

RESEARCH ARTICLE

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Heavy metal concentration in farmed Sea Bream (*Sparus aurata*)

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Abstract

The study was carried out to evaluate the concentration levels of mercury, lead, cadmium and chrome in muscle tissue of farmed Sea Bream (*Sparus aurata*). The fish samples were collected monthly at the main fresh fish market of Tirana, during 2011 - 2012. A total of 40 muscle sample tissue of fish species was measured by using atomic absorption spectrophotometer (AAS). Heavy metal concentration of fish samples in both groups (small & large fish size), expressed in mg/kg wet weight ranged as follows; Hg; 0.211–0.041., Pb; 0.022 – nd (mg/kg ww). In contrast cadmium (Cd) a highly toxic chemical substances and chrome (Cr) to resulted in all fish samples below the detection level (nd). According to the results the concentration levels of mercury and lead measured in muscle sample tissue of farmed Sea Bream in every case resulted lower than the maximum permitted level for human consumption set by EC regulation. The results obtained from the study revealed that farmed Sea Bream are contaminated with heavy metals, their concentration in muscle tissue resulted to be in acceptable limits, so this fish species can be safely used as food from Tirana consumers.

Keywords: heavy metals, farmed sea bream, *Sparus aurata*, concentration.

1. Introduction

Fish is actually becoming an important part of worldwide consumers diet. It provides a very good source of proteins, minerals, vitamins, unsaturated essential fatty acids (Ω_3) [13], carbohydrates and low level of cholesterol [16]. However, the benefits of fish consumption may be offset by the presence of heavy metals and other toxic substances in edible tissues of it. Heavy metals such as mercury, lead and cadmium are well known as high toxic metals. They have the ability to accumulate in tissues of marine organisms and being conveyed through the food chain to humans [13]. Numerous studies has reported heavy metal residuals in different fish species with particularly economic interest [1, 9, 11,12,13,14,15,16]. However in Albania a few researches has been reported on the residuals of heavy metals in both wild and farmed fish species [6,7,8]. Farmed species as sea bream are the most preferred fish species actually among Tirana consumers. Sea bream is characterized by an excellent tasteful meat and is reach with valuable proteins and essential fatty acids as well. Based on the particular interest of these species among consumers the study aims to monitor and evaluate the concentration levels of mercury, lead, cadmium and chrome in edible tissues of sea bream (*Sparus aurata*).

2. Material and Methods

2.1. Sample collection and preparation

The fish species namely Sea Bream (*Sparus aurata*), were collected during 2011-2012 . The fish species of farmed Sea Bream (imported production) were purchased in main fishery subjects of Tirana local markets. 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. According to fish commercially weight the samples were divided in two main groups, small fish size (average mean weight 200 g) and large fish

size (average mean weight 300 g). The study included 40 samples of muscle (20 samples each small & large fish size) tissue of farmed Sea Bream.

2.2. Analyses and determination of heavy metals

A total of 40 samples of muscle tissue of farmed Sea Bream were evaluated for the concentration level of mercury, lead, cadmium and chrome by using an Atomic Absorption Spectrophotometer (AAS). The muscle sample tissue of the fish species was homogenized in a blender; they were dried at 100 °C. One g of sample was weighed and then treated with 10 ml of HNO₃ and 5 ml of concentrated H₂SO₄ 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. Heavy metal concentration in fish was expressed in mg/kg wet weight (mg/kg ww).

2.3. 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).

3. Results and Discussion

3.1 Heavy metal concentration in muscle of farmed Sea Bream

The average mean concentration level (mg/kg ww) and (SD) of mercury (Hg), lead (Pb), cadmium (Cd) and chrome (Cr) in muscle tissue of fish samples are presented in the below table (Tab. 1). The order of heavy metal accumulation in both groups (small & large fish size) of Sea Bream samples followed these range: Hg>Pb. Cadmium and chrome as well resulted in all fish sample tissue below the detection level (nd).

Table 1. Average mean concentration level of mercury, lead, cadmium and chrome in muscle tissue of farmed sea bream (*Sparus aurata*)(mg/kg ww)

Heavy metals <i>Fish species, farmed Sparus aurata</i>								
	groups	Nr	Average	SD	SE	t	df	p *
Hg	small fish size	20	.2118	.26795	.05991	2.813	38	0.008
	large fish size	20	.0419	.03293	.00736			
Pb	small fish size	20	.0225	.04622	.01033	2.172	38	0.036
	large fish size	20	.0000	.00000	.00000			
Cd	small fish size	20	.0000	.00000	.00000			
	large fish size	20	.0000	.00000	.00000			
Cr	small fish size	20	.0000	.00000	.00000			
	large fish size	20	.0000	.00000	.00000			

*student test “t”, Nd – not detected

The highest concentration level of mercury (mg/kg ww) was found in muscle sample tissue (0.2118 ± 0.26795) of small fish size, while in large fish size resulted to be (0.0419 ± 0.03293). According to the result the concentration levels of mercury (Hg) showed important statistical differences between fish size ($p = 0.008$). The average mean concentration level of mercury (Hg), in all muscle sample tissues of sea bream resulted below the maximum permitted level for human consumption (Hg - 0.50 mg/kg ww) set by EC regulation [3,4]. The highest concentration level of lead (mg/kg ww) was found in the muscle tissue (0.0225 ± 0.04622) of small fish size samples of sea bream, while in large fish samples lead resulted always below the detection levels (nd). Referring to the study results (Tab.1), the average mean concentration level of lead in muscle sample tissue

of sea bream showed significant statistical differences ($p=0.036$) depending to fish size. The average means concentration level of lead (Pb) in all cases, of muscle sample tissues of farmed sea bream resulted below the maximum permitted level for human consumption (Pb - 0.30 mg/kg ww) set by EC regulation [3,4]. In our study, concentration levels of mercury (Hg) and lead (Pb) (mg/kg ww) in muscle tissue of farmed sea bream resulted always below the maximum permitted levels set for human consumption by EC legislation[3,4]. In generally contamination of fish by heavy metals is affected by several factors such as contamination of water environment, time of exposure, diet, sex, age, dose, metabolisms and other physical parameters as well [2,10]. As reported by literature a very important route of heavy metal contamination of farmed species may be their feeding diet and surrounding environment too [5]. Farmed fish species as sea bream reaches commercially weight in a very short period of time compare to wild species, and so we can suggest that their contamination with heavy metals may be due to their way of feeding primarily and origin. According to the data of the study, mercury and lead resulted in all samples tissue of farmed sea bream below the maximum permitted level for human consumption set by EC legislation (Hg - 1.0 mg/kg; Pb-0.30 mg/kg ww), while cadmium and chrome as well resulted always below the detection level (nd). Referring to these findings of the study we can conclude that farmed species as sea bream doesn't pose a possible threat for consumers health.

4. Conclusions

These study monitored the concentration level of mercury, lead, cadmium and chrome in muscle tissue of farmed sea bream. From the results of the study it can be concluded that the contamination of these farmed fish species by heavy metals doesn't pose a real threat to Tirana consumers. The level of contamination by mercury and lead are within the acceptable limits for human consumption set by EC limits.

5. References

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