IJBPAS, February, 2015, 4(2): 414-419

ISSN: 2277–4998

International Journal of Biology, Pharmacy and Allied Sciences (IJBPAS)

'A Bridge Between Laboratory and Reader'

www.ijbpas.com

# HEAVY METALS (LEAD AND CADMIUM) IN THE CATFISH (*SILURUS GLANIS*) LIVER OF ARAS RIVER IN THE POLDASHT REGION, WEST AZERBAIJAN, IRAN

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**ABSTRACT**

In order to determine the amounts of lead and cadmium in the liver of Catfish (*Silurus glanis*) in the Aras River, 11 catfish weighing approximately 15 ± 0.5 kg were sampled randomly. The samples were transferred to the fish Aquatics lab of the Veterinary faculty of Islamic Azad University of Tabriz. The samples were placed in 105°$^{c}$ oven followed by autopsy and sampling in order to drying, after all the chemical digestion was conducted. Then, the samples were transferred to flame-type atomic absorption spectrometry, model AA240 Varian made in USA, for measuring the metal concentration in target tissue. The results of the present study showed that the mean of lead and cadmium in the liver of the catfish were 578.236±09.359, and 358.45±82.149 µg/kg, respectively. Mean of lead and cadmium in understudied samples were more than the maximum limit specified in the European Union.

**Keywords: Lead, Cadmium, Catfish, Aras River,**

## INTRODUCTION

Aras River in the Poldasht area is one of the main water resources in West Azerbaijan province. The river originates from Erzurum-Turkey Mountains and enters Kura River in Azerbaijan republic. The area's residents Multiple use such as hunting

waterfowl, fishing, and using aquatic plants are just some of the features. Heavy metal can be named as the most important pollutants and among the heavy metals lead and cadmium have an important role in the poisoning of humans and livestock. These metals in combination with enzymes and carrier proteins enter into cells and exert their destructive effects on the cell's activities. The effects of pollutants on human health occur mainly following the chronic and gradual exposure to the pollutants. The pollutants have an adverse effect on liver, kidney, and bones as well as they are potentially carcinogenic, mutagenic and allergenic **[10]**.

Cadmium (Cd) belongs to Group IIB along with lead and mercury on the periodic table. It is relatively rare in nature and ranked in sixty seventh place considering abundance in the earth **(2).** Cd, is a heavy metal and unnecessary for fish. If the metal enters the fish body, mainly will be accumulated in the gill and kidney and to a lesser extent in the liver. Cd accumulation in gill results in increased chloride cells in the gill epithelium. Furthermore, the production of mucus increases in the body surfaces of fish exposed to cadmium, also the number of mucus-producing cells increases in the intestine and gills [**8]**.

Lead accumulates in bottom sediments more than 4 times the amount of lead in the water. This material accumulates mainly in the kidney, gills and muscle of the fish. Gill epithelium acute poisoning at first results in gill epithelium damage and the affected fish dies due to suffocation. Symptoms of chronic lead poisoning include changes in blood with a severe damage to white and red blood cells, dwindling changes of parenchymatous tissue and nervous system damage **[9]**.

Lead and cadmium are used in various industries such as metal alloys, battery, and paint industries. Furthermore, there is cadmium as a contaminant in some chemical fertilizers including phosphate fertilizers **[12]**. So, these metals has been extensively involved in the sea, underground water, soil, sediments, air, etc., and thereby agricultural products, animals and aquatics are exposed to pollution **[10]**. Since one of the important ways to pollution is exposing the human beings to lead and cadmium via food resources, evaluation and control of various food pollutions and detecting pollutant resources and consequently modify or removing the resources would have a significant effect on human health and lifespan.

There are abundant reports from different countries on evaluating various pollutants including heavy metals **[1, 3, 4, 5 and 11]**, but there is no recorded information in Iran except some limited studies. The present

study aimed at determining the heavy metals amounts, such as lead and cadmium in catfish liver of Aras River in Poldasht area and comparing obtained results with the recommended amounts.

## METHODS AND MATERIALS

### Sample Obtaining

This cross-sectional study was conducted on the catfish (*Silurus glanis*) population of the Aras River in Poldasht – West Azerbaijan province in the spring of 2011. For this purpose, the liver samples of 11 catfish with weight of 15±0.5 caught randomly were taken. It must be noted that the samples were stored at -18°C until testing.

