

Selected Trace Metal Concentration in Seven Fish Species from the Arabian Sea, Pakistan

JALEEL TARIQ, M. ASHRAF, M. JAFFAR AND KHALID MASUD
Department of Chemistry, Quaid-i-Azam University, Islamabad, Pakistan

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Summary: Levels of eleven trace metals in edible muscle of seven commercial fish species harvested from the south west coast of the Arabian Sea, Pakistan are reported. The maximum concentration was found in case of Zn (3.412 $\mu\text{g/g}$) and Fe (3.591 $\mu\text{g/g}$). Maximum Ag (0.273 $\mu\text{g/g}$) was found in *Argyrops spinifer* and As (0.041 $\mu\text{g/g}$) in *Chaetodon jayakeri*. The metal concentrations showed a high species-specificity.

Introduction

The pollution of the marine environment with trace metals has emerged as a serious issue during last two decades [1], especially in coastal areas close to industrial and agricultural activities [2-4]. Earlier studies [5-9] have evidenced enhanced levels of these metals in fish belonging to the south-west coast of Pakistan. The present study gives information on the amount of silver, arsenic, cadmium, chromium, copper, iron, manganese, nickel, lead, zinc and mercury, in the edible muscle of seven commercially exploited fish species: *Acanthopagrus latus*, *Argyrops spinifer*, *Arioma indica*, *Arius thalassinus*, *Atrubucca trewavasii*, *Carangoides malabaricus* and *Chaetodon jayakeri*.

Results and Discussion

The concentrations of selected metals in different fish species are given in Table-1. The results showed distinct distribution of all the metals in the fish muscle and thus all metals showed divergent levels in these fish.

Of all the metals investigated, the maximum concentration was found in case of zinc and iron, with comparable levels of scatter indicated by \pm SD values. The rest of metals showed concentration levels than 1 $\mu\text{g/g}$, wet weight. Maximum silver (0.273 $\mu\text{g/g}$) was found in *Argyrops spinifer* and minimum (0.041 $\mu\text{g/g}$) in *Chaetodon jayakeri*. Arsenic was found at the maximum concentration level (1.961 $\mu\text{g/g}$) in *Atrubucca trewavasii* and the minimum (0.359 $\mu\text{g/g}$) in *Acanthopagrus latus*. In addition to showing elevated silver level, *Argyrops spinifer* was found to contain maximum iron (3.591 $\mu\text{g/g}$) and manganese (0.206 mg/g) levels, not shown by any other fish.

The species-specificity was observed for *Atrubucca trewavasii* and *Carangoides malabaricus*. In former case, chromium and zinc were found at 0.115 $\mu\text{g/g}$ and 3.412 $\mu\text{g/g}$, respectively. A similar specificity for cadmium, copper, nickel, lead and mercury for the maximum

Table-1: Trace metal concentration ($\mu\text{g g}^{-1}$, wet wt.) in muscle of various marine fish from the Arabian Sea coast, Pakistan, along with relevant permissible daily intake limits.

Species (n)	Level	Ag	As	Cd	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Zn
Acanthopaganus latus (18)	X \pm SD	0.045	0.359	0.032	0.079	0.199	1.240	0.188	0.071	0.063	0.035	1.281
		0.013	0.120	0.010	0.024	0.043	0.318	0.055	0.024	0.019	0.010	0.330
Argyrops spinifer (15)	X \pm SD	0.273	0.451	0.136	0.107	0.395	3.591	0.168	0.206	0.081	0.026	1.623
		0.084	0.162	0.035	0.029	0.127	0.986	0.045	0.063	0.023	0.007	0.414
Ariomma indica (20)	X \pm SD	0.050	0.384	0.047	0.084	0.122	1.141	0.182	0.188	0.127	0.036	2.011
		0.012	0.165	0.013	0.026	0.040	0.296	0.043	0.048	0.036	0.010	0.536
Arius thalassinus (20)	X \pm SD	0.053	0.581	0.042	0.101	0.312	2.181	0.108	0.079	0.043	0.048	2.913
		0.016	0.140	0.011	0.023	0.100	0.633	0.027	0.025	0.015	0.012	0.740
Atrobucca trewavasii (15)	X \pm SD	0.113	1.961	0.076	0.115	0.147	1.366	0.414	0.138	0.050	0.135	3.412
		0.024	0.480	0.019	0.032	0.039	0.341	0.120	0.035	0.010	0.034	1.001
Carangoides malabaricus (19)	X \pm SD	0.123	0.744	0.277	0.104	0.571	2.653	0.468	0.075	0.316	0.283	2.315
		0.036	0.196	0.065	0.031	0.143	0.648	0.116	0.016	0.100	0.067	0.640
Chaetodon jayakerei (20)	X \pm SD	0.041	0.827	0.050	0.073	0.127	3.030	0.275	0.069	0.084	0.085	0.719
		0.010	0.213	0.010	0.021	0.035	1.000	0.064	0.018	0.021	0.021	0.170
IAEA*		4.5	3.0	8.0	20	0.6	5.0	0.7	1.6	0.08	0.7	4.2
Allowed Daily Intake		μg	μg	μg	μg	μg	μg	μg	μg	μg	μg	μg

*Reference [14]

concentration level was evident in *Carangoides malabaricus*. The study thus revealed that, out of seven fish species, *Carangoides malabaricus* contained enriched concentration of industrial metals such as cadmium, copper, nickel, lead and mercury.

In conclusion, the present study indicated an overall pollution stress in the southwest coast of the Arabian Sea, Pakistan. Compared with previous investigation [9], the present results are higher, in general, with respect to the metals found in *Arius thalassinus*. A later study also evidenced enhanced metal levels in fish from the same area [10]. The observed enrichment was 1.5-3.0 fold for most metals. The study, thus, suggested a regular metal monitoring programme based on annual study for the distribution of toxic metals in local fish to ward off public health against the ill-effects of the metals.

Experimental

Marine fish species were randomly procured from local fishermen operating trawllines along the southwest coast from sites S1 to S6 located within 20-30 km from Karachi and mouth of Indus. The samples were collected within a limited weight range (1000-1400 g) to validate comparative evaluation of metal content irrespective of weight dependence. The number of samples (n) procured for each fish from all sites ranged between 15 to 20 (Table-1). The sampling was conducted during

October, 1990 to February, 1991. The sample digestion and subsequent atomic absorption spectrophotometric procedure for the analysis of the metals is described elsewhere [11]. Control fish standards were acquired from National Institute of Health to routinely check the accuracy and precision of the finished data. These results were generally found to agree within ± 1.0 -1.5%. A Shimadzu Atomic Absorption system, with capability of estimating arsenic and mercury through hydride vapour generation and cold vapour technique [12,13] was used throughout this work.

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