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Toxicity Responses of the Fish Behaviour and Morphological Changes at Chromium Chloride in Hetropneustes-fossilis

Dr. Mahjabi Khan

Department of Zoology, D.S.N. P.G. College, Unnao

ABSTRACT

The current aquatic studies of toxicity of chromium chloride depond on biotic or abiotic factors i.e. temperature, concentration of Metal Salt Oxidation, PH, values, alkalinity, salinity and hardness of water. The experimental fish caused external behaviour responses observed were rest lessens, jumping, erratic swimming, gulping of air at the surface, loss of equilibrium sluggishness, opercular movements and fishes lied on the water surface before death and morphological changes like, discoloration of skin pigmented patches on body, shedding of scales sedimentation of chemical on body, mucous secretion and ballooning were observed in exposed animals the observed data shown the *H. fossilis* can be used as a good bio-indicator for heavy metal contamination in fresh water bodies.

Key words: Fishes, Chromium Salt, Behavioural responses, Morphological responses.

INTRODUCTION

Pollution may be explained as thing causing unnatural changes in the environment. Metal has been used various purposes but possibly those uses were less contributing to the environment in the preindustrial revolution days than they do know. Bakshi and Panigrahi; (2018). Jaishankar *et al., (*2014). Metal pollution in aquatic environment has been already reported Singaram, (1994). Somnath; (2002). Fishes more used to evaluate the health of aquatic ecosystem and physiological changes various newspaper printed many articles about the water pollution Gupta et al., (2018). Kakade et al; (2020). Fish Toxicity is a result of a sequence of events including different physical, chemical and biological process. Estimation of median lethal concentration or dosage (LC_{50} or LD_{50}) is important as it can be used as an indicator to the level of resistance of population response to metal Reda et al; (2010). Most of the metal are cumulative poisons Cr^{++}, Cr^{+++}, hexavalent or frequently bio-cumulated in their possible ionic form, both in fishes and others aquatic organism. Sivaperumal *et al;* (2007).

Chromium plating is one of the large numbers of uses in such as paint pigment, fabrication, leather industries. Chromium effluent from these process are more acidic and many contain the toxic hexavalent and trivalent the medicinal uses of chromium are limited to the external application of chromium trioxide as a causic intravenous s odium quadric chromate to evaluate the life of red cells tissues concentration of Cr in the general population have considerable geographic variation as 7 μg/kg in lungs of person NEW YORK with lower concentration Schroeder *et al;* (1965). Mason, (1996).

Fish is in omega 3 fatty acid, protein and various minerals that the men needs to stay however, potentially dangerous heavy metals are absorbed into the body tissue of fish that are transferred to human beings when the take to fish in their did fish have great economical values including direct and

indirect path way of motals- Afshan *et al*, (2014). Lacerda *et al,* (2020) Many published paper indicated highly mortality of juvenile fish and reduced breeding potentiality of adults after long term exposed to heavy metals. Pradhan and Hota, (1993). *Heteropneustes fossilis* is a carnivorous fish in order cypriniformes. The accessory respiratory organ for which it is quite hard and is usually found in muddy water i.e. it is available throughout the year. It also grow in the estuarine water Srivastava, (1968) which is much hostile type of an environmental,for other fresh water species. The present work to the find out the responses of behavioural and morphological changes in *Heteropneustes fossilis* due to the exposure of sublethal dose of chromium chloride.

MATERIAL AND METHODS:

Living specimens of Heteropneustes fossilis were procured from Kanpur Local fish market and acclimatized to the laboratory conditions before experimentations. The animal fed only boiled egg albumin and kept in well aerated glass and bathed in 1% of $KMNO_4$ solution. The size of glass Aquaria was 75 ×75×18 cm that contained in the laboratory at the water ambient temperature 26± 2^0C at winter session, value of water PH=7.1, both group of male and female fishes were selected for the experiment involving exposed to chromium salt solution by dissolving 1 gm of salt in the 1 litre of distilled water so that obtained a solutions of 1 mg/CC and this solution was added to aquarium containing 10 litres of water and the exposure was intended at the rate of 10 ppm 10 ml of stock solution to desired salt as added to its so that dilution of 10 mg/liters of (LC_{50}) achieved. Two groups of stock design group 1^{st} is normal aqualimized. Group II^{nd} is exposure of chromium chloride at 10ppm, 20 ppm & 30 ppm of chromium exposure. Each sets of 10 fishes kept the behavioural and morphological changes were recorded simultaneously at different exposure period. In order to maintain the concentration of chromium, the water in the aquaria was changed every 24 hrs during the acute exposure and for chronic exposure water was changed twice a week. Fishes were regularly noticed for any variation in behaviour and external morphology (Table-1).

Table No. 1: Mortality of Fish H. Fossilis in different concentration of Chromium Chloride at 96 has of exposure period.

Concentration of $CrCl_2$ (mg/l)	Log_{10} Conc.	Mortality %	Probit value
Control	-	-	-
45	1.653	20	4.16
65	1.812	30	4.48
85	1.929	40	4.75
105	2.021	60	5.25
125	2.096	90	6.28

RESULTS AND DISCUSSION:

Fishes are an important indicator of water pollution as its remain in direct water for food and oxygen and thus is highly susceptible to any change in aquatic environment. Metal does not break down in the environment and persist in the fish body for long periods and can bio accumulate for many years after the exposure to low levels of this metals Markowiez *et al,* (2019).

