Study on Alkaline & Acid Phosphatases in Mercuric Chloride ($HgCl_2$) exposed Fish *Heteropneutes fossilis* (Bloch.)

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Abstract

The current study performed the examine toxicity effect of mercuric chloride on fish. The alterations induced by chronic (30 days) exposure of the fish Heteropneutes fossilis to a sublethal concentrations (0.25 ppm conc.) of mercuric chloride on the alkaline and acid phosphatases in the gill, liver, kidney, testis and ovaries. The present study therefore points towards a severe metabolic dysfunction in response to mercuric chloride toxicity in the fish Heteropneutes fossilis (Bloch.).

Keywords: *Heteropneutes fossilis*, Mercuric chloride , alkaline, acid phosphatases.

INTRODUCTION

Mercury is viewed as the most toxic inorganic pollutant available in natural water. This element has a long-biological half-life in humans and it gets accumulated in vital organs-especially in liver and kidney throughout their lives (Sadeghi & Imanpoor , 2015).

Mercury chloride is danger, may be fatal if swallowed. Harmful if inhaled or absorbed through sin caused severe irritation to eyes, sin and respiratory tract. Mercury chloride is highly toxic not only acute but as a cumulative poison. Mercury is a dangerous pollutant, is one of the worst offenders, mainly after the environmental disaster at Minamata (Japan) and several other poisoning accidents due to the use of Hg pesticides in agriculture (Begam M, Sengupta M, 2015). It is widely known that fish are a great source of Hg in our food and their accumulation could represent a serious risk for human beings (Rice, *et al.*, 2014).

The fish, *Heteropneutes fossilis* (Bloch), locally known as “Shinghi”, having the presence of suprabranchial accessory respiratory organs, an air-breathing teleost and heavy metal mercuric chloride were selected for present study.

MATERIALS & METHODS

The air-breathing teleost *Heteropneutes fossilis* procured live from the local fish market, Darbhanga were washed with 0.1% $KMnO_4$ solution to remove dermal infection if any. Healthy fish of average length (15–20 cm) and weight (25–30 g) were acclimated for 15 days to laboratory conditions. The fish were fed with chopped goat liver every day adlibitum. Running tap water was used in all the experiments and the fish were adjusted to natural photoperiod and ambient temperature. No aeration was done.

Static acute bioassays were performed to determine LC_{50} values of mercuric chloride for 24, 48, 72 and 96 hours following the methods of APHA, AWWA & WPCF (1985; 1992). The LC_{50} values for these periods were 2.0 ppm, 1.5 ppm, 1.0 ppm and 0.5 ppm respectively. The sub-lethal concentration was determined following the formula of Hart *et al.* (1945). Twenty acclimated fish were exposed to a sub-lethal concentration (0.25 ppm) of mercuric chloride for 30 days. Side by side same number of fish as that of experimental one was maintained as the control group. At the end of exposure period the fish were anaesthetized with 1:4000 MS 222 (tricane, methane, sulfonate, sandoz) for two minutes. The gill, liver, kidney, testis and ovary were quickly dissected out, weighed to nearest mg and processed for the quantitative estimation of alkaline and acid phosphatases by the methods of Wootton (1964).

RESULTS

The control values of alkaline phosphatases are 53.0±15, 183.0±21, 56.0±20, 50.0±21 and 55.0±21 while in acid phosphatases the value are 3.5±10, 6.2±09, 6.5±15, 4.2±10, 5.2±09 in the gill, liver, kidney, testis and ovary. In the alkaline phosphatases value are highly significant at ($p<0.001$) in the gill, liver, testis and ovary while in kidney the value is non- significant at ($p<0.05$). In the acid phosphatases value are highly significant at ($p<0.001$) in the gill, kidney and ovary while in testis (at $p<0.01$) liver the value is non- significant at ($p<0.05$).

TABLE – I

Alterations in the activities of acid and alkaline phosphatases (in moles phenol/min/mg protein) in tissues of *Heteropneutes fossilis* chronically exposed to mercuric chloride (0.25 ppm) for 30 days. Values are mean ± SE 0f 5 observations.

Tissue	Control	Mercuric chloride exposed
Acid phosphatases		
Gill	3.5±10	6.7±21 (+91.42) ***
Liver	6.2±09	3.2±11 (-48.38)

		*
Kidney	6.5±15	10.4±10 (+60.0) ***
Testis	4.2±10	2.2±11 (-47.61) **
Ovary	5.2±09	2.3±11 (-55.76) ***
Alkaline phoshatases		
Gill	53.0±15	74.0±09 (+39.62) ***
Liver	183.0±21	185.0±30 (+1.09) ***
Kidney	56.0±20	58.0±11 (+3.57) *
Testis	50.0±21	55.0±30 (+10.0) ***
Ovary	55.0±21	60.93±30 (+9.09) ***

Value indicate % increase (+), decrease (-) over control value significant at

* =P<0.05

** =P<0.01

*** =P<0.001

DISCUSSION

The present study revealed that the enzymatic activity of alkaline phosphatases was found to be significantly inhibited and that of the acid phosphatases increased significantly in the tissue of all organs of test fish *H. fossilis* under the toxic influence of mercuric chloride. The increased alkaline phosphatases activity under the mercuric chloride exposure was in order Gill > Testis > Ovary > Kidney > Liver (Table-1).

The present findings are conformity with Sastry and Sharma (1978); Sastry and Gupta (1979); Jha and Jha (1995); Jagaraj (2008); Mohan, (2017) findings on different toxic compound exposure.

CONCLUSION

The test fish *Heteropneutes fossilis* when exposed to sub lethal concentration of mercuric chloride (0.25 ppm) for 30 days, the enzymatic activity significantly inhibited in alkaline phosphatases and increased significantly in acid phosphatases in the tissue of all organs. The inhibition of these enzymatic activities might be altered metabolism in fishes under stress of toxicants.

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