Available online at www.sciencedirect.com

ScienceDirect

Procedia Food Science 5 (2015) 65 – 68

Procedia Food Science

International 58th Meat Industry Conference "Meat Safety and Quality: Where it goes?"

Distribution of Mercury in Three Marine Fish Species

Jasna Djinovic-Stojanovic[a,]*, Dragica Nikolic[a], Danijela Vranic[a], Srdjan Stefanovic[a], Milan Milijasevic[a], Jelena Babic[a], Sasa Jankovic[a]

Institute of Meat Hygiene and Technology, Kacanskog 13, 11000 Belgrade, Serbia

Abstract

The aim of this study was to compare distribution of the total mercury (*THg*) content in three marine fish species: European seabass (*Dicentrarchus labrax*), Gilt-head bream (*Sparus aurata*) and Res scorpionfish (*Scorpaena scrofa*). Samples were collected from the Serbian market during 2014 and analysed by applying inductively-coupled plasma mass spectrometry (ICP-MS). The *THg* content in analysed fish samples was between 0.017 mg/kg and 0.108 mg/kg and significant differences ($p < 0.05$) in *THg* content was established only between Gilt-head bream and Res scorpionfish. The estimated weekly intakes of *THg* through fish consumption were several times lower than the established value.

Peer-review under responsibility of scientific committee of The 58th International Meat Industry Conference (MeatCon2015)

Keywords: Total mercury; European seabass; Gilt-head bream; Res scorpionfish

1. Introduction

Fish meat is a significant source of food, especially in countries that have access to the sea. It is food with high nutritional value and a wide variety of vitamins and minerals, including vitamins A and D, iodine, selenium and magnesium. According to the Food and Agriculture Organisation (FAO)[1] of the United Nations, fish is the most important single source of high quality protein, providing ~16% of the animal protein consumed by the world's population. The content of saturated fatty acids in fish meat is lower than in red meat, while oily fish is high in

* Corresponding author. Tel.: +381-11-2650-655; fax: +381-11-2651-825.
E-mail address: jasna@inmesbgd.com

Peer-review under responsibility of scientific committee of The 58th International Meat Industry Conference (MeatCon2015)
doi:10.1016/j.profoo.2015.09.016

essential fatty acids[2]. Favorable influence of omega-3 fatty acids from fish meat on human health has been confirmed in numerous studies[3,4]. Omega-3 fatty acids are critical for neurological development and health. Researchers suggest that consumption of fish lowers the risk of coronary disease, especially myocardial infarction, artherosclerosis, hypertension and other cardiovascular diseases[5,6]. Considering these health properties of fish consumption, various national and international bodies recommend how much fish we should eat to benefit health. Recommended values[7] for fish consumption ranges from 97 to 550 g capita^{-1} week $^{-1}$.

In contrast to the health benefits of dietary fish intake, there are many studies reporting significant levels of environmental pollutants in fish[8,9]. Toxic substances such as trace elements and persistent organic pollutants are contaminants present in the environment at low levels. These contaminants can be taken up by aquatic organisms and through processes of bioconcentration and bioaccumulation, achieve higher levels in fish. Scientific data indicate that fish are, potentially, major sources of human exposure to environmental pollutants[10].

Mercury is one of the most toxic heavy metals in the environment. The primary environmental source of human Hg exposure is through consumption of freshwater fish and seafood which have accumulated a considerable amount of Hg via biomagnification through the food chain[11]. This study seeks to estimate the content of total mercury (*THg*) in the edible portion of three species of marine fish collected from the Serbian market. Additionally, data from this study were used in order to assess intake of *THg* by analysed fish.

2. Materials and methods

Content of total mercury (*THg*) were measured in European seabass (*Dicentrarchus labrax*, n = 14), Gilt-head bream (*Sparus aurata*, n = 15) and Res scorpionfish (*Scorpaena scrofa*, n = 23). A total of 52 fish samples were collected in Serbian markets during 2014. Labelled samples were stored in polyethylene bags and frozen at -18°C prior to analysis. Day before analysis, fish samples were partially thawed at +4°C and edible parts were homogenized. Approximately 0.3 g of samples were mineralized by adding 5 ml nitric acid (p.a. SIGMA) and 1.5 ml hydrogen peroxide (30%, p.a., MERCK). Microwave assisted digestion was performed using the Microwave Digestion System (Via Fatebenefratelli, 1/5-24010 Sorisole (BG), Italy). The digested sample solutions were quantitatively transferred into disposable flasks and diluted to 100 ml with deionized water (ELGA).

THg analysis was performed by inductively-coupled plasma mass spectrometry (ICP-MS). Measurements were performed using the instrument "iCap Q" (Thermo Scientific, Bremen, Germany) which was equipped with collision cell and operating in kinetic energy discrimination (KED) mode. The ^{202}Hg isotope was measured. Torch position, ion optics and detector settings were adjusted daily using tuning solution (Thermo Scientific Tune B) in order to optimize measurements and minimize possible interferences. For qualitative analysis of the samples, a five-point calibration curve (including zero) was constructed for the ^{202}Hg isotope in the concentration range of 0.2 – 2.0 mg/l. An additional line of the peristaltic pump was used for on-line introduction of multi-element internal standard (^{45}Sc – 10 ng/ml; ^{71}Ga – 2 ng/ml). Concentrations of each measured sample were corrected for response factors of both higher and lower mass internal standard using interpolation. The quality of the analytical process was controlled by the analysis of the standard reference material (NIST SRM 1577c, Gaithersburg, USA). Measured concentrations were within the range of the certified values for all isotopes. The limit of quantification was 0.001 mg/kg.

For data analysis a one-way analysis of variance (ANOVA) and Tukey's post hoc test, which was performed using Minitab 16, was used for the comparison of the mean content of Hg in different fish species.

3. Results and discussion

Contents of *THg* (mg/kg) in three analysed fish species, expressed as mean value and standard deviation (SD), are shown in Figure 1. Statistical analysis of the data showed significant differences ($p < 0.05$) only between the total mercury content in gilt-head bream and res scorpionfish. *THg* limits defined by Serbian legislation[12] for European seabass and gilt-head bream (500 ng/g fresh weight) as well as for res scorpionfish (1000 ng/g fresh weight) were not exceeded in any of the analyzed samples. Content of total mercury in fish muscle was in the range of 0.017-0.108 mg/kg. According to the scientific data[13] the percentage of mercury from methyl mercury in total mercury is approximately 90%. Obtained results for *THg* content are in accordance with previous studies[8,10,14] where the presence of inorganic contaminants (As, Cd, Cr, Hg and Pb) was evaluated in different fish and seafood species.