ORIGINAL RESEARCH PAPER

Zoology

IMPACTS OF *MORINGA* DIETS ON PHOSPHATASES ACTIVITIES IN COPPER EXPOSED FISH, *CYPRINUS CARPIO*

KEY WORDS: copper toxicity, C. carpio, phosphatases activities, Moringa, exposure period

Sakthi Bama — Department of Zoology, Manonmaniam Sundaranar university, V.O.Chidambaram college, Tuticorin-628008

Dr. B. Geetha* — Department of Zoology, Sundaranar university, V.O.Chidambaram college, Tuticorin-628008 *Corresponding Author

ABSTRACT

The acid or alkaline phosphatases activity of liver, gill and muscle of *C. carpio* was 1.42 or 4.38, 0.17 or 3.47 and 0.12 or 2.35 mg p-nitrophenol released mg^{-1} protein hr^{-1} respectively in *C. carpio*. Acid and alkaline phosphatases activities were significantly (P < 0.05) declined with an extension of exposure period in copper exposed fish received control diet. However, both the phosphatases activities were declined in early exposure period (20 – 40 days) and thereafter they were enhanced and moved towards normally in copper exposed fish received *Moringa diets*. Among the *Moringa* diets, 30% diet (M2 group) exhibited the better performance on the reduction of copper toxicity and an improvement of phosphatases activities in tissues as compared to other diets.

INTRODUCTION

Recently, heavy metal is currently the serious pollution problem and prevalent in our daily life which should never be neglected. 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, 1998; James *et al*., 1995; Sampath *et al*., 1998). Metals and pesticides, in particular have a tendency to accumulate and undergo food chain magnification (Vinikour *et al*., 1980). 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). The present work has been designed to study the impacts of *moringa* diets on phosphatases activities in copper exposed fish, *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 hr 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).

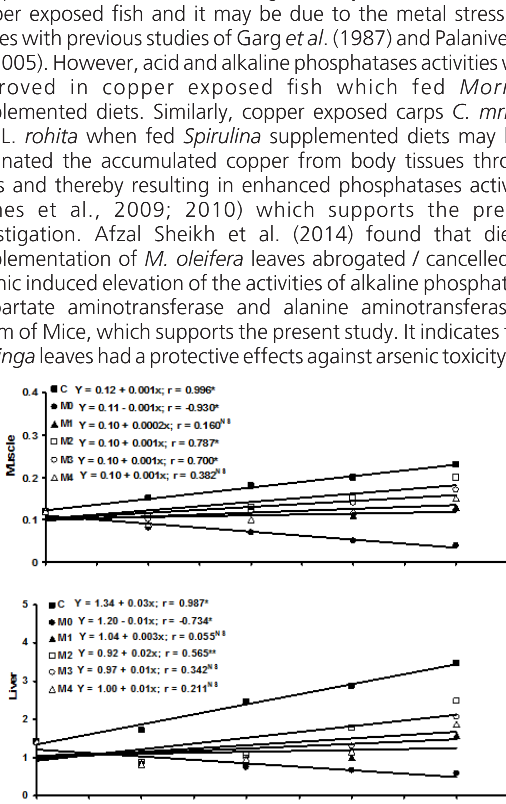
The acid and alkaline phosphatases were estimated according to the method of Bergmayer (1963) using p-nitrophenyl phosphate as a substrate

RESULTS

The phosphatases (both acid and alkaline) activities are more in liver followed by gill and muscle tissues. The acid or alkaline phosphatases activity of liver, gill and muscle of *C. carpio* was 1.42 or 4.38, 0.17 or 3.47 and 0.12 or 2.35 mg p-nitrophenol released mg^{-1} protein hr^{-1} respectively in *C. carpio*. Acid and alkaline phosphatases activities were significantly (P < 0.05) declined with an extension of exposure period in copper exposed fish received control diet. However, both the phosphatases activities were declined in early exposure period (20 – 40 days) and thereafter they were enhanced and moved towards normally in copper exposed fish received *Moringa* diets (Fig 1 and 2). Among the *Moringa* diets, 30% diet (M2 group) exhibited the better performance on the reduction of copper toxicity and an improvement of phosphatases activities in tissues as compared to other diets. Duncan multiple range test confirmed that, the phosphatases activities of M2 group were pre-dominantly co-existed with control fish as compared to other diets. The phosphatases activities in M1 – M4 groups were positively correlated between the *Moringa* diets and exposure period while M0 group was negatively correlated (Fig. 1 and 2).

DISCUSSION

The present study also showed that, acid and alkaline phosphatases activities were also significantly (P < 0.05) reduced in copper exposed fish and it may be due to the metal stress and agrees with previous studies of Garg *et al*. (1987) and Palanivelu *et al.* (2005). However, acid and alkaline phosphatases activities were improved in copper exposed fish which fed *Moringa* supplemented diets. Similarly, copper exposed carps *C. mrigala* and L. *rohita* when fed *Spirulina* supplemented diets may have eliminated the accumulated copper from body tissues through feces and thereby resulting in enhanced phosphatases activities (James et al., 2009; 2010) which supports the present investigation. Afzal Sheikh et al. (2014) found that dietary supplementation of *M. oleifera* leaves abrogated / cancelled the arsenic induced elevation of the activities of alkaline phosphatases as partate aminotransferase and alanine aminotransferase in serum of Mice, which supports the present study. It indicates that, *Moringa* leaves had a protective effects against arsenic toxicity.



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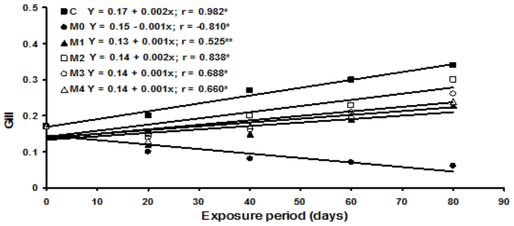

Acid phosphatase activity (mg p-nitrophenyl / mg protein / h)

Fig. 6.15. Regression lines in relation to *Moringa* diets on acid phosphatase activity in different tissues of copper exposed *Cyprinus carpio* as a function of time. *P<0.01; **P<0.05; NS – Non significant

A Alkaline phosphatase activity (mg p-nitrophenyl / mg protein / h)lkaline phosphatase activity (mg p-nitrophenyl / mg protein / h)

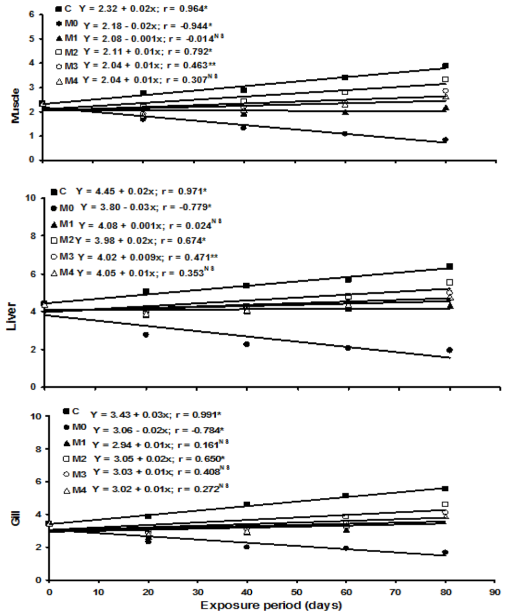

Fig. 6.16. Regression lines in relation to *Moringa* diets on alkaline phosphatase activity in different tissues of copper exposed *Cyprinus carpio* as a function of time. *P<0.01; **P<0.05; NS -Non significant

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