AA 6300). *O. mossambica* were exposed to 1/10th of LC_{50} / 48 hr. of Cd i.e.5 ppm for selected time intervals of 7d, 15d and 30d. After 15d Cd exposure, the test animals were subjected to Ca(1 ppm) supplementation for 30days long sojourn. Again after the specified time intervals (7d,15d and 30d) of Ca supplementation, the test fish were sacrificed and the select tissues were isolated and analysed for Cd concentrations. There was a significant decrease in tissue Cd concentrations after supplementation with Ca. The tissue retention of Cd also varied significantly with exposure time of supplementation. Maximum decrease in Cd accumulation was seen in muscle tissue of 30d Ca supplemented fish.

Key words: Cadmium bioaccumulation, Calcium supplementation, *Tilapia.*

The contamination of fresh waters with a wide range of pollutants has become a matter of concern over the few decades (Dirilgen, 2001; Vutukuru, 2005). Natural aquatic resources are extensively contaminated with heavy metals like lead (Pb), Cd, nickel(Ni) and copper (Cu) released from domestic, industrial and other man made activities (Conacher et al., 1993 and Velez and Montoro, 1998). The toxic effects of heavy metals have been reviewed, including bio-accumulation (Aucoin et al., 1999; Usha Rani, 2000; Rasmussen and Anderson, 2000; Adami et al., 2002; Waqar 2006). Among these metals Cd as a highly toxic metal, still attracts the attention because it is often detected in the air, water and food products, extending the maximum allowable limits (Eklund and Oskarsson, 1999 ; Korenekova et al., 2002).

Cd is an industrial and environmental pollutant, arising primarily from battery, electroplating, pigment, plastic, fertilizer industries and cigarette smoke. The largest source of Cd release to the general environment is the burning of fossil fuels (such as coal or oil) or incineration of municipal waste materials (WHO, 1992; WHO, 1993; Niragu and Pacyna, 1998).

Cd is a well-known cumulative poison in animals and enters water from disposal of wastes from households or industries. Introduction of toxic heavy metals like Cd cations in small amounts into an aquatic environment causes multiple changes in the internal dynamic of aquatic organisms even at sub lethal levels (Usha Rani and Ramamurthi, 1987). Among animal species, fishes are the inhabitants that cannot escape from the detrimental effects of the pollutants (Clarkson, 1998; Dickman and Leung, 1998; Olaifa et al., 2004). Earlier studies have shown that energy imbalance is implicated in Cd induced stress and toxicity in aquatic animals. The ion equilibrium is disturbed by the blockage in the ion transportation system under the effect of metals. Cd caused swelling in the epithelium and chlorine cells of the gills(Usha Rani, 1999), hyperplasia, hypertrophy, degeneration and necrosis of the hepatocyets (Usha Rani and Ramamurthi, 1989) and vacuolization of the tubule cells of the kidney (Trophon et al., 2003).

There is growing evidence that micronutrient intake has a significant effect on the toxicity and carcinogenesis caused by various chemicals. Ca is one of the important major element which acts as a micronutrient. It contributes to various biochemical mechanisms in vertebrates including fishes. Ca is an essential mineral for maintaining healthy bones as well as having properties that block the absorption of free radical generating iron into the blood stream. It plays a major role in bone formation, muscle contraction, enzyme activities and hormonal secretion etc., in animals. Though fish is a vertebrate, literature on the effect of Ca on Cd absorption, retention, elimination and detoxification is scanty. The bone deformities have been attributed to cadmium deposits in bone tissue that interferes with calcification, decalcification, and bone remodeling.

Therefore an attempt has been made in the present study to check whether additional supplements like Ca would lessen the Cd body burden of the tissues of freshwater fish *Oreochromis mossambicus (Tilapia).*

Methods

The fresh water healthy specimens of *Oreochromis mossambicus (Tilapia)* weighing 10 ± 2gm of body weight and 7-10cm length belonging to a single population were collected locally and were acclimatized to laboratory conditions for a week in separate troughs. The fish were fed *ad libitum* with groundnut cake and water was renewed for every 24 hrs with routine changing of troughs leaving no fecal matter.

Cadmium chloride was used as the metal toxicant and calcium chloride was used as Ca supplement. Fish were divided into four groups, with the first group as control and other groups as experimental. The experimental groups were exposed to sub lethal