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Heavy Metal Detection in a Cyprinid Species, *Labeo rohita* Collected from Shnebaye Stream of District Karak, Khyber Pakhtunkhwa Province, Pakistan

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Abstract: The present study is focused on the analysis of some selected metals like nickel (Ni), cadmium (Cd), copper (Cu), lead (Pb) and zinc (Zn) in three body regions of a cyprinid species, *Labeo rohita*, collected from Shnebaye stream of district Karak for their significance for human consumption. In the present study, 20 samples of fishes belong to two different size groups were also examined. During the detection of heavy metals in the present study, each fish sample was divided into three body portions i.e., head, abdomen and tail. The obtained results on the level of selected metals in the three body regions of fish were found in decreasing order as follows, Ni>Cd>Cu, while zinc and lead were not detected in studies parts. Variations were also observed among the different size groups as well as among the different body regions of fish. Thus, the results of the present study revealed that all selected metals were in permissible limit; hence, this carp species was suitable for human consumption.

Key words: Heavy Metal Concentration · *Labeo rohita* · Shnebaye Stream · Karak

INTRODUCTION

The term heavy metal is a general term, which applies to group of metals and metalloids with atomic density greater than water [1]. Metals are non-biodegradable that is considered as major environmental pollutants causing cytotoxic, mutagenic and carcinogenic effects in animals. Metal bioaccumulation is largely attributed to differences in uptake and depuration period for various metals in different fish species [2, 3]. The fresh and marine water contamination with a wide range of pollutants has become a serious matter of concern over the last few decades [4].

Aquatic organisms have the ability to accumulate heavy metals from various sources including sediments, soil erosion and runoff, air depositions of dust and aerosol and discharges of waste water [5]. As aquatic foods are the rich sources of essential amino acids, fatty acids, protein, carbohydrates, vitamins and some important trace minerals, therefore, among the other sea foods, fish are most commonly used as food and, hence, are connecting link for the transfer of toxic metals in human beings that later may also have harmful effect on health [6].

The real importance of fish in human diet is not only in its content of high-quality protein, but also to the two kinds of Omega-3 polyunsaturated fatty acids: Eicosapentenoic acid (EPA) and docosahexenoic acid (DHA). Omega-3 (n-3) fatty acids are very important for normal growth where the ported y reduce cholesterol levels and the incidence of heart disease, stroke and preterm delivery. Fish also contain vitamins and minerals which play essential role in human health [7]. As fishes are major part of human diet therefore it is not surprising that numerous studies have been carried out on metals pollution in different species of edible fishes. During the process of taking up heavy metals, different organs take up different concentration of heavy metals according to their affinities [8]. Therefore, the present study was also conducted to determine some trace metals in the different parts of *Labeo rohita* collected from Shnebaye stream of District Karak in order to analyze their impact on human health.

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MATERIALS AND METHODS

Study Area: Fish sampling was carried out from Shnebaye Stream in Handai, district Karak, Khyber Pakhtunkhwa during the month of April, 2015. The people of this area use the water of this stream in their daily life. This area also represents a good site of journey and entertainment.

Sampling Location: Twenty samples of a carp species, *Labeo rohita* were collected from Shnebaye Stream. Then all collected fish samples were divided into two different size groups i.e.,

Group 1: Fish Samples ranged from 18 to 21 cm in Total Length (TL)

Group 2: Fish samples ranged from 24 to 27 cm in Total length (TL)

The collected fish samples were packed in plastic container and transported to the department of chemistry Kohat University of Science and Technology (KUST), for further studies. The samples were collected in sterile polythene bags and kept in the laboratory deep freezer (-20°C) to prevent deterioration till further analysis.

Sample Preparation: Each fish sample was cut to divide it into three body parts viz. head, tail and abdomen. A clean washed high quality corrosion resistant stainless knife was used to cut the fish into head, tail and abdomen. Then take about 20g dried homogenized sample in an iodine flask separately and then placed in incubator for 2 hour to become ash.

Extraction of Metals: For analyzing the metals, firstly each sample was digested. Samples of fish muscle tissue were thawed, washed with the help of distilled water after then blotted using blotting paper. After that these samples were placed in to the clean washed and sterilized volumetric flask. 2 grams of each sample with known weight was placed in the volumetric flasks. Following this the digestion of samples was carried out implementing the methods illustrated by Due-Freez and Steyn [9] and Van Loon [10]. During digestion, 10 ml of 55% of nitric acid (HNO_3) was added to all flasks and 5ml of 70% Percholic acid was also added. After this the flasks were positioned and placed on the hot plate for purpose of digestion at temperature ranging from 200 to 250°C. Subsequent to digestion samples were cooled in 10ml of concentrated HNO_3 was added into each China dish and non porous Crucible. The samples in China dish and non porous Crucible were heated on a hot plate for half an hour to evaporate excess amount of HNO_3 and the solution was evaporated again on a hot plate, continuing until sample was completely digested and become colorless. The fluid was cooled to room temperature. The digested sample was filtered through Whatman filter paper no. 42 into 50 ml Graduated cylinder and made up to the volume using HPLC grade water.

