Bulgarian Chemical Communications, Volume 47, Special Issue D (pp. 222 – 225) 2015

Determination and assessment of three heavy metal content (Cd, Pb and Zn) in *Scomberomorous commerson* fish caught from the Persian Gulf

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Received June 26, 2015, Revised September 10, 2015

Most of fish that sold in southern city of Iran captured from the Persian Gulf. Heavy metals are recognized as one of the most important pollutants, that effect on human health even in trace amount. A study was conducted to quantitate the concentrations of heavy metals, such as Cd, Pb and Zn in *Scomberomorous commerson* fish caught off the coast of Persian Gulf. 25 fish samples of *Scomberomorous commerson* were collected between June – May 2012 at three different sites from Persian Gulf. The Cd, Pb and Zn concentrations were determined with an atomic absorption Spectrophotometer. The results expressed in micrograms of metal per dry weight gram of fish (µg/g). Statistical analysis of data was carried out using SPSS 16.0 software. Pb, Cd and Zn concentration in muscle of *S.commerson* were obtained 1.43-2.02 ppm dry wt, 0.11-0.27 ppm dry wt and 7.39-8.73, respectively. Heavy metal accumulation in muscle order was Zn>Pb>Cd. Pb concentration was increased with increase of length of fish. ANOVA was reveal that concentration differences among the heavy metals were high ($p<0.05$). In all samples, Zn level was higher than other metals and Cd was minimum. Pb concentrations exceeded FAO/WHO, IAEA-407, TFC, EC and Chine but had not exceeded the guidelines limits except for Range of International Standards. Zn values match with all noted Standards. The metal accumulation in the aquatic organism may be species and size -dependent.

Keywords: Heavy metal, *Scomberomorous commerson*, Persian Gulf.

INTRODUCTION

The contamination of receive waters with a wide range of heavy metals has become a matter of concern over the last few decades [1, 2]. Agricultural and industrial activities in an area directly increase the heavy metal of water [3] and also an important factor in the decline of water sediments and fish quality [4]. Heavy metals are dangerous because they tend to bio accumulate in marine organisms including fish and transfer to human through food chain [5, 6]. Fish, a part of being a good source of digestible protein vitamins, polyunsaturated fatty acids (PUFA) and minerals, are also an important source of heavy metals. Heavy metals have a specific density of more than 5 g/cm^3 [7] and are environmentally ubiquitous, readily dissolved and transported by water and taken up by fish, readily [8]. They can be classified as potentially toxic, probably essential and essential [9]. Toxic elements are non-biodegradable and can be causing cytotoxic, mutagenic and carcinogenic effects in animals [10]. Levels of heavy metals in fish samples have been widely reported in the literature [9, 11-13]. This study was conducted to determine the concentration of Cd, Pb and Zn in *Scomberomorous commerson* caught in Persian Gulf. Concentration of zinc was determined as vital elements, while lead and cadmium as toxic elements.

MATERIAL AND METHOD

Study area

Bushehr province coasts, located in the northern coasts of the Persian Gulf (29'N, 38'E), was investigated. This area because of its ecological significance is important.

Sampling and analysis

The number of 25 *Scomberomorous commerson* fish samples measuring 12-30 cm were collected between June – May 2012 and were transported to

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the laboratory in a thermos-flask with ice, also immediately frozen and stored at –20°C until dissection. During dissection in laboratory, Approximately 20 g of muscle fillets, from each sample were dissected, washed with deionized water, were dried in an oven at 60°C till constant weight. After that, they were digested with 2 ml nitric acid (65%, Merck, Germany) in Teflon bombs placed into a microwave digestion system [14]. After cooling, samples were transferred to a 50 ml volumetric flask and rinsed with triple distilled water. In order to check for possible contamination of the samples, one analytical blank was prepared as a control in the same manner, but without tissue samples.

Measurement of Zn, Pb and Cd

Atomic absorption spectrophotometer (Perkin-Elmer-5100) was used to measure the Zn, Pb and Cd concentrations (as µg/g dry weight). The results were validated according to ISO 17025 accreditation [15].

