

Heavy metal toxicity and food contamination: lead, cadmium, and mercury determination on fish matrices from the FAO 37.2.2

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ABSTRACTS

Heavy metals can be essential, benefits and toxic. The 246 samples of swordfish, tuna and bivalve molluscs examined coming from the request of private individuals and at the request of the Control Authorities in order to carry out routine checks or inspections of food safety. All the elements were determined by an ICP-MS. The level of contamination of heavy metals in the fish species sampled in the Mediterranean Sea has been investigated as an indicator of water pollution. This study highlighted the presence of lead and cadmium, especially in swordfish samples, but all within the limits of law; mercury is absent in all samples. Top predators have higher levels of heavy metals than other species due to the bioaccumulation phenomenon.

KEY WORDS

Heavy metals; marine top predators; contaminants; ICP-MS.

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INTRODUCTION

The term "safety food" defines the measures and conditions necessary to control the dangers and ensure the suitability for human consumption of a food product as required by EC Regulation 852/2004. The heavy metal (lead, cadmium and mercury) contamination in fish food has reached a significant interest due to urbanization and industrialization. In recent years, this concept has undergone an evolution, as initially the only presence of parasites and pathogenic microorganisms was considered, while today it has been included the ab-

sence or presence of voluntarily added chemicals (additives and colorants), environmental pollutants and/or physical particles that could be harmful to human health by detecting contamination levels in the sampling area. Heavy metals are present in the soil, in the atmosphere, in water and in living organisms and are defined as: essential when in their absence do not allow the individuals of a certain species to grow and complete the biological cycle; benefits when their presence improves some aspects of the biological cycle; toxic when their biological effect is only unfavorable. The geographical position of Sicily, at the center of Mediterranean Sea,

ensures the obtained data are important informations about the contamination level which can be used to create a mapping of risk and its spread in the Italian seas having regards to fish species of Mediterranean Sea.

MATERIAL AND METHODS

The 246 samples of swordfish, tuna and bivalve molluscs examined have come to the Institute either at the request of private individuals and at the request of the Control Authorities in order to carry out routine checks or inspections of food safety. All the elements were determined by an ICP-MS (7700x series, Agilent Technologies, Santa Monica CA, USA) equipped with octopole reaction system (ORS3). The sample solutions were pumped by a peristaltic pump from tubes arranged on an autosampler ASX-500 Series (Agilent Technologies, Santa Monica (CA), USA) and then conducted on a quartz cyclonic spray chamber. A fast and efficient sample digestion was achieved by a microwave-assisted system Multiwave 3000 (Anton-Paar, Graz, Austria) equipped with a rotor for eight MF100 PTFE-TFM (poly-tetrafluoroethylene-tetrafluoroethylene) vessels.

RESULTS AND DISCUSSION

There are many works in the literature that deal with the processing of non-detectable data from a statistical-mathematical point of view in order to evaluate, in terms of conformity, the observation of greater variability for lead and cadmium concentration values in samples swordfish and tuna fish compared to samples of bivalve molluscs showing less variability (Bencko et al., 1995; Canli & Atli, 2003). For swordfish and tuna fish samples, concentrations of 0.28 mg/Kg were obtained with an average value of 0.09 mg/Kg against a maximum cadmium value of 0.10 mg/Kg with an average value of 0.015 mg/Kg and 0.029 mg/Kg. The maximum recorded mercury value is

0.10 mg/Kg and an average value of 0.003 mg/Kg and 0.061 mg/Kg. In bivalve mollusc samples, a maximum lead value of 0.27 mg/Kg was obtained with an average value of 0.02 mg/Kg and 0.10 mg/Kg. Mercury concentration values were all lower than 0.06 mg/Kg which is the quantification limit of the method used (<LoQ), while for the cadmium on 120 samples only two have a value above the quantification limit; 0.03 and 0.04 mg/Kg.

CONCLUSIONS

In this paper, the level of contamination of heavy metals (if existing) in the fish species sampled in the Mediterranean Sea (FAO 37.2.2 zone) has been investigated as an indicator of water pollution. This study highlighted the presence of lead and cadmium, especially in swordfish samples, but all within the limits of law; while mercury is absent in all the analyzed samples. This first evaluation shows a greater ability of swordfish to accumulate contaminants, as at the apex of the marine trout chain. Big predatory fish such as tuna and swordfish have higher levels of heavy metals than other species due to the bioaccumulation phenomenon and the trend towards long migrations. The maximum values and the mean concentrations recorded for lead and cadmium in the samples analyzed were all lower than the legal limits (see also Bencko et al., 1995; Canli & Atli, 2003).

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