RESULTS AND DISCUSSION

The obtained results of the detection of heavy metals i.e., Nickel (Ni), Copper (Cu), Zinc (Zn), Lead (Pb), cadmium (Cd) in three body region (i.e., head, abdomen and tail) of 20 collected samples (10 samples of each size group) of *Labeo rohita* from Shnebaye Stream were calculated and presented in Tables 1-2, respectively. The obtained results of the present study revealed that metals concentrations about the three different body regions of fish were found in decreasing order as Ni>Cd> Cu, while zinc and lead were not detected in the samples of *Labeo rohita*. This might be because different organs have different affinities to take up different concentration of heavy metals from their surrounding environment [8]. Furthermore, No significant variations ($p<0.05$) were also observed in concentrations of these selected metals of present study among the three body regions of two different size groups as shown in Table 3.

Table 1: Concentration of metals (mg/L) in three body regions in *Labeo rohita* (Group 1)

Heavy metals	Head	Abdomen	Tail
Ni	0.86±0.02	0.77±0.01	0.88±0.05
Cu	0.56±0.05	0.65±0.02	0.70±0.04
Zn	ND	ND	ND
Pb	ND	ND	ND
Cd	0.66±0.05	0.67±0.01	0.35±0.02

ND: Not detected Number of represented samples= 10 Data Are represented as mean ± standard error

Table 2: Concentration of metals (mg/L) in three body regions in *Labeo rohita* (Group 2)

Heavy metals	Head	Abdomen	Tail
Ni	0.76±0.03	0.64±0.01	0.78±0.05
Cu	0.60±0.02	0.64±0.01	0.70±0.04
Zn	ND	ND	ND
Pb	ND	ND	ND
Cd	0.68±0.06	0.67±0.02	0.36±0.02

ND: Not detected Number of represented samples= 10 Data Are represented as mean ± standard error

Table 3: Analysis of variations between the means of metal concentrations in three body regions of the two size groups of *Labeo rohita*

	2 samples t-test at 95% Confidence interval (CI)			
Body regions	95% Cl	t-test	p-value	Significant at p<0.05
Head	-0.3302±0.3035	-0.13	0.902	NS
Abdomen	-0.2121± 0.1187	-1.21	0.349	NS
Tail	-0.673± 0.613	-0.15	0.89	NS

Note: NS=not significant when p>0.05.

Nickel (Ni): Nickel is widely used in industry and is a common aquatic pollutant. In natural waters, Ni^{2+} is the dominant chemical species. In aquatic ecosystems nickel inter- acts with numerous inorganic and organic compounds and occurs as soluble salts adsorbed onto substances of different chemical origin. Some of these interactions are additive or synergistic in producing adverse effects and some are antagonistic. The detected level of Nickel in all samples was more but under the permissible limit of this metal in human body [11].

Copper (Cu): Copper is a trace element which can be found in almost every cell of the human organism. The highest concentrations of copper are discovered in the brain and the liver; the central nervous system and the heart have high concentrations of copper as well. About 50% of copper content is stored in bones and muscles (in skeletal muscle it is about 25%), 15% in skin, 15% in bone marrow, 8 to 15% in the liver and 8% in the brain [12]. Copper is an essential elements to the human body and the concentration of copper detected in the all samples were normal.

Zinc (Zn): Although human body can accommodate high concentration of zinc, acute Zn toxicity can cause eminent health problems such as stomach cramps, skin irritation, nausea, vomiting and anemia, while chronic deficiency may lead to copper deficiency in man [13].

Lead (Pb): The absorbance of high concentration of lead in the human blood stream may increase the lead level in the blood. Inorganic lead is certainly one of the oldest occupational toxins and lead poisoning is evident since Roman times. At very high level in blood is a powerful abortifacient, at low level it has been associated with miscarriage and low birth weight of infants. Some cases have shown reduced count mortality other include showing of sensory motor time in male, reduced resistance and increased mortality rate in experimental animal sand. Impairment of antibody production with reduction of immuglobin plaque-forming cells [14]. In the present study, lead was not detected, so this carp species is suitable for human consumption.

Cadmium (Cd): The primary and most serious adverse health effects of long- term exposure to cadmium include kidney dysfunction, lung cancer and prostate cancer. Cadmium may cause local skin or eye irritation and can affect long-term health if inhaled or ingested. Cadmium make the part of food chain of fish and these fishes after using by human beings makes cause of some dangerous diseases [15-17]. The concentration of cadmium in all the samples was found in suitable range that's why safe to eat this fish.

CONCLUSIONS

From the obtained results, it was concluded that carp species, *Labeo rohita* found in from Shnebaye Stream contain metal concentration in permissible limit, so, hence, this carp species was suitable for human consumption. Furthermore, as the environmental conditions of this stream are free from the accumulation of heavy metals pollution, thence, it is more suitable to take some steps for the management and conservations of *Labeo rohita* found in this Stream, which is most commonly used edible fish species in the diets of the local community of district Karak.

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