

Short Communication

Heavy metals (Cd, Cu, Ni and Pb) content in two fish species of Persian Gulf in Bushehr Port, Iran

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Heavy metal (HMs) pollution of aquatic environment has become a great concern in recent years. In this study, cadmium (Cd), copper (Cu), nickel (Ni) and lead (Pb) levels were determined in muscle and skin of two important consumed fishes (Indo-Pacific king mackerel and Tigertooth croaker) in Bushehr Province in the Southwestern of Iran. Heavy metal concentrations were analyzed by using inductively coupled plasma (ICP). The mean contents of metal, expressed in mg/kg wet weight, varied from 0.17 to 0.26 for Cd, 1.25 to 1.84 for Cu, 0.6 to 0.84 for Ni and 0.31 to 0.7 for Pb. Results showed that the highest and lowest contents of heavy metals in muscle and skin of both fish samples were related to Cu and Cd concentration, respectively, and heavy metal contents in both skin fish samples and muscle of Tigertooth croaker were found to decrease in sequence as Cu>Pb>Ni>Cd.

Key words: Heavy metal, fish, Bushehr, Iran.

INTRODUCTION

Heavy metal (HMs) pollution of aquatic environment has become a great concern in recent years. HMs can have toxic effects on organs (Macfarlane and Burchett 2000). HMs contents in aquatic environment have increased because of different activities such as industrial, domestic and agricultural (Kalay and Canli 2000; Mance, 1987). Nowadays, because of toxicity and accumulative behavior of HMs, they can make different changes in aquatic environment such as species diversity (Health, 1987). HMs can enter into water via drainage, atmosphere, soil erosion and all human activities by different ways. With increasing HMs in the environment, these elements enter the biogeochemical cycle (Kerdrick et al., 1992; Mansour and Sidky 2002; Riget et al., 2004). HMs can enter from contaminated water into fish body by different routes and accumulate

in organisms (Olaifa et al., 2004; Surec, 2003). These metals concentrated at different contents in organs of fish body (Khaled, 2004). Some HMs such as iron, copper, zinc and manganese are essential for biological systems such as enzymatic activities, whereas, other HMs like lead, cadmium and mercury have no known important role in living organs and are toxic even in trace amounts (Fernandes et al., 2008). Essential metals must be taken up from water, food or sediment by fish for its normal metabolism (Canli and Atli 2003); however, these metals can also have adverse and toxic effects at high concentration (Tüzen, 2003).

In Bushehr Province, there have been a number of studies concerning the water contents (Dobaradaran et al., 2008a, b, 2009), but there appear to be none about HMs concentration in the fish. Thus, in this study, Cu, Ni, Cd and Pb levels in hunted fishes from Persian Gulf Sea and consumed in Bushehr were measured.

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Abbreviations: ICP, Inductively coupled plasma; HMs, heavy metals.

MATERIALS AND METHODS

Bushehr Province is located in the Southwest of Iran (Figure 1).



Figure 1. Location of Bushehr Province in Iran.

Table 1. Mean concentration (mg/kg/wet weight) with standard deviation and minimum and maximum values of heavy metals in muscle and skin of fishes.

Fish species	Tissue	N	Cd	Cu	Ni	Pb
Indo-pacific king mackerel	Muscle	7	0.17±0.107 (0.009-0.271)	1.84±0.93 (1.03-3.376)	0.605±0.142 (0.435-0.773)	0.625±0.517 (0.085-1.515)
	Skin	7	0.174±0.216 (0.001-0.506)	1.68±1.078 (1.086-4.112)	0.758±0.264 (0.535-1.21)	0.701±0.588 (0.222-1.781)
Tigertooth croaker	Muscle	7	0.23±0.171 (0.006-0.45)	1.547±1.475 (0.738-4.851)	0.607±0.205 (0.331-0.881)	0.31±0.258 (0.076-0.835)
	Skin	7	0.26±0.177 (0.33-0.528)	1.251±0.418 (0.88-2.093)	0.842±0.254 (0.496-1.125)	0.32±0.162 (0.145-0.584)

Two fish species namely: Indo-Pacific king mackerel (I-p king mackerel) and Tigertooth croaker that were hunted from Bushehr shores were bought during April to June, 2009 from Bushehr fish market. Fishes were brought to the laboratory and dissected with clean stainless steel instruments. Muscle and skin were dried and homogenized and grinded to a powder. One gram of each dry skin and muscle were weighed, transferred into polyethylene bottle and 10 ml of concentrated nitric acid was added to the sample and samples were digested with boiling until all the contents dissolved. After cooling, the solution was filtered (FAO, 1983) and later the heavy metal concentrations were determined using inductively coupled plasma (ICP) (Arcos- spectra) and each sample was analyzed three times for Cd, Cu, Ni and Pb concentrations.

