

Trace Metal Contents in Selected Marine Fish Species of Northwest Coastal Area of Karachi, Pakistan

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Summary: Levels of trace metals in edible mussels of five fish samples *Pampus Argenteus*, *Pampus chinensis*, *Parastromateus niger*, *Protonibea diacanthus*, and *Otolithes ruber*, of northwest costal area of Karachi were studied by AAS technique. All estimation were made on wet basis. Iron was found maximum (0.890-9.395 µg/g) among all species and cadmium was found as minimum (0.015-0.041 µg/g). Levels of other metals varied in the range of 0.249-0.986, 0.137-0.49, 0.29-0.929, 0.391-0.986 and 0.081-0.243 µg/g for As, Co, Cu, Mn & Pb respectively in the muscles of various fishes investigated. Maximum concentrations of all metals were found in *Protonibea diacanthus* except Cd, which was found maximum in *Parastromateus niger*, and *pampus argenteus* was found to contain the minimum amount of all metals. Various fish contain different concentration of all metals.

Introduction

Heavy metal contents in aquatic bodies have arisen due to rapid industrialization and urbanization. This has created great health concern throughout the world. Some toxic metal contents (Al, Ba, Cr, Cu, Fe, Hg, Mn, Ni Pb, and Zn) were studied in Mosses and lichens and the concentration were found maximum in dry and barren environment [1].

It is well known that the nutritious metals become toxic at high intake. Organo-metallic

derivatives of these metals are often volatile and may concentrate in lipid tissues and some time cause chromosome damages, making them dangerous. Heavy metals are quite effective in inhibiting the action of enzymes. The pollution of the marine environment with trace metal has emerged as a serious issue during last two decades, especially in coastal areas close to industrial and agricultural activities [2-3]. Trace metals Ag, As, Cd, Cu, Fe, Mn, Ni, Pb, Zn and Hg were investigated in 143 fish

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samples. It was observed that Cr and Mn have increased 4-fold and as by 2.5 fold during past six years [9]. Jaleel and co-worker investigated level of selected trace metal concentration in seven fish species of Pakistan. Zinc and iron found maximum whereas Pb and Ag found minimum [10].

The present study gives information about the levels of heavy metals in edible muscles of fish named *Pampus Argenteus*, *Pampus chinesis*, *Parastromateus niger*, *Protonibea diacanthus*, *Otolithes ruber* to assess the rate of increase in pollutants in Karachi. USEPA, FAO and WHO have established ranges of the maximum dietary intake of these trace elements, which are given in the table 1.

Table-1; Allowed human intake level of heavy metal

S.No.	Metal	Intake level	
		mg/day ⁴	µg/day ⁵
1.	Arsenic	0.04	3.0
2.	Cadmium	0.01	8.0
3.	Cobalt	300	-
4.	Copper	-	0.6
5.	Iron	1000	5.0
6.	Manganese	5.0	1.0

Results and Discussions

The concentrations of selected metals are given in Table-2. The data in reflects species specificity toward metal uptake and evidence divergent levels of the metals in various fish. Of all the six species investigated *pampus argenteus* shows the minimum concentration of all metals except Co, Cu and Mn. These metals found minimum in *parastromateus niger*.

Metal concentrations were observed different in all different species. Among all fish species Fe and Mn concentration were found maximum Arsenic found maximum in case of *protonibea diacanthus*

(0.986 µg/g) and minimum in *pampus argenteus* (0.259 µg/g), cadmium was found maximum (0.041 µg/g) in *parastromateus niger* and minimum (0.015 µg/g) in *pampus argenteus*. Lead was found maximum (0.43µg/g) in *protonibea diacanthus* and minimum (0.081 µg/g) in *pampus argenteus*. All other metals found maximum in *protonibea diacanthus* and minimum in *pampus argenteus*. *protonibea diacanthus* is the fish which seems to bioaccumulate all metals except Cd, which is found highest in *parastromateus niger*. This fish seems to be different from other species belonging to same cultivation area but exhibiting different metal level the individual variability of fish in relation to the maximum level of various metals was quite revealing also.

