LEVELS OF HEAVY METALS (HG, PB, CD, AND CR) IN TISSUES OF TRACHURUS TRACHURUS

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Abstract:

The study was carried out to monitor the concentration level of mercury, lead, cadmium and chrome in different tissues of *Trachurus trachurus* (Horse mackerel). The concentration level of heavy metals was measured by using atomic absorption spectrophotometer (AAS). Concentrations of heavy metals in muscle tissue and liver of this animal ranged as follows: Hg 0.032-0.106; Cd nd-0.067 mg/kg wet weight; Pb and Cr resulted always below the detection level (nd) in all tissue samples. According to the results the concentration levels of heavy metals measured in the muscle tissue was lower than the maximum permitted level for human consumption set by EC and Albanian regulation. The results obtained from the study indicate that heavy metal levels are in acceptable limits, so this product can be used as food for human consumption.

Keywords: heavy metals; *Trachurus trachurus*; concentration

1. Introduction

The contamination of aquatic products has become a matter of great importance these last decades. Heavy metals are natural components of aquatic environment; their levels are increasing due to enhanced industrial activities and agriculture ones.

The natural concentration of these metals in sea water are very low and hence the risk of contamination in living tissue is high, because of the ability of these organisms to accumulate them [9]. Heavy metals can be accumulated by fish throw both the food chain and water [6]. They have the ability and tendency to accumulate in various organs and muscle tissue of marine organisms, especially fish, which in turn may enter into the human metabolisms through consumption, causing serious health hazards [13].

Pelagic fish species as Horse mackerel have an excellent meat which is reach rich with proteins and Ω_3 fatty acids, for this reason they are an important part of Mediterranean human diet. The purpose of this study was to evaluate the concentration level of heavy metals in muscle tissues of Horse mackerel *(Trachurus trachurus)* and the comparison of them in different tissues (muscle and liver tissues).

2. Material and Methods

2.1. Sample collection and preparation

The fish species namely Horse mackerel originated from Adriatic Sea, were collected monthly from January to December 2011. The fish species of Horse mackerel were purchased in main fishery subjects of Tirana local markets. According to the weight the samples were divided in two main groups: medium fish size (145 g) and large fish size (192 g). The fish samples before they were sent to the laboratory of Toxicology, Institute of Veterinary and Food Safety, Tirana they were first, identified, weighed, catalogued and conserved at - 18°C. The study included 20 samples of muscle (10 samples for each size) and 20 samples of liver tissue of *Trachurus trachurus* (Albanian fisheries).

2.2 Analyses and determination of heavy metals

A total of 40 samples of muscle and liver tissue of Horse mackerel were evaluated for the concentration level of mercury, cadmium, lead and chrome by using an Atomic Absorption Spectrophotometer (AAS). The muscle and liver tissue of the fish species was homogenized in a blender; they were dried at 100 ºC. One g of sample was weighed and then treated with 10 ml of HNO_3 and 5 ml of concentrated H_2SO_4 and let in overnight. The next day they were dried at 150º 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.

3. Results and Discussion

3.1 Heavy metal concentration in muscle and liver tissue

The average mean concentration level and (SD) of mercury, lead, cadmium and chrome in the muscle tissue and liver of fish samples are presented in the below figures (Fig. 1 and 2). The concentration level of mercury (Hg) varies among muscle tissue and liver of Horse mackerel, according to the weight (Fig. 1, 2). The highest concentration level of mercury (mg/kg ww) was found in the liver (0.106±0.039) of large fish size (192 g) of *Trachurus trachurus,* while the lowest level was detected in the muscle tissue of medium fish size (0.032±0.012). Referring to data (Fig.1), the concentration level of mercury (Hg) in muscle tissue of *Trachurus trachurus* (Horse mackerel) doesn't show sinjificant differences ($p<0.1$). Mercury reveals low concentration level in muscle tissue in spite of liver (0.106±0.039). As we know, during last decades it is calculated that more than 5% of total mercury in the Mediterranean Sea is accumulated in fish [2], so our results are according to it. The different quantity accumulation of heavy metals may be related to the nature and fish habitat and feeding type of them. The species of *Trachurus trachurus* is a pelagic fish which feeds mainly with sardines and shrimps [15]. Romeo *et al*., [17] in their study pointed out that heavy metal concentration in edible muscles of pelagic species is lower than benthic fish species, which is in accordance with our results.