Statistically analysis

Statistical analysis of data was carried out using SPSS 16.0 statistical package program (Chicago, IL). One-way analysis of variance (ANOVA) was employed to assess whether metal concentrations varied as significantly among fish (between heavy metal and length) and followed by Tukey post hoc comparisons for the source of statistically significant difference ($P<0.05$). The results are presented as means ± standard error.

RESULTS

Pb, Cd and Zn concentration in muscle of *S.commerson* were obtained 1.43-2.02 ppm dry wt, 0.11-0.27 ppm dry wt and 7.39-8.73, respectively. Mean concentrations of cadmium, lead and zinc in muscle is shown in figure 1.

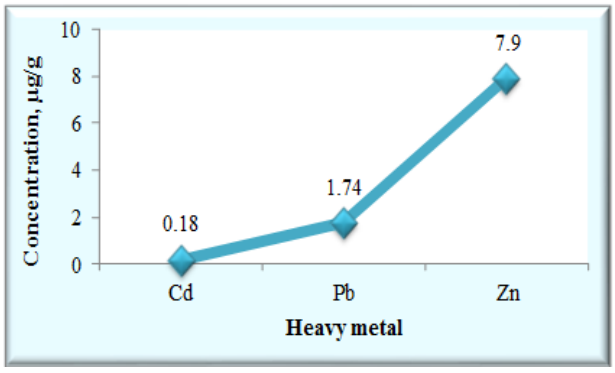

Fig. 1. Concentration of Cd, Zn and Pb (µg/g dry weight) in *Scomberomorous co=mmerson*

The highest concentrations were found Zn and the lowest levels were detected for Cd (Heavy metal accumulation order was Zn>Pb>Cd). Our results showed that different fish length contained different metal levels in their muscle. Statistically, significance analysis was performed among the heavy metal and our results showed that, the concentration differences among the heavy metals were high ($p<0.05$). Also, relationship between the fish size and the metal levels for Cd and Zn was not significant ($P>0.05$), whereas, for Pb was positive ($P<0.05$). (Table 1 and Figure 2, 3 and 4)

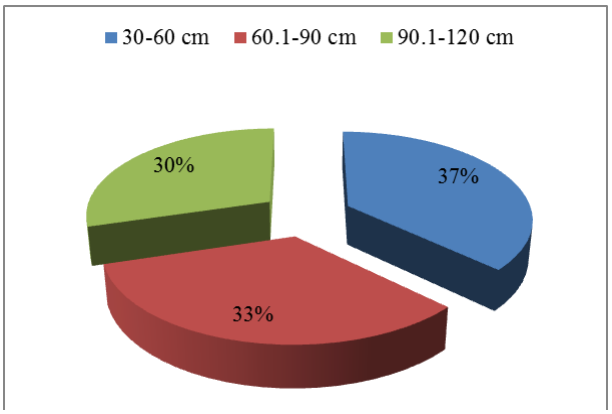

Fig. 2. Relative frequency (%) of Cd in *Scomberomorous commerson* base on size of fish

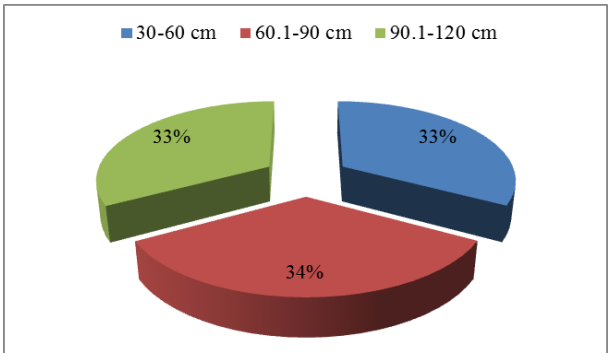

Fig. 3. Relative frequency (%) of Zn in *Scomberomorous commerson* base on size of fish

