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Non-dioxin like polychlorinated biphenyls in mackerel (*Scomber scombrus*) available on the Serbian market

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Abstract

Mackerel is rich in omega-3 fatty acids, but this fish may be contaminated with environmental pollutants. The aim of this study was to evaluate concentrations of non-dioxin like polychlorinated biphenyls (ndl-PCBs) in 160 samples of mackerel available on the Serbian market. Average and maximum ndl-PCB concentrations were 7.9 ng/g and 74 ng/g, respectively. A higher average level of ndl-PCBs was found in mackerel from Spain, but this was still three times lower than the permitted level. We conclude that levels of ndl-PCBs in mackerel available on the Serbian market are acceptable.

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Keywords: polychlorinated biphenyls; mackerel; gas chromatography

1. Introduction

Fish has an important role in the human diet because it is rich in proteins, minerals, vitamins and unsaturated essential fatty acids, especially polyunsaturated fatty acids (PUFAs). Due to health benefits, fish consumption has

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increased in Serbia in recent years[1]. Besides trout and carp, a significant proportion of the Serbian diet consists of marine fish - hake, sprat and mackerel. Mackerel is an important fish that is consumed worldwide. As an oily fish, it is a rich source of omega-3 fatty acids[2]. On the other hand, fish and fishery products may be contaminated with environmental pollutants such as polychlorinated biphenyls[3].

Polychlorinated biphenyls are a mixture of organohalogen compounds. They have been used in industry since the thirties of the 20th century. Since then, their production increasined until the seventies, when research after accidents (Japan, USA, Slovenia) pointed to their toxicity[4,5]. Of the total intake of PCBs in the humans, almost 90% come from consumed food[6,7]. Polychlorinated biphenyls are particularly accumulated in fish and marine mammals, reaching levels which may be several thousand times larger than those in the water. Toxic effects that result from the exposure to PCBs include effects on the liver, thyroid, skin, eyes, immune system, nervous system, and prolonged exposure to these compounds can induce reproductive toxicity and carcinogenicity.

All PCBs can be classified on the basis of toxicity depending on chemical structure similarity to the PCB dioxin - dl-PCBs (dioxin like PCBs), and PCBs which are not similar to dioxin. In the environment and consequently in food, ndl-PCBs are far more common. Most often, their detection is based on so-called indicator congeners which include ndl-PCBs 28, 52, 101, 153, 138 and 180. Very often in the scientific papers, PCB congener 118, which belongs to the dl-PCBs, is also added to this group.

The aim of this study was to evaluate concentrations of ndl-PCBs in mackerel imported to the Serbian market from different countries.

2. Materials and methods

Concentrations of ndl-PCBs were measured in mackerel available on Serbian market.

In total, 160 mackerel samples from seven countries were analysed. These data were collected during the period 2011–2014. The origin of analysed fish was Spain, Ireland, Island, the Netherlands, Great Britain, Norway and Canada. Measurements were completed at the Institute of Meat Hygiene and Technology, using analytical methodology in compliance with the standard ISO 17025.

Edible parts of fish were chopped into 2–3 cm thick portions and homogenized. ndl-PCBs were extracted with petrol ether and separated in columns filled with partially deactivated alumina. The eluate was evaporated to an appropriate volume. An aliquot of 1 µl was injected into a gas chromatograph coupled with electron capture detector. GC Varian Model 3800 equipped with a ^{63}Ni electron capture detector and Zebron ZB 1 column (30 m x 0.25 mm i.d. and 0.25 µm film thickness) were used for analysis of ndl-PCBs (congeners 28, 52, 101, 118, 138, 153, and 180). Operating conditions were the following: injector 250°C; detector 300°C; column oven program: initial 50°C raised to 230°C. Data acquisition was performed by Varian Star software.

Limit of detection was 1 ng/g. Analytical quality control was achieved by using certified reference material ERM-BB446.

3. Results and discussion

Ndl-PCBs were detected in 64% of samples (n = 160). Detectable ndl-PCB was found in a high percentage (87%) of mackerel from Spain. In mackerel from Iceland and Norway, less than half of analysed mackerel had concentrations of ndl-PCBs above the limit of detection (1 ng/g).