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EFFECTS OF LEAD ACETATE ON RESPIRATORY BEATS AND OPERCULUM ACTIVITIES OF SNAKEHEAD FISH, *CHANNA PUNCTATUS*

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Abstract

Channa punctatus, a species of freshwater fish, was subjected to an experiment to measure the effects of lead acetate on its morphology, respiratory rate, and operculum activity. The fish in the experiment were dosed with lead acetate, which might have entered their bodies through their gills, skin, or digestive systems. Lead acetate was shown to have accumulated on the gills, operculum, morphology, and respiratory rate of the cichlid fish Channa punctatus. Fishes are particularly vulnerable to the accumulation of heavy metals in fresh water since they are the top consumer in aquatic systems. Fish consumption may have an effect on humans, especially in regions where fish is a staple meal.

Keyboard: Lead Acetate, Behavioral changes, Operculum movement, *Channa punctatus.*

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Introduction

Due to their toxicity, accumulation, and bio-magnification by marine animals, heavy metals in the aquatic network are among the most significant contaminants. Heavy metals in natural aquatic systems may have their origins in both domestic and industrial activities as well as anthropogenic causes (Velez and Montoro, 1998). Fish are one of the species used to gauge the state of an aquatic ecosystem since pollutants like heavy metals bioaccumulate in the food chain and produce the detrimental consequences, even mortality. Bioaccumulation of pollutants is greater in higher-ranking fish due to their greater exposure to heavy metals from their diet (EFSA, 2005).

According to the definition provided by Chavan and Muley (2014), a toxicant is an agent that can cause an undesirable response in an organism, severely impairing the structure or function of the organism to the point where death results. Industrial activities, sewage disposal, soil leaching, and rainfall all contribute to the release of heavy metals into the environment. Constant pollution of the aquatic environment by effluents and other hazardous compounds has a negative impact on the development of aquatic life, especially commercially valuable fish species.

Individual development rates, physiological functioning, mortality, and reproduction in fish can all be negatively impacted by heavy metal toxicity (Amundsen *et al.*, 1997). There are three potential entry points for heavy metals into fish bodies: the gills, the digestive tract, and the skin. Although the body surface is typically expected to play a minimal role in the uptake of heavy metals in fish (Selda and Nurşah, 2012), the gills are thought to be the important site for direct uptake of metals from the water (Romeo *et al.*, 1999). It is of public health concern to ensure that aquaculture products are safe for human consumption because seafood will become an even more important source of food protein in the future (WHO, 1999).

The ecological harmony of the recipient habitat and a variety of aquatic creatures may be severely disrupted by heavy metal contamination. Many aquatic organisms are in danger because of the effects it has on their genes, bodies, and brains (Scott and Sloman, 2004). Multiple studies have linked Pb exposure to a wide variety of adverse health effects, including changes in the central nervous system, gastrointestinal tract, reproductive system, cardiovascular system, immune system, and histopathology and histochemistry (Reglero *et al.*, 2009; Abdallah Mirhashemi, *et al.*, 2010; Rout and Naik, 2013a). Some physiological changes in fish can be seen as biological markers of environmental contamination (Dautremepuits *et al.*, 2004), and fish are widely utilized in assessing the quality of aquatic systems.

Since chemical and physical measurements alone are insufficient to identify potential effects on aquatic biota, toxicity studies are essential in water pollution evolution (Prakash and Verma, 2018). Papermaking is an extremely water-intensive industry because of all the water used in the manufacturing process. Annually, this industry in India uses about 905.8 million cubic meters of water and discharges about 3 695.7 million cubic meters of wastewater (Srivastava *et al.*, 2019). The response of the fish towards toxicity was found to be largely dependent on the concentration of effluents and the length of exposure, as documented by Sadguru and Ashok (2020), who worked on the toxic effect of paper mill effluents on mortality behavior and morphology of snake headed fish Channa punctatus (Bloch.).

Materials and Methods

Healthy snakehead (*Channa punctatus)* of weight 41.7± 13.1g and length 14.4 + 3.2 cm, were obtained from a local source. The fish were treated with potassium permanganate 0.04% to avoid dermal infections, if any. The fish were kept in large holding glass aquaria for acclimatization for 15 days. Fish were fed commercial fish feed; water tanks were cleaned regularly and water parameters were estimated as per APHA (1998). During the test period, water temperature was between 28-35°C, pH ranged between 7.4-7.6, dissolved oxygen ranged from 7.1 to 7.4 mg/L, conductivity was between 290-300 ì S/cm and total hardness was 178-180 mg/L. Food was discontinued 24 hours before the start of toxicity study.

Lead acetate was obtained from Avarice Pvt. Ltd. Gaziabad, U.P., India. Range finding studies were conducted to determine the different concentrations of lead acetate to be used for the acute toxicity experiments. Lead acetate was dissolved in 100% acetic acid glacial to prepare a stock solution. The stock solution was diluted to prepare five different test concentrations viz., 15 mg/L, 20mg/L, 25mg/L, 30mg/L and 35mg/L and a control was also employed. In the acute toxicity test, a set of ten fishes in each aquaria for all the treatments were randomly exposed to different concentration of lead acetate. Fish respiratory responses, operculum activities and morphological changes were recorded at 96 hour.

