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Short Communication

Heavy Metal Concentrations in Water and Fish *Labeo Rohita* of River Godavari, at Nathsagar Dam in Aurangabad District, Maharashtra

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The pollution of aquatic environment by inorganic and organic chemicals is a major factor posing serious threat to the survival of aquatic organisms including fish. Among the environmental pollutants, metals are of particular concern due to their potential toxic effect and ability to bioaccumulate in aquatic ecosystems. The presence of heavy metals in aquatic ecosystem is the result of two main sources of contamination; natural processes and anthropogenic activities. Heavy metals including both essential and non-essential elements have a particular significance in ecotoxicology, since they are highly persistent and all have the potential to be toxic to living organisms [2].

Fish is often at the top of aquatic food chain and may concentrate large amounts of some metals from the water. Metal bioaccumulation is largely attributed to differences in uptake and depuration period of various metals in different fish species. Multiple factors including season, physical and chemical properties of water can play a significant role in metal accumulation in different fish tissues. The gills are directly in contact with water. Therefore, the concentration of metals in gills reflects their concentration in water where the fish lives, whereas the concentration in liver represents storage of metals in water [4]. The studies carried out on various fishes have shown that heavy metals may alter the physiological activities and biochemical parameters both in tissues and in blood [11]. Fishes are notorious for their ability to concentrate heavy metals in their muscles and since they play important role in human nutrition, they need to be carefully screened to ensure that unnecessary high level of some toxic trace metals are not being transferred to man through fish consumption.

The present research work aimed to analyze the accumulation of heavy metals (Cadmium, Chromium, Lead, Nickel and Zinc) in water and fish organs of *Labeo rohita*, of river Godavari at Nathsagar Dam in Aurangabad district of Maharashtra.

Nathsagar dam is one of the largest dams in state of Maharashtra in India. It is 86 Km away from a metro city of Aurangabad. The dam is located at latitude of 19.48°N and a longitude of 75.37°E. Water samples and fish samples (*Labeo rohita*) were collected from two different sites of river Godavari in October 2020. Site I was near the wall of Nathsagar Dam and Site II was 2 Km away from the wall of Dam, at upstream water of river Godavari. Water samples were collected in the middle of the river at 50 cm below the surface, using 1 liter polythene bottles with screw caps. The bottle had been washed and soaked in 5% nitric acid and rinsed with deionized water before use. The water samples were acidified immediately after collection by adding 5 ml nitric acid to minimize adsorption of heavy metals onto the walls of the bottles [3]. Water samples were analyzed using UV-VIS Double Beam Spectrophotometer for detection of heavy metals, and the results were given as µg/L of sample water.

Samples of five fish (*Labeo rohita*) of nearly equal size and weight were dissected to remove muscles, gills and liver. The separated organs were put into petri dishes to dry at 120°C. The organs were placed into digestion flasks and ultrapure Con. Nitric acid and hydrogen peroxide (1:1 v/v) was added. The digestion flasks were then heated to 130°C until all the materials were dissolved. Digest was diluted with double distilled water appropriately. The heavy metals Cd, Cr, Pb, Ni and Zn were assayed using UV-Spectrophotometer and the results were given as µg/gm dry weight. Data obtained from the experiments were analyzed and the results were expressed as mean of all five. Values of $P<0.05$ were considered statistically significant.

Average heavy metal concentrations in the sample water collected from two sites of Nathsagar Dam is given in (Table 1). The traces of heavy metals in water were found to decrease in the sequence Ni>Pb>Zn>Cr>Cd at both the sites. Maximum amount of metal found in sample water was nickel. The values of nickel observed were 5.12µg/L at site I and 4.82µg/L at site II. The values of cadmium were minimum 1.27µg/L at site II and 1.32µg/L at site I. The higher level of nickel, lead and zinc in the river water may be due to excessive use of pesticides and fertilizers in the agriculture fields along the banks of this river.

The analysis of heavy metals in different organs of fish *Labeo rohita* is shown in (Table 2). All the three organs – muscle, gills and liver show different values of accumulation of heavy metals. Gills show higher level of metals succeeded by

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muscle and liver. In the gills, the sequence of trace metals is Pb>Cd>Ni>Zn>Cr. It is observed that the sequence of trace metals is Pb>Ni>Cd>Cr>Zn in muscles and Pb>Cd>Ni>Zn>Cr in liver. The concentration of zinc and chromium shows fluctuations in all the three organs. The maximum amount of metals found in fish organs is lead, accumulating the gills. It shows values 2.65 µg/gm dry weights at site I and 2.37 µg/gm dry weights at site II. The minimum amount of heavy metal is chromium found in liver. It shows values of 0.35µg/gm at site I and 0.28µg/gm at site II. The muscles show minimum amount of zinc (0.53µg/gm) and maximum amount of lead is 2.17µg/gm.