The average means concentration level of mercury (Hg), in all cases, of muscle and liver sample tissues resulted below the maximum permitted level for human consumption (Hg - 0.50 mg/kg ww) set by EC and Albanian regulation [5, 16]. It can be harmful when it is ingested for a long period of time and after absorption it is distributed in soft tissues and than in bones.

The concentration level of lead resulted below the detection level (nd) in all samples of muscle and liver tissues of Horse mackerel. Lead is a toxic metal found everywhere in the environment. Long term exposure to lead in children can lead to diminished intellectual capacity [7]. Recent investigations illustrate [11] that the application of special measurement concerning lead has influenced the decreased level of lead in the Mediterranean Sea.

The highest concentration level of cadmium (mg/kg ww) was found in the liver of both fish size, (0.067±0.009), (0.036±0.011) of *Trachurus trachurus.* Cadmium in all muscle tissue of fish samples resulted bellow the detection level (nd). Referring to the data the concentration level of cadmium in liver of *Trachurus trachurus* shows sinjificant differences ($p<0.0001$) between to fish sizes.

The concentration level of cadmium in liver of species under study, resulted below the maximum values (Cd-0.10 mg/kg ww) set by EC regulation [5]. Cadmium concentrates in animals rich peaks to hundreds to thousands of times higher than in water [1,8]. In aquatic environment, cadmium passes from the sediment in the phytoplankton and than in mollusks, crustaceans and small fish, which serve as food supply for *Trachurus trachurus*. Cadmium has the tendency to bioaccumulate in the fish liver due to the similar function of it as an organ that involves the detoxification process [14].

Chrome related, to other chemical elements in an essential one. It plays important roles in many metabolic processes in the human body. Chromium is known to enhance the action of insulin, a hormone critical to the metabolism and storage of carbohydrate, fat, and protein in the body.

In our study, the concentration level of chrome resulted as in the case of lead below the detection levels (nd) in muscle and liver tissues of Horse mackerel.

According to figure 1, the concentration level of mercury is higher in large fish size (192 g) than in medium fish size (145 g). But, the level of mercury resulted lower than the maximum permitted level for human consumption set by EC regulation [4], in both cases.

According to figure 2 the concentration level of heavy metals in the liver of large fish size is higher than in medium fish size.

As we can see from figure 3 the concentration level of mercury are higher in the liver than in the muscle tissue of *Trachurus trachurus* species. Fish muscle tissue tends to bioaccumulate lesser metals compared to other fish organs, like as liver [18], fact which is in according to the present study.

According to the data the concentration level of mercury, lead, cadmium and chrome resulted below the maximum permitted level for human consumption

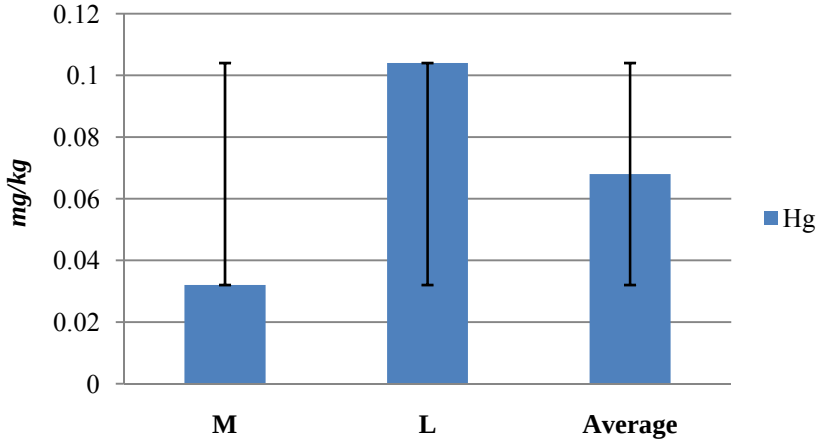

Figure1. Comparison of average mean value and SD (standard deviation) of mercury in muscle tissue of *Trachurus trachurus* in different fish sizes (medium and large) (mg/kg wet weight)

