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Volume 2 • Issue 4 • 2018

Research Article

Nutrition and Food Toxicology

ISSN: 2573-4946

Study on Heavy Metals Levels and its Risk Assessment in Edible Fish (*Himantura imbricate*) from Persian Gulf

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Received: December 30, 2017; **Published:** January 24, 2018

Abstract

Heavy metals are contaminants of great environmental concern due to their multiple origins (natural and anthropogenic), the ability to accumulate in organs and tissues, and the deleterious effects they can cause in organisms. Studies on the accumulation of metals in seafood, such as fish, have increased in importance due to the risk for human health when consuming fish contaminated by metals. The present work was aimed at verifying the concentrations of cadmium (Cd), Nickel (Ni) and lead (Pb) in the muscular tissue of Himantura imbricate (from the Persian Gulf in Hormozgan province, Iran. Samples were analyzed by Atomic Absorption Spectroscopy. There were significant variations among heavy metal accumulation levels of the species and their regions. The heavy metal concentrations found in regions varied for Cd: 0.14, Ni: 0.33, Pb: 0.02 in Qeshm and Cd: 0.25, Ni: 0.48, Pb: 0.03, µg/g in Suoroo. The heavy metal concentrations of fish in Qeshm were lower than those of fish from Suoroo regions. This research showed that heavy metal concentrations in muscle of investigated specie were also lower than the maximum levels set by law.

Keywords: *Himantura imbricate; Risk assessment; Atomic Absorption Spectroscopy and Persian Gulf*

Volume 2 Issue 4 Jauary 2018

Introduction

In the recent years, world consumption of fish has increased simultaneously with the growing concern of their nutritional and therapeutic benefits. In addition to its important source of protein, fish typically have rich contents of essential minerals, vitamins and unsaturated fatty acids [1]. Among the pollutants, non-degradable pollutants (persistent pollutants) such as heavy metals in sediments and mud and sludge concentrated as potential marine pollution and at the same time accumulate in aquatic and body tissue and concentrated And fish consumption may be toxic to humans and severe adverse effects such as disorders of the nervous system, renal, genetic mutations, and so on to be created, It is of utmost importance. Among the heavy metals Pb, Ni, and Cd indices, oil pollution and pollution from industrial activities in the marine ecosystem, the capacity of ecosystems to accept the changes in the environment and although, by its nature

has the ability to cope with change But today it is clear that destruction has been the speed of natural regeneration. And the process for irreversible environmental degradation is growing, so measures to protect the environment should ponder [2].

In addition, today one of the major concerns in the discharge of heavy metals into the marine environment is all over the world. And is well established that heavy metals cause toxicity and accumulation of ecological significance are many, these elements have devastating effects on the marine ecosystem and species diversity [3]. Lead one of four metals that have the most damaging effects on human health. Bio-synthesis of hemoglobin disorders and anemia, high blood pressure, kidney damage, miscarriage and preterm birth, nervous system disorders, brain damage, infertility in men, decreased learning ability and behavioral disorders and hyperactivity in children from the negative effects of increasing the concentration of lead in body [4].

Nickel toxicity varies widely and is affected by salinity and the presence of other ions is placed. Industrial and commercial use of nickel-containing stainless steel, plating, painting and ceramics are. Nickel also from anthropogenic sources enters the water system. Small amounts of nickel in people who are allergic to this heavy metal can cause severe inflammation of the skin [4].

Cadmium is one of the natural elements in building the body's cells and many enzymes and hormones involved. The metal body with many vital macromolecules are irreversibly linked and threatened to disrupt the biological activity of cells. Cadmium also causes gastrointestinal disturbances such as nausea, vomiting, dry mouth, fever, headache and neurological disorders and respiratory diseases are also on the human body in high concentrations in the prostate, bone, muscle and liver accumulates [5]. The most important control methods, choice of different fish species widely to the physiological effects of heavy metals can be used [6]. Thus, the concentration of heavy metals in the tissues of aquatic can be a prelude to detect the level of aquatic pollution [7]. Such as indicator species to measure the amount of pollution can be traced to the Fish table *Himantura imbricate.*

