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EFFECT OF HEAVY METAL TOXICITY, ARSENIC TRIOXIDE ON THE BIOCHEMICAL PARAMETER OF FRESH WATER FISH, *CLARIAS BATRACHUS*

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ABSTRACT

With the increasing industrialization, urbanization and anthropogenic activities, pollution of heavy metal has spread more in the earth. Most of the heavy metals like arsenic are polluted by mining and erosion of mountains and rocks. The current experiment observed many changes in the biochemical parameter of catfish (Clarias batrachus) due to arsenic trioxide, in which the blood serum protein of catfish was observed. Arsenic trioxide has reduced its protein content by observing catfish in arsenic trioxide contaminated water within the stipulated time, which indicating that arsenic trioxide reduces or decreases protein content.

KEYWORDS: Arsenic trioxide, Biochemical parameter, *Clarias batrachus*, Protein.

INTRODUCTION

Heavy metal toxicity that means an overabundance of required concentration or it is unwanted which were found naturally on the earth, and become concentrated as a result of human-caused activities, enter in the plant, animal and human tissues via inhalation, diet and manual handling.Heavy metals are largely found in dispersed form in rock formations. Increasing industrialization and urbanization have the anthropogenic contribution of heavy metals in the biosphere (Asati *et al.*, 2016). In the fish heavy metals and their various compounds may affect their physiology and metabolic activity and abnormalities in haematology and biochemistry (Pichhode and Nikhil, 2015; Pichhode and Gaherwal, 2019a,b).

Proteins are playing important role in major physiological events therefore the evaluation of the protein content can be treated as a diagnostic tool to define the physiological phases of any organism. Proteins are highly sensitive to heavy metal toxicity. Depletion of protein content has been mentioned in the intestine, muscle and brain of the fish. When the animals are under toxic stress, diversification of energy occurs to achieve the impending energy demands and hence the protein levels are depleted (Neff, 1985). Arsenic and their various compounds are also known to induce major stress protein families, including heat-shock proteins both in vitro and in vivo condition in kind of model systems. In most of the situation, the induction of stress proteins depends upon the capacity of the arsenical to access the target, its valences, and the variety of exposure. Arsenate is one of the most potent inducer of most of the Heat-shock proteins in many organs and their systems with a rapid dose-dependent response to acute exposure (Papaconstantinou *et al.*, 2003). Arsenic and its components can cause toxicity by attacking directlyon phosphate or thiol groups consequent in impaired proteins or indirectly production of reactive oxygen species and free radicals drive oxidative stress harm to both DNA and proteins (Andrew*et al.*, 2003). The high toxic effect of arsenite: As +3 results from its greater affinity with sulfhydryl: SH, groups of biomolecules, whereas arsenate: As +5 does not bind directly to sulfhydryl group to exert its toxicity (Lam *et al.*, 2006). Arsenic toxic effects results are due to interaction with sulfhydryl groups of various

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enzymes, proteins and it also substitutes phosphorus in biochemical reactions (Patlolla and Tchounwou, 2005). The present study has been focused on arsenic trioxide induced biochemical changes (protein) in *Clarias batrachus*.

MATERIALS AND METHODS

Experimental Animal: The healthy catfish *Clarias batrachus* were used as an experimental animal and it was collected from local fish market of Indore and acclimatized in the laboratory for one week.

Test Chemical: The analytical grade arsenic trioxide (As_2O_3) (CAS No.: 1327-53-3) (Anhydrous) with 98% purity was taken from Spectrum chemical mfg. corp. Mumbai, India and used without further purification for the experiment.

Collection of Blood Sample: The blood collected by disposable syringe and needles from cardiac puncture of *Clarias batrachus* and kept in sterilized appropriate vials then processed for various biochemical analyses (Dacie and Lewis, 1975).

Experimental Design and Duration: In the present investigation experimental fishes were divided into two groups control and arsenic trioxide treated group. Ten (10) fishes were kept in control group and exposed to normal water and in experimental group forty (40) fishes were exposed to concentration of arsenic trioxideat different time intervals. In both control and experimental group fishes were exposed to maximum 96 hours (Pichhode and Gaherwal, 2019c).

Biochemical Analysis (Estimation of Total Protein): The estimation of total protein by Biuret methodwas determined (Harris, 2003). The total serum protein was expressed as g/dL.

RESULTS

Biochemical Estimation-In the present investigation biochemical estimation of control and arsenic trioxide (LC_{50} value- 84 mg/L) treated fishes were completed. The total proteinof control fish was 5.20 g/dl.

Total Protein in Blood (TP)- The quantity of total protein in blood serum of experimental fishes was found decreased in arsenic trioxide treated group. The decreased total protein concentration in blood of experimental fishes after 96 hrs. was 22.30 per cent. The decreased in protein value of blood after

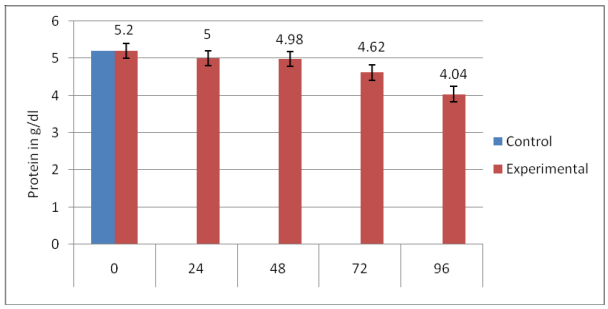

Fig. 1. Showing total protein in the blood of *C. batrachus* exposed to arsenic trioxide (84 mg/L) for different duration

24, 48 and 72 hrs. were 3.84, 4.23 and 11.53 per cent respectively.

In the present experimental investigation due to effect of arsenic trioxide (84 mg/L) total protein was decreased as compared to control value at 24, 48, 72 and 96 hrs.

DISCUSSION

The lake in plasma protein may be due to liver cirrhosis or nephrosis in kidney or might be due to changes in enzymatic activity involved in biosynthesis of protein (Palaniappan and Vijayasundurum, 2009; Pichhode and Gaherwal, 2019d). Alteration in total protein concentration of various tissues in different fishes exposed to various heavy metals such as arsenic, cadmium, lead, mercury etc. (Pazhanisamy, 2002).

The slime secretion of the gills and skin of fishes protects the fish in different manner. It offers a thick barrier level which prevents the penetration of the different toxicants into inner layers. When the toxicants affect then the process of slimy secretion is subsequently sloughed off and fish suffered to progressive depletion of protein content of the skin and gills of exposed fish (Blechinger, 2002). In fish, heat-shock protein 70 (Hsp 70) have been sequenced in different species including rainbow trout, magur, medaka, zebra fish and tilapia. In zebra fish, arsenic induced expression of heat-shock protein 70 in the gills, liver, olfactory rosette and skin. The scheme of expression for heat-shock protein 70 was tissue specific and dose dependent also. The synthesis of stress proteins in various cell types induces elevated concentrations of arsenic exposure, which exert a protective role on cell survival (Agarwal *et al.*, 2009). The present study shown that total protein of blood serum of *Clarias batrachus* is decreased due to toxic effect of arsenic trioxide.

CONCLUSION

The toxic effects of arsenic trioxide (84 mg/L) in catfish (*Clarias batrachus*) have been demonstrated in the present study. It is clearly represented that arsenic trioxide significantly reduced protein level in blood of *Clarias batrachus*and it is harmful for aquatic fauna.

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