Table 1 Average heavy metal concentrations (µg/L) in sample water collected from two sites of Mula Dam

Heavy metals	Site I	Site II
Cd	1.32	1.27
Cr	1.47	1.38
Pb	4.68	4.10
Ni	5.12	4.82
Zn	2.86	2.59

The values and sequence of heavy metals found in different organs are correlated with the results found by [1], [9].

Accumulation of bioactive metals like cadmium, chromium, lead, nickel and zinc was actively controlled by fish through different metabolic processes and the level of accumulations usually depend on ambient concentrations. Lead concentration in all the tissues of *Labeo rohita* was higher than other metals. Lead concentration is followed by nickel and cadmium. Similar results were observed by [7] working on lake Kolleru in Andhra Pradesh. In the literature, heavy metal concentration in the tissues of freshwater fish vary considerably among different studies [6], [8], [12], possibly due to chemical characteristics of water, ecological needs, metabolism and feeding patterns of fish. Difference in concentration of metals in different parts of an organism could be attributed to the tendency of metals to bind to various molecular groups found within the cells of organisms as well as the degree of exposure to metal as influenced by its metabolic characteristics and position in the food chain [10]. Heavy metals in aquatic environment and aquatic biota pose a risk to fish consumers and other wild life. Heavy metals may enter aquatic ecosystem from different natural and anthropogenic sources including industrial or domestic sewage, storm runoff, leaching from landfills and atmospheric deposit [5]. Therefore, care should be taken in terms of frequent physicochemical analysis of river water and to measure accumulated metals in the organs of edible fish species collected from the region of water receiving effluent.

Collection of *Labeo rohita*

Collection site of Godavari River

Table 2 Average heavy metal concentrations (µg/gm dry weight) in different organs of fish *Labeo rohita* collected from Mula Dam

Organ	Site I					Site II				
	Cd	Cr	Pb	Ni	Zn	Cd	Cr	Pb	Ni	Zn
Muscle	1.64	0.72	2.17	1.96	0.61	1.58	0.64	1.98	1.73	0.53
Gills	2.33	0.86	2.65	2.14	1.47	2.11	0.71	2.37	1.98	1.19
Liver	1.38	0.35	1.43	0.92	0.43	1.03	0.28	1.18	0.74	0.37

SUMMARY

The present study was conducted to determine the concentrations of heavy metals (Cd, Cr, Pb, Ni and Zn) in sample water and organs (muscle, gills and liver) of fish *Labeo rohita* of Godavari River, at Nathsagar Dam in Maharashtra. There was an appreciable decrease in metal concentrations in sample water from site I to site II. The heavy metal concentrations in sample water were in the order Ni>Pb>Zn>Cr>Cd. Accumulation of heavy metals in the organs of fish *Labeo rohita* was found in the order gills>muscle>liver. In the gills, lead was found maximum (2.65 µg/gm dry weight), whereas chromium was minimum (0.71µg/gm dry weight). In the muscles, lead was found maximum (1.98 µg/gm dry weight), whereas zinc was minimum (0.53µg/gm dry weight). In the liver, lead, cadmium and nickel were more concentrated compared to zinc and chromium. The concentration of heavy metals accumulated in gills and liver was found in the order Pb>Cd>Ni>Zn>Cr and in the muscles, it was found in the order Pb>Ni>Cd>Cr>Zn. As the fish *Labeo rohita* is largely consumed by people, it is essential to make awareness about water pollution and effects of heavy metals on human body. The results of this study supply valuable information on the metal contents in water sample and fish organs of the river Godavari, at Nathsagar Dam. Fish gills and muscles shows highest tendency to accumulate lead, cadmium and nickel, while accumulation of metals is less in liver. It is important to examine the toxic effect of metals on

fish since they constitute an important link in food chain and their contamination by metal causes imbalances in the aquatic system. Hence, a scientific method detoxification is essential to improve the life of these economically important fishes in any stressed conditions.

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