Materials and Methods

Sample collection

The Persian Gulf is characterized by warm and saline water with a total area of 240,000 km^2. It has an average depth of 35m which decreases from east to west with maximum depth of 90 m in the Strait of Hormuz. The average seawater temperature of the Persian Gulf is 28-30°C, but it can rise up to 35.8°C, and the oxygen content can vary from 4 to 7 mgl^{-1}. High evaporation result in increasing salinity with values as high as 40 ppt. The Persian Gulf is considered one of the most highly anthropogenic ally impacted regions in the world. It is estimated that N40% of the coasts of the Gulf has been developed. In terms of pollution, the water quality of the Persian Gulf is influenced by various industrial and urban outputs in which wastewater directly discharges into the sea or enters via rivers [8]. Besides pollution through riverine inputs from adjacent countries (Iran, Iraq, Kuwait, Saudi Arabia, and the Emirates, Bahrain, Qatar and Oman), the Gulf has been exposed to various additional contaminants. Dredging and reclamation, hyper saline water discharges from desalination plants and oil pollution are examples of anthropogenic stresses that contribute to environmental degradation in the Persian Gulf.

Sampling

Samples were taken during April and May 2015 from three major stations in the Hormozgan Province-Iran (one of the most important fishing centers of the Persian Gulf): "Qeshm" (Tarqui; geographic coordinates: 0° 57' 0.26 S and 80° 42' 33.79 W) and "Souroo" (Tarqui; geographic coordinates: 0° 57' 0.26 S and 80° 42' 33.79 W) beach located" in Persian Gulf including crap. A total of 90 freshly caught marine fish (n = 30 individuals per species). Muscle tissues were collected, stored in plastic zip-lock bags and frozen at–20 °C until being analyzed. Total length and total weight were determined for all the organisms sampled.

Digestion and Metal determination

Before analysis, the fish were thawed and the muscular tissues from dorsal, abdominal and tail regions of each fish were taken out and homogenized. Four grams of the homogenized muscles (without skin) were taken from each specimen and placed in 300 ml digestion tubes. A digestion mixture containing 6.0 ml of high purity nitric acid (Merck), 2 ml of hydrochloric acid (10M) and 4 ml of hydrogen

peroxide (35%) was added to each tube. The samples were then heated at 130˚C by heating digester until clear solution was obtained. The digested portions were filtered through Whitman filter paper (No. 42) and diluted to a final volume of 50 ml using deionized water. The analytical technique used to determine heavy metal levels in all samples was thermo element Solar S4 Atomic Absorption Spectroscopy [9].

Statistical analysis

All samples were collected and analyzed in duplicate and the duplicate tests were statistically similar is paired-samples t-test, at 95% significance. The average results were used to represent the data. Statistical software, Minitab 16.0 for Windows, was used to test two-way analysis of variance (ANOVA) at 95% significance to investigate the effect of seasons and different fish species on variation of the metal concentrations in studied fishes. And one-way (ANOVA) was used to compare metals between species in single organ (significant values, P- value > 0.05). Metal concentrations in muscle were checked for normality by using the Kolmogorov–Smirnov test. Other calculations were performed by Microsoft Excel 2010.

Results

Analysis of variance showed that the concentrations of lead, nickel and cadmium in muscle tissue of Fish table *Himantura imbricate* between regions Qeshm and Souroo there is a significant difference (P-value< 0.05). As the studied concentration in the muscle of fish table Himantura imbricate Souroo higher than from Qeshm and the difference was statistically significant (P- value < 0.05). (Table 1 and Figures 1).

Index Area	Qeshm	Souroo
Nickel (micrograms per gram)	0.02 ±0.33	0/03± 0.48
Lead (micrograms per gram)	0/002 ± 0.024	0/003±0.035
Cadmium (micrograms per gram)	0.01±0.25	0.02 ±0.34

Table 1: *compares the results of the average of the elements nickel, lead and cadmium in muscle tissue of Fish table Himantura imbricate in Qeshm and Souroo (mean ± SD), (n = 30).*

