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IMPACTS OF MORINGA DIETS ON BIOCHEMICAL COMPONENTS IN COPPER EXPOSED FISH, CYPRINUS CARPIO

Zoology

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ABSTRACT

The muscle contained more quantum of protein content followed by intestine and liver. It has been confirmed by the b values of 0.25 and 0.05 obtained for protein content in muscle and liver tissues of control fish The regression equations (Y = a + bX) obtained for protein content 20.07 + 0.25X; 17.61 + 0.12X, 19.42 + 0.18X, 19.30 + 0.16X and 18.94 + 0.13X in muscle tissue of control, M1, M2, M3 and M4 groups respectively. From the above regression lines the 'b' value of M2 group was 0.18, very close to the 'b' value of control fish elicited that 30% *Moringa* diet reduced the copper toxicity quickly and protein content attained the normally as compared the other diets. Similar performances were also obtained in lipid, ash and energy contents also.

KEYWORDS

copper, protein, lipid, ash, moringa

INTRODUCTION

Recently, heavy metal is currently the serious pollution problem and prevalent in our daily life which should never be neglected. It has been identified that the polluted environment includes cationic metals i.e., cadmium (Cd), chromium (Cr), copper (Cu), lead (Pb), manganese (Mn), mercury (Hg), nickel (Ni) and Zinc (Zn) whereas anionic metals are arsenic (As), boron (B), molybdenum (Mo) and selenium (Se) (USDA, 2000). Natural as well as anthropogenic actions are the sources of heavy metal pollution including point sources such as emission, effluent, smelting, mining, discharge from industry and vehicle exhaustion. The non-point sources are the use of pesticide and municipal wastes in agriculture and disposal of industry (Lone *et al.,* 2008). Copper is used as electroplating, smelting and refining processes (Rai and Pal, 2002) and their wastes pollute. Most of the environments and affect survival, physiology and biochemistry of target organisms (James and Sampath, 1995; Sampath *et al.,* 1998). Metals and pesticides, in particular have a tendency to accumulate and undergo food chain magnification (Vinikour *et al.,* 1980). They could also cause catastrophic diseases like Minamata and Itai-Itai. Some of these organisms, like fish, are consumed by human beings. Hence, reduction of toxic elements in aquatic environments by acceptable method is needed. Numerous plant species have been identified and examined for their potential in reducing different heavy metal toxicity. Among them, *Moringa oleifera,* is the new challenge of tradition medicinal plant use both in *in vitro* and *in vivo* for reducing metal toxicity in environment and living organisms (Gopala Krishnan *et al.,* 2016; Roopashree Mallya *et al.,* 2017). Hence, the present study has been undertaken to investigate the effects of dietary *Moringa* leaf on the reduction of copper toxicity in fish and improvement of selected biochemical parameters in *Cyprinus carpio.*

MATERIALS AND METHODS

For the experiment, active and healthy juveniles of *C. carpio* were collected from the acclimation tank and starved for 24 hrs prior to the commencement of the experiment. They were divided into six groups and maintained with chosen sublethal levels of copper (0.5 ppm or mg l^{-1} i.e. one third of the LC_{50} value of Cu) for 80 days. Group 1 served as control and reared in freshwater and fed with control diet (C). Test animals belonging to 2^{nd} – 6^{th} groups were exposed to 0.5 ppm copper. Among the copper exposed groups, 2^{nd} was fed with control diet (M0), however, 3^{rd} (M1), 4^{th} (M2), 5^{th} (M3) and 6^{th} (M4) groups were fed with 0, 20, 30, 40 and 50% *Moringa* leaf meal diets respectively. Each group consisting of 20 individuals was reared in circular epoxy coated cement tank containing 100 *l* water (width: 58.5 cm; height: 40 cm; capacity: 120 *l*). Triplicates were maintained for corresponding experimental diets. The experimental copper media were changed once in 2 days and fresh sublethal level of copper was prepared to maintain the constant toxicant in the medium (Sprague, 1971).

RESULTS

Muscle contained more quantum of protein content followed by intestine and liver (Fig. 1). It has been confirmed by the b values of 0.25 and 0.05 obtained for protein content in muscle and liver tissues of control fish (Fig. 1). Regression lines obtained for protein content in experimental groups were clearly segregated and control group is on top (Fig. 1). A significant ($P < 0.05$) and positive correlation obtained between the protein content / other biochemical components and chosen exposure with *Moringa* diets; however, the trend was reversed in copper exposed fish. The regression equations (Y = a + bX) obtained for protein content 20.07 + 0.25X; 17.61 + 0.12X, 19.42 + 0.18X, 19.30 + 0.16X and 18.94 + 0.13X in muscle tissue of control, M1, M2, M3 and M4 groups respectively (Fig. 1). From the above regression lines the 'b' value of M2 group was 0.18, very close to the 'b' value of control fish elicited that 30% *Moringa* diet reduced the copper toxicity quickly and protein content attained the normally as compared the other diets. Similar performances were also obtained in lipid, ash and energy contents also (Fig.1-3.).