Statistical analysis of data was carried out with the statistical package for the social sciences (SPSS) and one way analysis of variance (ANOVA) was performed for statistically significant difference. Differences in mean values were accepted as being statistically significant if $P < 0.05$.

RESULTS AND DISCUSSION

The mean concentrations of Cd, Cu, Ni and Pb in muscle and skin of I-p king mackerel and Tigertooth croaker are shown in Table 1. The highest and lowest content of HMs in muscle and skin of both fish samples were related to Cu and Cd concentration, respectively. In both fish

samples, HMs concentrations decreased in the sequence for both skin samples and for the muscle samples of Tigertooth croaker as $Cu > Ni > Pb > Cd$ while the sequence for the muscle of I-P king Mackerel samples was $Cu > Pb > Ni > Cd$.

Cd, Cu, Ni and Pb concentrations in muscle and skin of I-p king mackerel showed no significant difference ($P > 0.05$) and also Cd, Cu, Pb concentrations in muscle and skin of Tigertooth croaker showed no significant difference ($P > 0.05$) but there was a significant difference ($P < 0.05$) between Ni concentration in muscle and skin of Tigertooth croaker. Another analysis showed no significant difference ($P > 0.05$) between Cd, Cu, Ni and Pb concentrations in muscle of I-p king mackerel and Tigertooth croaker and also in skin of both fish samples.

Our Cd mean values range from 0.17 to 0.26 mg/kg, and were almost similar to the results of Rayment et al. (2000), Usero et al. (2003), Dural et al. (2007) and Chandra-sekhar et al. (2003) results but lower than that of Canli and Atli (2003). The highest value of Cd was in skin of Tigertooth croaker with 0.26 ± 0.177 mg/kg, that is still lower than the Food and Agriculture Organization (FAO) limit (FAO/WHO, 1989). Cadmium like some other HMs such as Pb and Hg has no biological function in

human system (Robert, 1991). Kidney damage, testicular tissue destruction, high blood pressure and red blood cells destruction are some adverse effects of acute cadmium toxicity (Gupta and Mathur, 1983).

Copper mean concentrations in this study range from 1.251 - 1.84 mg/kg and was almost similar to the results of Dural et al. (2007), Rayament and Barry, (2000), Usero et al. (2003) but lower than that of Chandra-Sekhar et al. (2003) and Canli and Atli (2003). Like Cd, Cu concentrations in muscle and skin of both fish samples were lower than FAO limits (FAO/WHO, 1989). Higher Cu contents in muscle and skin of fish samples in comparison with other HMs are related to the importance of Cu in biota metabolisms (Fernandes et al., 2008). Ni mean contents range from 0.605 to 0.842 mg/kg and were lower than some reports (An and Kampbell 2003; Karadede and Ünlü, 2000; Öztürk et al., 2008). Ni values in muscles of both fish samples were in agreement with tolerable value but Ni concentrations in skin of both fish samples were a little higher than tolerable value (Wyse et al., 2003).

Finally, the mean values of Pb were in the range of 0.31 to 0.701 mg/kg in agreement with some studies (Canli and Atli 2003; Usero et al., 2003) and lower than other reports (Chandra-Sekhar et al., 2003; Dural et al., 2007; FAO/WHO, 1989). Pb values in muscle and skin of Tigertooth croaker were lower than FAO limits (FAO/WHO, 1989) but Pb concentrations in muscle and skin of l-p king mackerel were 0.12 and 0.2 mg/kg higher than FAO limits, respectively.

Consequently, it can be concluded that the levels of Cd and Cu in all muscle and skin of both fish samples, Ni values in muscle of both fish samples and Pb concentrations in muscle and skin of Tigertooth croaker are at acceptable levels. The present study shows that precaution measures need to be taken to prevent future contamination of fishes to HMs, especially Pb and Ni.

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