The average concentration found in various fish species was highest for metals. The obvious reason for the concentration of the local fish with these toxic trace metals is the unregulated industrial effluents that are being dumped into the sea continuously through their tributary rivers and streams. This situation has worsen over a the past few years, which has reported earlier [9-11]. Karachi have two planned industrial areas viz. Korangi Industrial Area (KIA) and Sindh Industrial Trading Estate (SITE). SITE covers an area of about 16 km² containing approximately 500 major industries, 60% of which are textile mills and other are diverse types dealing with chemicals, detergents, iron and steel, vegetable oils, beverages and food products [12]. KIA is located in district Malir, has a total area of 34.4 km², having 2000 various types of small and medium sized industries. However, leather and textile industry are dominating industries of KIA. [13]. All the two streams coming from these industrial area bring these toxic metal to sea and become a major source of toxic metals in the sea. Marine organism tends to accumulate the toxic elements in the edible

Table-2: Trace metal contents (µg/g) analyzed in edible muscle of marine fish along northwest coastal are Karachi, Pakistan.

S.No.	Species	As	Cd	Co	Cu	Fe	Mn	Pb
1.	<i>Pampus Argenteus</i>	0.259	0.015	0.248	0.340	0.890	0.564	0.081
	SD	±0.02	±0.009	±0.02	±0.009	±0.01	±0.01	±0.01
2.	<i>Pampus chinesis</i>	0.249	0.019	0.350	0.295	3.168	0.976	0.101
	SD	±0.02	±0.002	±0.02	±0.02	±0.3	±0.05	±0.005
3.	<i>Parastromateus niger</i>	0.682	0.041	0.159	0.290	7.185	0.391	0.168
	SD	±0.09	±0.004	±0.02	±0.03	±0.08	±0.04	±0.02
4.	<i>Protonibea diacanthus</i>	0.986	0.030	0.490	0.929	9.395	0.986	0.243
	SD	±0.01	±0.003	±0.02	±0.009	±0.08	±0.04	±0.02
5.	<i>Otolithes rubber</i>	0.396	0.039	0.137	0.357	8.658	0.690	0.225
	SD	±0.03	±0.004	±0.01	±0.04	±0.6	±0.04	±0.02

tissues. It is therefore, essential that effective and appropriate measures may be taken and necessary regulations may be adopted to prohibit the indiscriminate discharge and disposal of industrial effluents.

Experimental

Apparatus

Tecator digester model-2006 was used for the wet digestion. Perken-Elmer model- 2380 atomic absorption spectrophotometer equipped with standard burner in air acetylene flame was used for the trace metal analysis. Pyrex glassware pre-washed with nitric acid and then with distilled de-ionized water was used.

Reagents and Solution

Merck AR grade reagents were used for digestion. For the analysis of trace metal Stock solutions (500ml) were prepared from BDH spectrosole AA standard (1000 ppm). The working standard solutions were obtained after diluting the stock to the required concentration.

Procedure

a) Sampling

Samples were collected during July to Dec. 1998. These samples were purchased from local fisherman operating along southwest coastal area of Karachi. 25-30 samples of all species of a weight range 500-1500g were collected

b) Digestion

5g of fish muscle sample was taken in digestion tube (Tecator-2006). 10ml HNO₃ was added to the sample and sample was allowed to stand for 24hrs. The tube was then heated for 30 minutes till all NO₂ are removed. Tube was then cooled and 15ml HNO₃ was added to it. The samples were then heated for 30 minutes at 120°C and then at 150°C till the digestion were completed. After cooling 2 ml of 70% HClO₄ was added to the sample. Digested sample was then diluted to a volume of 50ml by distilled de-ionized water [8].

b) Analysis

Absorption of each stock solution was measured in atomic absorption spectrometer. The

readings were put into a graphic paper to draw a calibration curve. Using standard hollow cathode lamp and standard operational condition trace metals contents were estimated in the digested samples. Blank runs on the acid used were conducted to incorporate background correction [6-7]. Determination of Cd, Co and Pb were carried out by flameless (ETAAS), and Cu, Fe and Mn by flame (FAAS), atomic absorption spectrometry. Additional technique were employed for the estimation of trace metals, APDC- MIBK (Ammonium pyroldine dithiocarbamate-Methyl isobutyl ketone), to determine the concentration of Cd, Co and Pb. The detection limits of Cd, Co, Cu, Fe, Mn and Pb were found to be 0.2, 2.4, 15, 25, 10 and 2.5 x 10⁻³ µg/g respectively.

Analysis of each metal was carried out in triplicate to get representative results and the reported in µg/g. Precision of the method was determined from the coefficient of variation (CV) values were found to be below 10%.

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