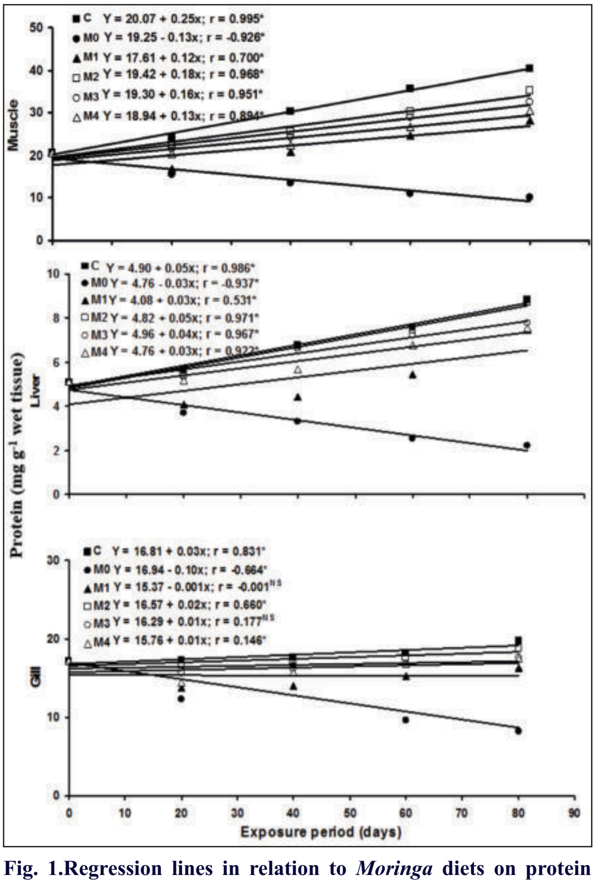

Fig. 1.Regression lines in relation to *Moringa* diets on protein content in different tissues of copper exposed *Cyprinus carpio* as a function of time. * P < 0.01; ** P < 0.05; NS – Non-significant

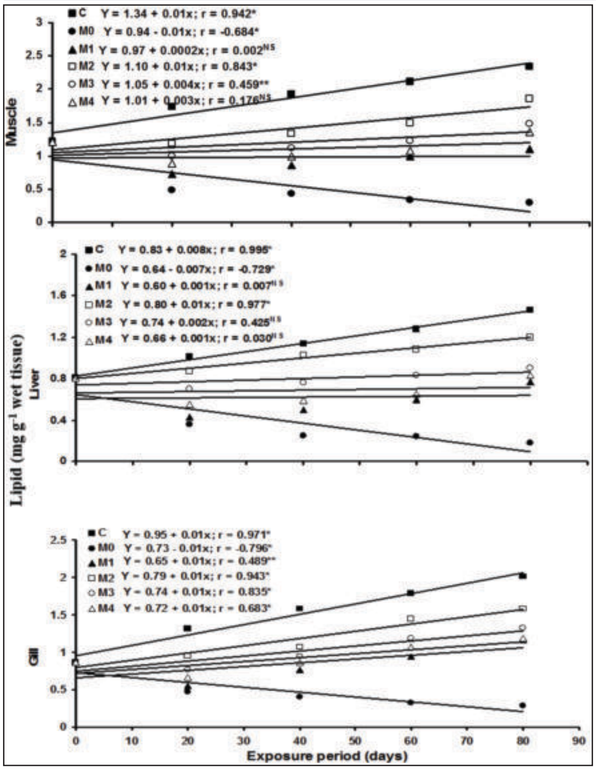

Fig. 2. Regression lines in relation to *Moringa* diets on lipid content in different tissues of copper exposed *Cyprinus carpio* as a function of time. * P < 0.01; ** P > 0.05; NS – Non significant

DISCUSSION

The present study revealed that, copper toxicity significantly ($P < 0.05$) reduced biochemical components in common carp, *C. carpio*. Copper exposed *C. carpio* exhibited a significant ($P < 0.05$) decline of protein, lipid and energy contents. The decline of protein indicates proteinolysis during metal stress and the depleted proteins are utilized for various metabolic processes. Similar observation was also made in *H. fossilis* exposed to individual and combined exposures of copper and mercury (James and Sampath, 1995). Kabeer *et al.* (1984) reported that a decline of protein content in malathio exposed *T. mossambica* and could be due to an intensive proteinolysis, which inturn contributed to the increase of free amino acids and used into tricarboxylic acid cycle (TCA) as keto acids under pollutant stress. These findings support the present investigation. Like protein, lipid also declined in copper stress which might also be due to their utilization for the energy demand under stress condition (Tytler and Calow, 1985; James *et al.,* 1991).

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