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## **Heavy Metals in Edible Tissue of Red Mullet from Tirana Market**

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**Abstract:** High levels of heavy metals in seawater deputize a warning for public health and environment. The purpose of the study was to monitor and evaluate the concentration levels of heavy metals in edible sample tissue of Red mullet. A total of 40 of muscle sample tissue of Red mullet purchased directly from the local fresh fish market of Tirana was utilized to determine by using atomic absorption spectrophotometer (AAS). The results of the study showed that mercury ( $p=0.049$ ) and lead ( $p<0.001$ ) concentration levels varied significantly between samples of Red mullet with different weights. According to the results concentration level of mercury and lead measured in muscle samples tissue resulted below the maximum permitted levels for human consumption set by EC legislation. High levels of cadmium made an exception (0.44 mg/kg wet weight). The results of the monitoring study give relevant information on heavy metal contamination of fish species with commercially interest such a Red mullet. The results of the monitoring process suggest that Red mullet should be object of further monitoring with the goal to protect Tirana consumer's health from heavy metals contamination.

**Keywords:** Heavy metals, Red mullet, Muscle tissue, Public health

### **Introduction**

Fish constitutes an important source of proteins, minerals, vitamins and unsaturated essential fatty acids, especially omega-3 (Storelli, 2008; Copat et al., 2010). The nutritive and economical values of fish are attributed to its good and cheap source of protein and minerals, richness in non-saturated fatty acids and sources of omega-3 that help in reduction of the blood cholesterol and prevent heart malfunction (arteriosclerosis) (Erkkilä et al., 2004). As a result of the buoyant demand and increased awareness of the biological values, fisheries have increased significantly in our country over the last decades (Isntat, 2021).

Environmental pollution due to discharged wastewater or rapid progress of industries represent a worldwide problem. Albania has a very long coastline and fishing is an important source of food for the population. The Adriatic coastline continue to be subject to environmental toxic waste emissions, which have contributed to the destruction of the ecological balance in the aquatic environment. In addition, fish caught from contaminated water the possibility to found the presence of toxic substances such as heavy metals are much higher. The consequences of consuming contaminated fish by heavy metals can be quite severe, sometimes even resulting to

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death for humans. Long-term exposure may result in slowly progressing physical, neurological degenerative processes that mimic Alzheimer's disease, Parkinson's disease, muscular dystrophy and multiple sclerosis (Zeitoun et al., 2014).

The quality of fish deputed a challenge not only from a microbiological point of view but also for the presence of heavy metals that tends to bioaccumulation in fish tissue. Analytical evaluation on the presence of heavy metals in muscle tissue is important because it represents the edible part of the product that is used for consumption and can serve as a risk factor for the consumers' health. Therefore, periodic survey for the presence of the heavy metals in marine environment and fish tissue are especially important to protect human health. Based on the above mentioned issues and taking into account the importance of public health and consumer protection the aim of the study was to monitor and evaluate the concentration level of heavy metals in edible tissue of Red mullet and then compare the results with EC regulation limits for human consumption (EC, 2008).

## Method

A total of 40 Red mullets (*Mullus barbatus*) fish species was collected during Summer 2013 at the main fresh fish market of Tirana. All the red mullet sample were with different weight (small fish size mean weight - 30 g, big fish size 55 g).

The fish samples were first, identified, weighed, catalogued and conserved at - 18°C and then they were sent for further investigation to the Laboratory of Toxicology, Institute of Veterinary and Food Safety, Tirana. A total of 40 samples of muscle tissue of red mullet were evaluated for the concentration level of mercury (Hg), lead (Pb) cadmium (Cd), and chrome (Cr) by using an Atomic Absorption Spectrophotometer (AAS). Both tissues of fish species were homogenized in a blender; and then they were dried at 100 °C. One g of sample was weighed and then treated with 10 ml of HNO<sub>3</sub> and 5 ml of concentrated H<sub>2</sub>SO<sub>4</sub> and let in overnight. The next day they were dried at 150° C for at least, 30 minutes and 50 ml of it were put into a normal flask, and filled with tap water. The heavy metals were measured by ICP-OES, Optima 2100 Dv produced by Perkin Elmer.

## Statistical Evaluation of the Data

The comparison of the data between two groups was held by using student test, possibilities less than 0.05 was considered statistically important. (p<0.05). The entire statistic evaluation was carried out by using SPSS 20.0 (Statistical Package for Social Science). The statistical data on the below table comprised average, standard deviation, standard error, p value and interval of confidence.

## Results and Discussion

The concentration level and (SD) of mercury, lead, cadmium and chrome (mg/kg wet weight) in muscle sample tissues of red mullet samples are given in the below tables (Tab. 1). The results of the study show that heavy metals are present at different concentration levels in all sample tissues of red mullet. The order of accumulation in Red mullet muscle tissue samples ranged as follows, Cd>Cr>Hg>Pb.