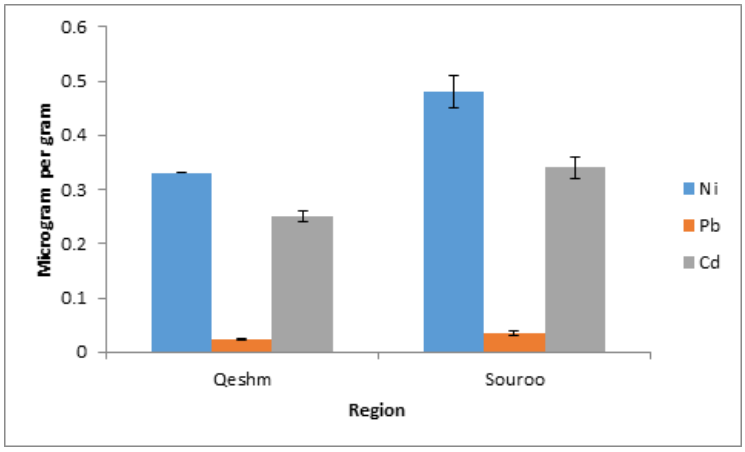

Figure 1: *Comparison of nickel, lead and cadmium in muscle tissue of Fish table Himantura imbricatemuscle in Qeshm and Souroo*

Discussion

Exploration, extraction and transportation of oil in the Persian Gulf, in addition to direct contamination, due to large amounts of heavy metals, chemical pollution of the Gulf marine and aquatic life is [10]. Fabris and colleagues (2006) showed that the concentration of heavy metals such as arsenic, cadmium, iron, zinc and mercury in fish and lobster J. Edwardsis P. bassenis ground now and abalone H. rubra to the location where the fish live in it. Depends on the concentration of the species in different parts of the coastal waters of Victoria in Australia there is a significant difference, but a pattern and there was no consistent trend across regions at a concentration of heavy metals.

There are significant differences between the concentrations of heavy metals in different areas can be discussed and not because of different management application, environmental conditions, evacuation of wastewater, the presence of industrial plants and aquaculture activities in the areas [11]. Chen (2002), showed significant differences in the concentrations of lead, cadmium, mercury, silver, copper and iron Chi-Ku Lagoon was found in samples from different regions. He also said that in areas where the origin of pollutants from sewage or fresh water input. Cadmium, mercury and copper were present in the environment, while the entrance to the remote areas of the mouth and go wetland reduced concentrations of these elements [12].

Dural and colleagues (2007), with several experiments showed that the concentration of heavy metals in aquatic organisms in different regions (the Persian Gulf, Gulf Egypt, the Gulf Askndryvn, in the South Atlantic salt marshes and wetlands Spain California) due to different environmental conditions such as: temperature, salinity, pH and light industrial activities.... and there is a significant difference [13]. Turkmen and colleagues (2005) reported that concentrations of heavy metals in fish muscle, according to the area where the fish is caught. And according to the species of fish can be very diverse and vary, also showed. Although not different between the concentrations of heavy metals in different parts of sampling fish there are significant differences [14]. Meador., *et al*. (2005), the concentration of three cadmium, mercury and lead in sediments and fish in several areas in Alaska and California have measured the results showed concentrations of lead and cadmium in sediments rural areas of California due to human activity is the because gasoline is increasing [15].

A significant impact on aquatic habitats so that the concentration of heavy metals, heavy metals in organisms that live in the Gulf are less than the amount of heavy metals in the body of organisms in coastal waters and estuaries, bays and inlets are present [16]. Unfortunately, in the discharge of sewage and solid waste and industrial development and dredging operations off the coast and ports, unloading of agricultural pesticides and fertilizers, as well as Persian Gulf oil extraction operations are heavily polluted with heavy metals and hydrocarbons is [17]. More pollutants into aquatic systems are eventually are deposited in the sediment. Sediments, aquatic environments are a critical component for performance and nutrition provide habitat for many organisms and in many cases the accumulation of metals in sediments than in the water [18].

And semi-benthic benthic species vulnerable to contaminants in sediments and contaminants are water-soluble, this species also play a constructive role in this environment and therefore their demographic shifts affect all societies and threaten the balance of ecosystems [19]. Generally, the most important reasons for the high concentration of lead, nickel, and cadmium in muscle tissue in the *Himantura imbricate* in Qeshm island compared to Souroo in various industries along the coast, discharge of industrial effluents and urban coastal waters is that their wastewater in a variety of heavy metals, and this increases the concentration of these metals. On the other hand there dhow building yards along the waterfront of the island and the use of color and anti-corrosion material (which contains zinc chromate and lead oxides area and finally moved to the coastal waters and adjacent areas and water pollution in this area are), too Boat traffic (tourism and fishing activities) and the presence of lead and nickel in gasoline and publish it in the air, then lead and nickel from combustion and quickly deposited on the soil, The nickel-containing sediments by rivers to the Persian Gulf could also be other reasons for this increase.

