ASSESSMENT OF HEAVY METALS IN INDIAN MAJOR CARPS

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The present study determined the levels of arsenic and copper in muscle tissues of Indian Major Carp (*Labeo rohita*, *Catla catla* and *Cirrhinus mrigala*) of 500-1500 g of weight ranges. The fish samples were collected from Rahara fish farm of ICAR-Central Institute of Freshwater Aquaculture, North 24-parganas and Mudialy Fishermen Co Operative Society fish farm, South 24 Parganas and estimated the health risk posed by fish ingestion. Heavy metals concentrations in fish were analyzed by using atomic absorption spectrophotometer. Arsenic content was found to be 0.17 ± 0.02 , 0.87 ± 0.03 and 0.19 ± 0.05 (ppb) respectively in rohu, catla and mrigal which was significantly ($P < 0.05$) higher in *Catla catla*. In the present work, the concentration of copper in the muscles of rohu, catla and mrigal was found to be 0.64 ± 0.13 , 0.69 ± 0.22 and 0.25 ± 0.01 (ppm) respectively. Copper content did not differ significantly among rohu, catla and mrigal. Levels of heavy metals (arsenic and copper) were below the permissible limits of human health. Regular monitoring of heavy metals in fish tissue is required to check its contamination level in fish tissues reared in wastewater. Thus, the present study shows that the consumption of fish reared in wastewater is safe for human so far heavy metals like arsenic and copper are concerned.

Key words: Arsenic, Copper, Fish muscle, Indian major carp, Tolerable intake

Metals are unrelenting contaminants and they aggregate in soil, water, sediment and mostly, in trophic chains. Heavy metals are naturally occurring trace components of the aquatic habitats that have been increased tremendously due to domestic, industrial, mining and agricultural activities (Karbassi *et al.*, 2006). Fish can be considered as one of the most significant bio-monitors in freshwater systems (Begum *et al.*, 2005). For fish, the gills, skin and digestive tract

are the most likely sites of uptake of water borne chemicals (Barlas, 1997). Fishes are major part of the human diet due to high protein and sufficient polyunsaturated fatty acids which are known to support good health, therefore, various studies have been taken worldwide on the contamination of different fish species by heavy metals (Rauf *et al.*, 2009). Hence, it is important to monitor all potential contaminants of the ecosystem and its effect on food web to

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ensure the food quality and safety (Andreji *et al.*, 2006). Copper is an essential substance to human life, but in high doses it can cause liver and kidney damage, and stomach and intestinal irritation (Hubicki and Kolodynska, 2012). The Present study has been made to investigate the concentration of arsenic and copper in Indian Major Carps as there is worldwide concern about of contamination of aquatic organisms by metal concentration.

Seven numbers juveniles each of *Labeo rohita*, *Catla catla* and *Cirrhinus mrigala* were randomly collected from Rahara fish farm of ICAR-Central Institute of Freshwater Aquaculture and Mudialy Fishermen Co Operative Society. The collected samples were iced immediately and then taken for analyses. Sampling procedure and sample preparation was done as per (Sankar *et al.*, 2010). Heavy metals analysis was done as per (AOAC, 2005). The samples were subjected to wet oxidation (digestion) with di-acid mixture of HNO_3 and H_2SO_4 at the ratio of 3:1(v/v) at $<150^\circ\text{C}$ until watery coloured solution appeared (Paul *et al.*, 2014). It was transferred to a volumetric flask (100 mL capacity) and volume was made up to the mark with 2% HNO_3 . This solution is then filtered through glass filter (25 mm

diameter and porosity 0.22 μm). Total arsenic was analyzed under Atomic Absorption Spectrophotometer coupled with Hydride Generator (Thermo Fisher, M Series; U.K.). Data were subjected to statistical analysis (Snedecor and Cochran, 1994) and the least significance difference (LSD) was used for comparison of the mean values.

Table 1 represents the concentrations of heavy metals in the samples tested. Arsenic content was found to be 0.17 ± 0.02 , 0.87 ± 0.03 and 0.19 ± 0.05 (ppb) respectively in rohu, catla and mrigal, which was significantly ($P<0.05$) higher in catla. The concentrations of copper in the muscle tissues of rohu, catla and mrigal was found to be 0.64 ± 0.13 , 0.69 ± 0.22 and 0.25 ± 0.01 (ppm) and it was found to be non-significant among the three species.

Fishes are the simple and reliable biomarker of copper pollution of aquatic bodies (Lodhi *et al.*, 2006). In the present study content of copper in rohu, catla and mrigal tissue was 0.64 ± 0.13 , 0.69 ± 0.22 and 0.25 ± 0.01 (ppm) respectively (Table 1). The copper concentration in muscle tissue varied from 2.12 to 27.94 $\mu\text{g/g}$ for fishes from East Kolkata Wetlands (Kumar *et al.*, 2011).

Table 1. Arsenic and copper content in Indian Major Carp

Heavy metals	<i>Labeo rohita</i>	<i>Catla catla</i>	<i>Cirrhinus mrigala</i>
Arsenic (ppb)	$0.17^a\pm0.02$	$0.87^b\pm0.03$	$0.19^a\pm0.05$
Copper (ppm)	0.64 ± 0.13	0.69 ± 0.22	0.25 ± 0.01

Data presented as Mean $\pm$ S.E, Superscripts ^{ab} in a row differs significantly ($P<0.05$)

Adhikari *et al.* (2008) calculated 14.7 µg/person daily intake of copper through fish consumption which is based on the average copper content of the five fish species i.e. *Labeo rohita*, *Catla catla*, *Cirrhinus mrigala*, *Oreochromis mossambicus* and *Cyprinus carpio*. 7.59 µg/g level of copper was found in the body of fish collected from Pennar estuary, India (Ravanaiah and Murthy, 2010) and 0.40-0.59 µg/g in the tissues of fish from freshwater lake of Bhopal, India (Malik *et al.*, 2010). Copper level in the muscle of catla was 0.48±0.14 µg/g dry weight (Adhikari *et al.*, 2008). Samir and Ibrahim (2008) reported 2.80 ppm of Cu in the muscle of *Oreochromis niloticus* collected from the Northern Delta lakes of Egypt.

Foata *et al.* (2009) reported that the fish collected from Presa river, France having 0.62-1.37 µg/g range of arsenic. The arsenic level of rohu and mrigal reported in this study was lower than the earlier reports (Foata *et al.*, 2009; Kar *et al.*, 2011). However, arsenic level in catla was within the similar

range of earlier worker (Kar *et al.*, 2011). USEPA (2002) reported that an adromous nature and resident fish from Columbia River Basin contained 86% of total arsenic in their fillets in comparison to whole bodies for 10 numbers of species.

Total arsenic residues in muscle of rohu, catla and mrigal did not exceed the permissible limit of Indian Standard of 1ppm (MFPO, 1992; FSSAI, 2011). The permissible limit for copper set by WHO (2004) is 30 ppm. Total copper residues in IMC in the present study are also within the permissible limit (FSSAI, 2011). Thus, the present study shows that the consumption of fish reared in wastewater is safe for human beings.

Conflict of Interest: The author declares that they have no conflict of interest.

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