Table 1. Average mean concentration level of heavy metals in muscle sample tissue of Red mullet with different weight (mg/kg wet weight).

| Species Red mullet ( <i>Mullus barbatus</i> ) |        |    |      |      |      |        |    |        |        |       |
|---|--------|----|------|------|------|--------|----|--------|--------|-------|
| Metals  | weight | Nr | A    | SD   | SE   | t      | df | p*     | CI 95% |       |
| Hg  | S      | 20 | .032 | .029 | .009 | 2.039  | 37 | 0.049  | .000   | .037  |
|   | M      | 20 | .014 | .011 | .003 |        |    |        |        |       |
| Pb  | S      | 20 | .128 | .145 | .032 | 3.947  | 38 | <0.001 | .062   | .194  |
|   | M      | 20 | .000 | .000 | .000 |        |    |        |        |       |
| Cd  | S      | 20 | .242 | .229 | .065 | -2.299 | 38 | 0.027  | -.385  | -.025 |
|   | M      | 20 | .447 | .275 | .061 |        |    |        |        |       |
| Cr  | S      | 20 | .249 | .410 | .092 | 1.592  | 38 | 0.120  | -.040  | .335  |
|   | M      | 20 | .102 | .065 | .015 |        |    |        |        |       |

Concentration level of mercury (Hg) – According to the results the average mean concentration level of Hg resulted  $0.032 \pm 0.029$  mg/kg ww in small fish size into  $0.014 \pm 0.011$  mg/kg ww in large sized fish. Concentration levels of Hg revealed significant statistical differences between two groups with different weight ( $p=0.049$ ).

Concentration level of lead (Pb) – From the comparison of the data resulted that average mean concentration level of Pb ranged  $0.128 \pm 0.145$  mg/kg ww in small fish size, while in large fish size resulted always below the detection level (nd). Based on the results the average concentration level of Pb represents significant statistical difference between two groups ( $p<0.001$ ) of fish.

Concentration levels of cadmium (Cd) – Based on the results the average mean concentration level of Cd ranged from  $0.242 \pm 0.229$  mg/kg ww in small fish size in into  $0.447 \pm 0.275$  mg/kg ww in large sized fish muscle samples. The concentration level of Cd represents significant statistical differences ( $p=0.027$ ) in both groups. Concentration levels of chrome (Cr) – From the analyzed data it resulted that average mean concentration levels of Cr ranged from  $0.249 \pm 0.410$  mg/kg ww in small fish size at  $0.102 \pm 0.65$  mg/kg ww in large sized fish. The concentration level of Cr in both groups doesn't showed any statistically significant differences ( $p=0.120$ ).

According to the data of the study mean concentration level of mercury and lead in muscle samples tissue of both groups resulted lower than the maximum permitted level for human consumption set by EC regulation (Hg – 1.0; Pb - 0.30 mg/kg wet weight, EC, 2006 & 2008). These results are similar with other studies were the Hg value of was Mean: 0.31 mg/kg w.w (Storelli et al., 2005). Practically alike results were observed from (Kucuksegin et al., 2001) levels of Hg in Red mullet ranging from 0.016 to 0.2 mg/kg ww.

In the case of cadmium (Tab. 1) the average mean concentration level in muscle sample tissue in both groups exceeded the maximum permitted values for human consumption (Cd – 0.050 mg/kg wet weight, EC, 2006 & 2008). High levels of Cd that range from 1.059 mg/kg w.w. (Nerja) to 1.550 (Cartagena) was also observed in a study from (Benedicto et al., 2007) conducted in Iberian Peninsula coast.

The differences in heavy metals concentration in fish is related not only to origin of species, but also to others factors such as nature of aquatic environment (Canli et al., 2003) their nutritional level (Kalay et al., 2004), sex, weight etc. Red mullet is a typical benthic fish species which lives in to near contact with the sediment were it mainly bury and feeds. Data reported from other studies revealed that fish species which lives into near contact with the sediment are much more exposed to heavy metals pollutants than other fish species (Canli et al., 2003; Yilmaz, 2005; Storelli, 2008). These data are in accordance to our results.

According to the results concentration level of Cd in Red mullet overpassed the maximum permitted levels for human consumption set by EC regulation of 0.050 mg/kg wet weight (EC, 2006; EC, 2008), which means that these species aren't safe for human consumption. In order to protect human health from heavy metals, Red mullet should be object of further monitoring process.

## **Conclusion**

The results gathered from this monitored study showed that mercury, lead and chrome concentration in muscle sample tissues of Red mullet was below the maximum permitted levels set by EC legislation. High levels of cadmium made an exemption in this study as they surpassed the maximum limit for human consumption of 0.050 mg/kg wet weight.

## **Scientific Ethics Declaration**

The authors declare that the scientific ethical and legal responsibility of this article published in EPHELS journal belongs to the authors

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