In the first study to estimate the amount of entry and the risk of heavy metals nickel, lead and cadmium were the *Himantura imbricate*. Results showed that all estimates of daily log metals is no danger in taking this species of fish found not consumers. It should be noted that in Crab various other metals such as mercury and organic pollutants such as poly aromatic hydrocarbons, and accumulate. It

is therefore essential that health authorities such as the Ministry of Health and other organizations in comprehensive background check estimate the amount of risk in different groups of consumers such as children and pregnant women do, and the accumulation of heavy metals in fish consumed annually carcinogenic and non-commercial and examine.

Reference

1. Medeiros RJ., *et al*. "Determination of inorganic trace elements in edible marine fish from Rio de Janeiro State, Brazil". *Food Control* 23.2 (2012): 535-541.
2. GanJavi M., *et al*. "Effect of conned tuna fish processing steps on lead and cadmium contents of Iranian tuna fish." *Food Chemistry* 118.3 (2010): 525-528.
3. Agah H., *et al*. "Accumulation of trace metals in the muscle and liver tissues of five speciies from the Persian Gulf". *Environmental Monitoring and Assessment* 157.1-4 (2009): 499-514.
4. EPA. Drinking water standards Environment of Criteria and Assessment. (1997).
5. Merian E. "Metals & their compounds in environment". *Journal of Environmental Health Criteria* 4 (1992) 53-63.
6. Obasohan EE. "Heavy metals concentration in the offal, gill, muscle and liver of a freshwater mudfish (parachanna obscura) from Ogba River, Benin City, Nigeria". *African Journal of Biotechnology* 6 (2007): 2620-2624.
7. Dugo G., *et al*. "Concentration of Cd (II), Cu (II), Pb (II), Se (IV) and Zn (II) in cultured sea bass (Dicentrarchus labrax) tissues from Tyrrhenian Sea and Sicilian Sea by derivative stripping potentiometry." *Food Control* 17.2 (2006): 146-152.
8. Naser HA. "Assessment and management of heavy metal pollution in the marine environment of the Persian Gulf: a review". *Marine Pollution Bulletin* 72 (2013): 6-13.
9. Moopam. Manual of oceanographic observations and pollutant analysis methods. 3rd edition, Kuwait, (1999): 321.
10. Al-Saleh I and Shinwari N. "Preliminary report on the levels of elements in four fish species from the Persian Gulf of Saudi Arabia". *Chemo Sphere* 48.7 (2002): 749-755.
11. Fabris G., *et al*. "Tract metals concentration in edible tissue of snapper, flathead and ablone from coastal waters of Victoria, Australia." *Ecotoxicology and Environmental Safety* 63.2 (2006): 286-292.
12. Chen MH. "Baseline metal concevtration in sediments and fish and determination of bioindicators in the subtropical." *Baseline Marine Poullution Bulletin* 44 (2002): 703-714.
13. Dural M., *et al*. "Investigation of heavy metal levels in economically important fish species from the Tuzla lagoon". *Food Chemistry* 102.1 (2007): 415-421.
14. TurkmenA., *et al*. "Heavy metals in three commercially valuable fish species from Iskenderun Bay, North East Mediterranean Sea, Turkey". *Food Chemistry* 91(2005): 167-172.
15. Meador J., *et al*. "A comparison of the non- essential elements cadmium, mercury and lead foud in fish and sediment from Alaska and California". Science of the Total Environment 339.1-3 (2005): 189-205.
16. Al- Yousef MH., *et al*. "Trace metals in liver, skin and muscle of Lethrinus lentjan fish species in relation to body length and sex". *Science Total Environment* 256.2-3 (2000): 87-94.
17. Ashraf V. "Accumulation of heavy metals in kidney and heart tissues of Epinephelus microdon fish from the Persian Gulf". *Journal of Environmental Monitoring and Assessment* 101. 1-3 (2005): 311- 316.
18. Unlu S., *et al*. "Heavy metal pollution in surface sedimentns and mussel samples in the Gulf of Gemlik". *Journal of Environmental Monitoring and Assessment* 144. 1-3 (2008): 169-178.
19. Cogun H Y., *et al*. "Metal concentrations in fish species from the Northeast Mediterranean Sea". *Journal of Environmental Monitoring and Assessment* 121. 1-3 (2006): 431-438.