### Sample Preparation

The caught fish were transferred to the Aquatics lab of the Veterinary faculty of Islamic Azad University of Tabriz. Then they were Necropsied in order to take samples. 10 g of liver tissue was weighted and prepared for drying at 105°c oven. During 72 hours the samples were weighted three successive times (24, 48, and 72 hours). When the difference between two consecutive times was zero, it was found that the samples were dried thoroughly. After final weighing and recording the dry weight of the samples, 0.5 g of each dried tissue was taken and chemical digestion was conducted. At this stage, 0.5 g of each sample was taken. The obtained samples were ground and powdered in a porcelain mortar, and then 5 ml of 65% nitric acid was added to the powder and kept at room temperature for an hour. The resulting solution was poured into a Teflon container (Teflon Bomb) and aluminum sheet wrapped thoroughly around the container, then it was put in a $90^{\circ c}$ heatter (hot plate) for 3 hours. After the mentioned time the container was allowed to become cold completely. The resulting solution was poured in a Joujeh balloon up to 50 ml. In order to measure the metal concentration in the target tissue, the sample was transferred to the flame type atomic absorption device model AA240 Varian made in the US **[13]**.

## RESULTS

After evaluating lead and cadmium, using atomic absorption spectrometry, in liver tissue samples of catfish caught from the Aras River at Poldasht region the following results were obtained which are shown in **Table 1**:

**Table 1: Moderate amounts of Lead and cadmium the catfish liver caught from Aras River at the region of Poldasht**

| Sample type | Number | Lead level (ppm) | Cadmium level (ppm) |
|---|---|---|---|
| **liver** | **11** | **mean±SD** | **mean±SD** |
| | | **359.09± 236.578** | **149.82±45.358** |

**Table 2: Comparison of the standard levels cadmium in the catfish liver based on EU and US standards**

| Heavy metal | FDA (US) | Un standards (Protein Advisory Group) |
|---|---|---|
| cadmium | Less than 0.05 ppm | 1 ppm |
| lead | Less than 0.05 ppm | 5 ppm |

## DISCUSSION AND CONCLUSIONS

Water pollution with heavy metal compounds, leading to fish toxicity and, subsequently, direct mortality, chronic toxicity and sub-lethlal changes in the physiology of fish which will result in the inability of the animal to survive. Chronic toxicity of some metals in fish also can reduce the ability to reproduce, body deformity, inability to escape from enemies, and increased susceptibility to infections **[9].** Metals in different environmental conditions are absorbed by fish body. Different organs of fish are exposed to the environment and may be a place for sediment transport and accumulation of heavy metals. These organs include the skin, intestine and gills among which the gills are more than two times susceptible than other organs and chloride cells play an important role in the organ **[7].**

In the study conducted by Saeid Pour in 2007 to determine the concentration of heavy metals in different fishes of Hormozgan province Coast and comparison of heavy metal concentrations in different species and different fishing areas in the province, the mean of lead concentration in the liver of *Psettodids erumei* in Bandar Abbas and Bandar Lengeh was respectively 47.55 ppm and 38.46 ppm, and the mean of lead concentration in the liver of *Euryglossa orientalis* in Bandar Abbas and Bandar Lengeh was respectively 87.94 ppm and 09.86 ppm. Also, the mean of concentration of Cadmium in the liver of *Psettodids erumei* in Bandar Abbas and Bandar Lengeh was respectively 79.16 and 76.48 ppm, and the mean of concentration of cadmium in the liver of *Euryglossa orientalis* in Bandar Abbas and Bandar Lengeh was respectively 37.40 and 83.39 ppm **[13].**

In a research conducted by Shahriari in 2003 in order to measure the amounts Cadmium, Chromium, lead and Nickel in edible tissues of *Blacrskspot snapper* and *Tigertooth croaker* in Persian golf it was demonstrated that the metals rate in *Blacrskspot snapper* were 0.422, 0.333, 0.063, 0.322 ppm respectively based on the dry weight of the fish and in *Tigertooth croaker* they were 0.48, 0.062, 0.064, and 0.480 ppm based on dry weight, respectively **[14].** In a study conducted by Uluzlu in 2007 in order to evaluate the heavy metals rate in Whales from the Black Sea and the Aegean Sea, the amount of heavy metals in whale samples was

determined as follows: Copper 73.0 -83.1, Cadmium 45.0 – 90.0 µ g / g, Lead 33.0 – 93/0 µ g /g, Chromium 95.0 - 98.1 µ g /g, and Nickel 68.5 – 92.1 µ g /g. Lead and cadmium levels in fish samples exceeded the recommended limit values for human consumption **[15].** The results of the present study showed that the mean of concentration of heavy metals such as lead and Cadmium in the liver of catfish was 578.236±09.359 and 149.82±45.358 µg/kg respectively, which was greater than the allowable amount of European Union. Phosphate fertilizers with excessive heavy metals play an important role in increased levels of lead and Cadmium of water, sediments, plants and consequently body organs of aquatics of the river [**6].** Therefore, considering the high rate of the metals in catfish's liver of Aras River probably the pollution of the river by mentioned pollutants is very high, so, analyzing the metals from water resources and sediments of the river seems necessary in future studies.

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