Result and Discussion

Channa punctatus exposed to lead acetate showed a dose dependent increase in restlessness, erratic swimming and surfacing behavior. When exposed to concentrations of lead acetate @ 12 mg/L and above, the fish hung vertically in water and showed loss of balancing ability towards the later stages. The changes in behavioral and morphological parameters after exposure to different concentrations of lead acetate are summarized in Table – 1.

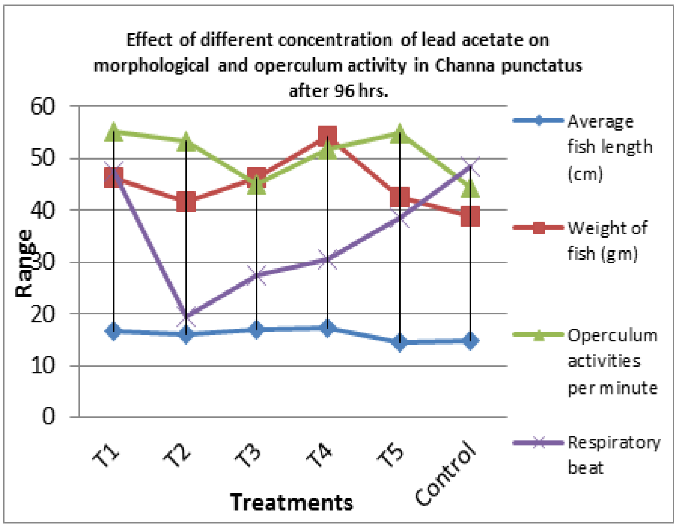
Effect of different concentration of lead acetate was noticed on the basis of results obtained as the behavioral and morphological changes in all the treatments. Morphological changes was recorded of the colour appeared of the skin, gills and fin, it was noticed that the skin clour was recorded as normal grey in control where as in T_1, T_2, T_3. T_4 and T_5 treatments it was noticed as grey, grey and moderate slimy, dark grey and slimy, dull blackish slimy and few black and white patches covered with mucous respectively. The colour of the gill was recorded as Dark grey to Red and light slimy, moderate slimy, dull red and blackish red in Control, Treatment-1, T_2, T_3, T_4 and T_5 simultaneously. Fin colour was recorded as grey in control, Grey in T_1, light slimy in T_2, moderate slimy grey in T_3, High slimy grey in T_4 and grey and wounded in T_5 treatment respectively.

The maximum length of tested fishes was observed as 17.2 cm in Treatment- 4 where as lowest length was recorded 14.4cm in T_5 treatment. 14.9 cm length was recorded in control condition where no lead acetate was applied. The weight of the tested fishes was ranged between 38.8 gm -54.1 gm. Operculum activities per minute was recorded ranged between 44.5–55.25. Respiratory beat in tested fish (*Channa punctatus* Bloch) was recorded as low in 19.33 in T_2 treatment and higher in 48.46 in control. In T_1 treatment respiratory beat was recorded as 47.3 and 27.32 was recorded in T_3 treatment. 30.45 and 38.52 respiratory beat was observed in T_4 and T_5 treatment respectively.

Because of their high sensitivity to changes in the marine environment, fish are widely regarded as a reliable bio-indicator of water quality. Channa punctatus morphological alterations after exposure to lead acetate at varying doses for 96 hours are shown in table -1. Fish that have been exposed to effluent exhibit signs of mucus production excess. Fish were found to have clots on their gills and external bodies. Fishes that were exposed to effluent also saw their gill color change from bright red to a dull red, and their skin developed eruptions. According to the results of the current research, lead acetate is toxic to the air-breathing fish Channa punctatus. The fish's morphology, respiration rate, and operculum activity were evaluated after being exposed to lead acetate. The fish that can be eaten contains high levels of heavy metals. Fish consumption has been linked to a variety of health issues in humans.

Table: Effect of different concentration of lead acetate on morphological and operculum activity in *Channa punctatus* after 96 hrs.

Treatments	Morphology			Average fish length (cm)	Weight of fish (gm)	Operculum activities per minute	Respiratory beat
	Skin	Gills	Fin				
T_1	Gray	Red	Grey	16.5	46.1	55.25±1.98	47.3±1.96
T_2	Grey and moderate slimy	Red and light slimy	light slimy grey	15.9	41.7	53.3±1.46	19.33±4.2
T_3	Dark grey and slimy	Red and Moderate slimy	Moderate slimy grey	16.8	46.2	44.95±2.66	27.32±0.45
T_4	Dull blackish slimy	Dull red	High slimy grey	17.2	54.1	51.75±2.97	30.45±0.90
T_5	Few black and white patches appears and covered with mucous	Blackish Red	Grey and wounded	14.4	42.4	54.75±5.50	38.52±0.44
Control	Normal grey	Dark red	Grey	14.9	38.8	44.5±1.50	48.46±1.40



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