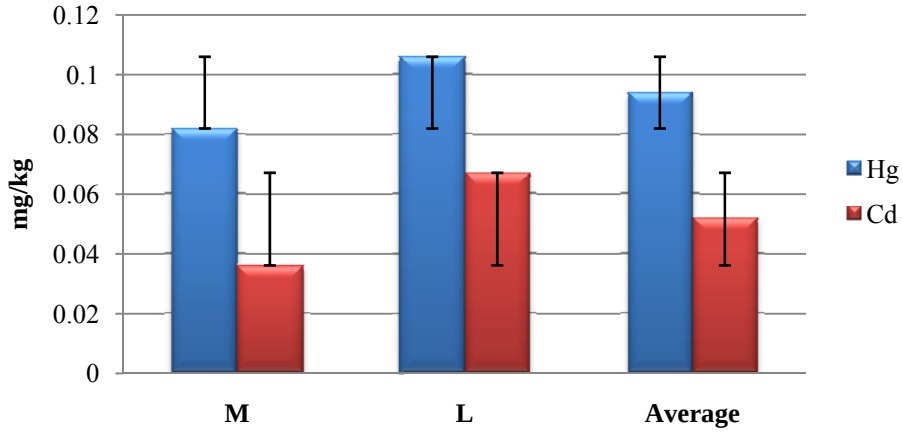

Figure 2. Comparison of average mean value and SD (standard deviation) of heavy metals in liver of *Trachurus trachurus* in different fish size (medium and large) (mg/kg wet weight)

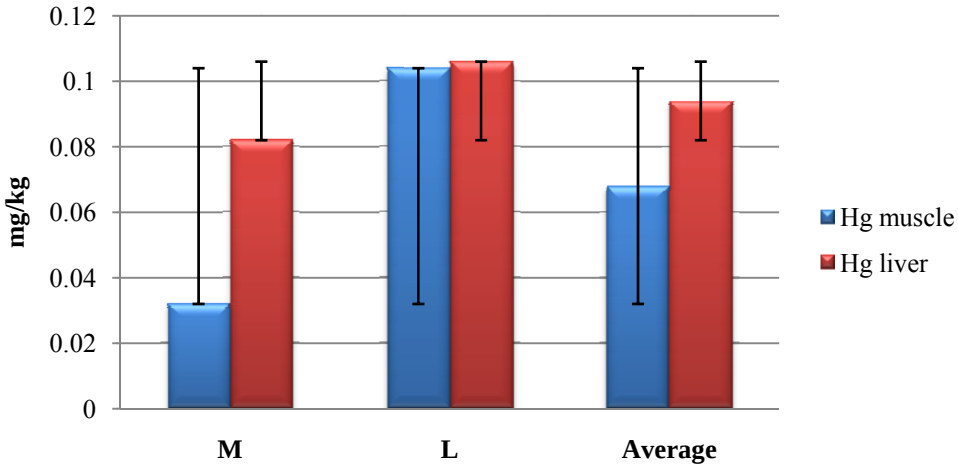

Figure 3. Comparison of average means values and SD (standard deviation) of mercury between muscle and liver of both medium and large fish size of *Trachurus trachurus* (mg/kg wet weight).

(Hg-0.50 mg/kg; Pb-0.30 mg/kg, Cd- 0.10 mg/kg wet weight), [4, 5]. Other author in their studies reported higher concentration level of Pb, Cd and Cr in *Trachurus trachurus* species than in our study [3, 11, 12, 19].

4. Conclusions

The concentration level of heavy metals in muscle and liver tissue are lower than the maximum permitted level for human consumption set by EC and Albanian regulation. Our results indicate that heavy metal levels are in acceptable limits, so this product can be used as food for human consumption.

5. Acknowledgments

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