LC_{50} Estimation:

The exposure fish *H.fossilis* was exposed to heavy metal chromium (cr) as chromium chloride ($Crcl_2$) upto 96 hrs i.e. IV^{th} days. The present mortality rate for each concentration of $Crcl_2$ concentration at which mortality observed was 45 mg/l. The first death of experimental fish was recorded in 125 mg/l at 24 hrs i.e. I^{st} day of exposure. IV^{th} day experimental i.e. 96 hrs LC50 values was found to be 80.62 mg/l. No, mortality was observed over 96 hrs in central group of fishes. This variation in LC50 value may be due to change of fish species, geographical area as well as Metal toxicity, Kausal and Mishra, (2013). Observed fish mortality may chromium compounds resulted by absorption, bio-accumulation of metal compounds or greater activity of chemical absorb in fish body.

Behavioural changes:

When *Heteropneustes fossilis* exposured to different concentration of chromium chloride. It reported that increased amount of chromium resulted in increased mortality and caused various behavioural and morphological changes. In both the control and the experimental aquaria, the behaviour and condition of fishes were observed during the experimental time. When fishes were exposed to sublethal concentration of chromium chloride. They shown remarkable changed while in control group such changed were not reported. Just after introducing the fishes to the test aquaria, they shown the symptoms of swimming disability like uncontrolled irregular, erratic and darting swimming movements, restlessness loss of equilibrium, drawing, hitting against the wall of aquaria to avoid the chemical may be related to change in neurorecptors. Svece Vieus, (2001). Kwade and Khillare, (2014). (Table 2)

Table No. 2: Effect of sublethal dose of Chromium Chloride exposure in behavioural responses of *H. Fossilis.*

S. No.	Behavioural changes	Control Fishes	Expose of CrCl2 period				Chronic	
			Acute test				Test	
			24 hrs	48 hrs	72 hrs	96 hrs	20 days	30 days
1.	Loss of Equilibrium	Normal	Nil	Prominent	Mode rate	Prominent	Mode rate	Less
2.	Gulping air at surface	Normal	Less Change	Mode rate	Mode rate	Prominent	Mode rate	Less
3.	Erractic Swimming	Normal	Nil	Mode rate	Mode rate	Prominent	Less	Less
4.	Opercular Movements	Normal	Nil	Mode rate	Mode rate	Prominent	Less	Less
5.	Rest lessness	Normal	Mode rate	Mode rate	Mode rate	Prominent	Mode rate	Less
6.	Jumping	Normal	Mode rate	Prominent	Mode rate	Prominent	Mode rate	Less
7.	Sluggishness	Normal	Nil	Nil	Mode rate	Prominent	Mode rate	Less

Other changes observed were hyper excitability disturbed schooling and shoaling behaviour reduce feeding behaviour, mucous sluggishness observed at the end of exposure periods, loss of energy, erratic swimming and jumping and restlessness. Behavioural activity increase after the exposure of 96 hrs i.e. IV days after every 24 hours, similar observed the increase in the number of days they shown to get adopted to the toxic environment upto some extent water was changed in their colouration and changed the PH values of water. Behavioural changed have been sensitive indicator of chemically induced stress in aquatic organisms. Suedel et al, (1997). Exposure fish indicate of internal disturbances of the body functions such as inhibition of enzyme functions impairment in mural transmission.

By the comparing two stock of the fish is appeared that not only total mass of the fish but also individual weight is responsible to decide the rate of surfacing and gills movements as less the weight higher is respiration and probably might be for highs thyroid activity in younger specimens.

Morphological changes:

During this study the various morphological changes in the body being exposed to the different time period of chromium chloride including changes of skin their chemical deposition on the skin patches. Mucous secretion may be responsible for the thin layer of chemical on aquarium bottom shedding of scales (Table -2). Similar result by Gupta and Dua, (2015). Other changes observed were clumping of Gills hyper extension of abdominal fins, splits and necrosis of fins-Lesion on skin, eye deformities and muscular tetany. Copious mucous secretion and its coagulation observed at higher chemical concentration. These changes were seemed after the long term hrs of exposure i.e. 10 days of exposure more prominent at 30 days of exposure these all deformities was increased with the increase exposure at long term by observed Anita et al, (2010). Exposure water turbity P_H values change due to the concentration of metalio, ions. Aquoria exposure water colour dark blackish greenish in colour. Similar observation were reported by Brraich and Kaur, (2015) water has become turbid due to mucous secretion from the skin of fish. Some fishes died after the experimental exposure. Fishes loss the body balance the morphological responses was dependent on the concentration of toxicant and length of exposure. These parameters are used to determine toxicity Kaushal et al, (2013). The behaviour changes in fish can be considered to access the health status of the fishes as well as aquatic bodies protection in the major requirement of the society.

CONCLUSIONS:

In the present study result showed that when fished exposed to sublethal concentration of chromium chloride they shown morphological and behavioural responses of the fishes *Heteropneustes fossilis* has showed differential mortality level at different concentration the mortality has showed an increased level with an increase in the duration of exposure period of chromium chloride prolonged exposure induces behavioural and morphological changes in fishes. These changes and responses indicated stress in fishes. Which can further lead to death and reduction in fish fauna.

This type of observation base study helps understand the effect of heavy metal pollution of fishes so, as to determine safe environmental concentration where there is no stress.

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