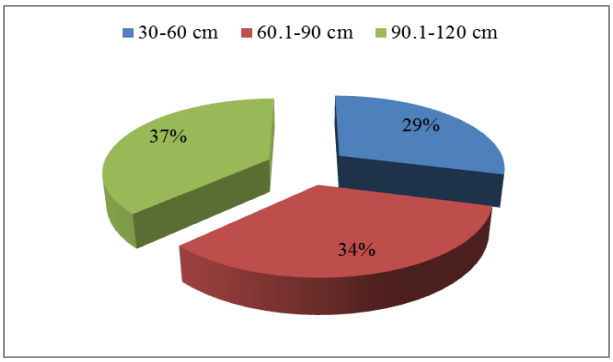

Fig.4. Relative frequency (%) of Pb in *Scomberomorous commerson* base on size of fish

Table 1. Mean (± SD) concentrations of Cd, Zn and Pb (μg/g dry weight) in *Scomberomorous commerson* base on size of fish

Size of fish, cm	Cd	Zn	Pb
30 - 60	0.2 ± 0.52	7.78 ± 0.25	1.53 ± 0.07
60.1 – 90	0.18 ± 0.03	8 ± 0.43	1.76 ± 0.87
90.1 - 120	0.16 ± 0.04	7.8 ± 0.16	1.95 ± 0.05

DISCUSSION

Fish may accumulate heavy metals by consumption of contaminated food and sediments [16]. The present work revealed marked presence of heavy metals concentration in muscles tissue of investigated fish. Fish are often at the top of the aquatic food chain, hence, fish contamination can also have major impacts on people and society [17]. The efficiency of metal uptake from contaminated water may differ in relation to size of fish [18]. The present work revealed marked increase of Pb concentration with increase of size of fish, simultaneously. It is generally accepted by Marijic et el [19]. The maximum Permissible doses for an adult are 3 mg Pb and 0.5 mg Cd per week, but the recommended doses are only one-fifth of those values(8). Pb concentrations in this study exceeded FAO/WHO [8], IAEA-407 [20], TFC [21], EC [22] and Chine [23] but had not exceeded the guidelines limits except for Range of International Standards [24]. Zn is an essential metal which play an important role in metabolic processes and biological systems and is assimilated by the organisms over time, but it can also produce toxic influences when bioaccumulate and reach toxic level [25].

Protective effect of Zn against the Cd and Pb toxicity had been reported, Zn values in this study match with FAO/WHO (1989) [25], TFC (2002) [21]. EC (2006) [22] and Chine and Range of International Standards [26]. Similar results had been reported by Özparlak, et al [8]. Cd content of muscles was lower that reported by Mohammadnabizadeh [15]. In research of Metwally and Fouad, Cd, Zn and Pb concentration in three different types of fishes (*Pagellus acarne*, *Sarpa salpa* and *Liza saliens*) were 0.062, 0.38 and 0.56 ppm, respectively that are lower in compare to this study [11]. Pb and zinc levels were reported as high as 0.064μg/l and 4.82μg/l in fish and shellfish in ABA river, from Nigeria by Ubalua [17]. Cd content of muscles was lower that reported by RAUF et al (2009) in fish collected from river Ravi, Pakistan [10] and muscle tissue of nine fish species from Beyşehir Lake, Turkey [8]. Also it was higher than reported from fish in Southeast Coast of India [13]. Heavy metal concentrations in Scomberomorous commerson varied significantly depending upon the type of metal. The concentrations of heavy metals differed significantly ($p<0.001$) depending upon the size of fish. According to investigations, the metal accumulation in the aquatic organism is size-dependent [10]. In general, accumulation of zinc is higher than lead and cadmium in fish tissues. This matter was confirming by Huang [16]. Zinc values ranged from 7.39-8.73 ppm and were lower Beyşehir Lake, Turkey [8], Groatia [27] and Köycegiz Lake-Mugla [18] and Langkawi island, Malaysia [6]. This present study showed lower accumulation of cadmium than other two metals, too. Hence, knowledge of heavy metal concentrations in fish is important with respect to nature of management and human consumption of fish.

Ethical Consideration: *Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.*

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