Copper, Chromium and Manganese in Some Fishes of Kali Estuary, Karwar

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Copper, chromium and manganese concentrations in the gill, muscle and whole body samples of four estuarine fishes, namely, *Mugil cephalus, Sillago sihama, Leiognathus brevirostris* and *Gerromorpha setifer* were determined during the period July-November, 1989. Concentrations of these metals in different body parts varied from species to species. The three trace metals in *M. cephalus, S. sihama* and *L. brevirostris* in whole body were in the order Mn > Cr > Cu whereas in *G.setifer* the abundance was in the order Cr > Cu > Mn. Significant correlation was observed between concentration of metals in gills and whole body in all species except *M. cephalus*. Considering the trace metals concentration in relation to wet weight, all the metals are within safety limits in edible part.

Trace metals are normal consituents of marine environments and traces at least are always fund in marine organisms. Although at suitable concentrations some trace metals are essential for enzyme activity, they also form an important group of enzyme inhibitors when normal concentrations are exceeded. Some metals such as Cu can act in either a stimulatory on inhibitary way depending on their level of availability (Engel *et al.*, 1981). Cons equently, most trace metals, whether essential or not, become potentially toxic at higher concentrations to living organisms, and also to human beings through the food chain. Trace metal concentrations in fishes have been studied by Bagley & Lockey (1967), Simpson *et al.* (1979) and Barber *et al.* (1972). Investigation into the interaction between trace metals and marine organisms have been intensified recently because of increased anthropogenic inputs of these metals into the aquatic systems (Patin, 1982; Moore & Ramamurthy, 1984).

In the present investigation, the trace metals, namely, Cu, Cr and Mn in the gills, muscles and whole body of *Mugil cephalus, Sillago sihama, Leiognathus brevirostris* and *Gerromorpha setifer* collected from Kali estuary were determined, keeping in view the relative biological importance of the above trace metals and also the food value of these fishes.

Materials and Methods

Four species of fishes namely, *M. cephalus, S. sihama, G. setifer* and *L. brevirostris* were caught by cast net and were immediately cleaned in sea water. They were taken to the laboratory and kept in refrigerator (at 0°C) before processing. Totally 16 fishes were collected comprising four numbers for each species.

Before dissection, they were washed thoroghly with tap water and later by double distilled water. They were then asceptically dissected using clean dissection tools. Gills and muscles were dissected out and kept in clean watch glasses. They were dried in dessicator first for 10–15 days at room temperature and then dried at 65–70°C in an oven for 24 h to remove all the moisture.

A known quantity (100 mg) of each dried sample was taken in a 100 ml beaker. To this 8 ml of concentrated HNO_3 and 2 ml of perchloric acid were added and then heated on a hot plate to near dryness, till about 1 ml of solution remained in the beaker. Then about 50 ml double distilled water was added to each beaker and filtered through

Whatman 42 filter paper (Martin & Knauer, 1937) in case of whole body samples (gut sometimes contained sand particles) and finally made upto 100 ml using double distilled water. For whole body samples, the dried fish were crushed to fineess in mortar and pestle and well mixed sample was taken for the analysis.

Concentration of Cu, Cr and Mn in different samples was determined by Atomic Absorption Spectrophotometer (G B C - 902 model, Australia), using air-acetylene flame, at their respective wave lengths. The results are expressed in ppm dry weight of tissues.

Results and Discussion

Table 1 shows the mean concentration of copper, chromium and manganese in gills, muscle and whole body of four species of fish. The concentration of these metals in the whole body of *M. cephalus, S. sihama* and *L. brevirostris* was in the order Mn > Cr > Cu while in *G. setifer* it was in the order Cr > Cu > Mn. There was highly significant positive correlation between metal concentration in gills and whole body of *L. brevirostris* ($r = 0.81$, $p \leq 0.01$) and significant correlation in *S. sihama* ($r = 0.57$, $p \leq 0.05$) and *G. setifer* ($r = 0.62$, $p \leq 0.05$). The correlation was not significant in *M. cephalus* ($r = 0.35$).

Bryan (1976) has reported concentration of Cu, Cr and Mn in fishes in the order of 0.5, 3.0 and 10 ppm dry weight of whole body respectively, disregarding the species specificity. In the present study, Cu in whole body of four fish species varied from 5.46 to 11.83 ppm, Cr from 8.28 to 12.29 ppm and Mn from 5.20 to 15.90 ppm. Except for *G. setifer,* in three other species, the metal concentration in whole body of fishes were in the order Mn > Cr > Cu. In *G. setifer,* the order was Cr > Cu > Mn. However, from Table 2 it can be seen that there was a significant relationship between trace metal abundance in gills and whole body in all species, except *M. cephalus.* This suggests that, in the three species studied *(S. sihama, L. brevirostris* and *G. setifer)* the trace metals are possibly taken up through the gills and then passed on to other body parts. Further, the distribution of trace metals in different organs of fish is species specific (Jaffar & Ashraf, 1988).

Zingde *et al.* (1976) have recorded higher levels of metals (Cu, 28.6–32.5 ppm and Mn, 17.9–26.3 ppm) in *Mugil parsia* and attributed to their feeding habits. The above authors, further reported 2.3–6.1 ppm of Cu and 5.3–12.9 ppm of Mn in *Leignathus splendens,* which closely agrees with the present results of *L. brevirostris.* For other species, namely, *S. sihama* and *G. setifer* no comparable reports are available. However,

Table 1. *Mean trace metal concentrations in gills, muscle and whole body of four fishes (ppm dry weight)*

Species	Sample	Cu	Cr	Mn
M. cephalus	Gill	3.93 + 1.84	8.78 ± 2.43	5.75 ± 3.46
	Muscle	5.27 ± 1.70	8.65 ± 2.31	2.30 ± 0.90
	Whole body	5.46 ± 1.98	8.28 ± 2.46	15.90 ± 14.38
S. sihama	Gill	9.72 ± 4.74	16.83 ± 8.85	7.70 ± 4.64
	Muscle	5.15 ± 1.56	6.63 ± 1.61	0.40 ± 0.22
	Whole body	7.74 ± 2.71	11.01 ± 4.59	11.69 ± 7.10
L. brevirostris	Gill	6.46 ± 2.37	10.22 ± 4.30	11.65 ± 4.82
	Muscle	3.77 ± 0.61	6.52 ± 1.63	1.40 ± 0.94
	Whole body	6.86 ± 2.02	9.42 ± 2.66	11.96 ± 6.51
S. setifer	Gill	12.53 ± 8.02	18.54 ± 4.00	4.85 ± 1.27
	Muscle	4.37 ± 2.95	6.05 ± 1.57	0.53 ± 0.24
	Whole body	11.83 ± 4.29	12.29 ± 1.83	5.20 ± 3.59

Note: The S.D. refers to variation between sampling periods (July, September, October and November 1987)

the type of metal and its concentration in fishes depend on the type of its diet (Cross *et. al.*, 1975) and bioavailability of trace metals (Sunda & Guillard, 1976; Anderson & Morel, 1978)

Taking into consideration, the average metal concentration in edible part (muscles) of these fishes, Cu was 5.3 ppm, Cr was 8.7 ppm and Mn was 2.4 ppm. Further, average moisture content of these fishes was about 72% in whole body and about 85% in muscles. Hence on the basis of wet weight, the concentration of these metals in different body parts, specially in muscles are within the safety limits.

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