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CONTENT OF HEAVY METALS IN CANNED SEA FISH

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ABSTRACT

The aim of presented paper was to point on quality and healthiness of canned seafood considering the quantity of monitored hazardous elements, which are commonly available in Slovak trade network. We specified 19 types of sample for use in this paper that represent different locations of fish outs as well as different species baseline. We realized analyses to determine quantity of Cd, Pb, Hg and Cu in our samples. We compared obtained results of heavy metals quantity with adequate highest permitted levels defined by legislation effective in EU and SR. Obtained results show that the excess of maximum amounts we recorded for Cd and Pb, while on samples for which we did not exceed the values defined by legislation, we found similarity of content of heavy metals. In general we can come to conclusion, despite breaching the HPL, that monitored products do not represent any health risk due to consummation of this food.

Keywords: sea fish, heavy metals, food, contamination

INTRODUCTION

Heavy metals are ubiquitous part of the environment as a result of mutual natural and anthropogenic activities causing increased exposure of human populations to their effects through various channels **(Wilson - Pyatt, 2007, Poty et al., 2012)**. Increasing concentrations of certain trace elements, especially their mobile forms can cause serious environmental concern about contamination and accumulation in soil, vegetation, animals, surface and ground waters, respectively **(Chopin - Alloway, 2007)**.
The primary source of environmental contamination is mainly metals, whose main part is particularly lead, zinc or copper, in addition, antimony, arsenic, mercury, cadmium, thallium, gallium, and others. The production of metals is a very important source of environmental contamination by metals as well as burning of fossil fuels, especially coal. Fly ash from the incineration of atmospheric leakage through contaminated soil. Increasingly important source of environmental pollution with heavy metals is becoming a burning municipal waste streams and pollution effluents containing elevated levels of toxic metals **(Bencko et al., 1995)**.
Atmospheric deposition is related to the clearing of the atmosphere by dry or wet. It is one of the most important sources of soil contamination. The territory of Slovakia has the disadvantage that the air masses bring emissions from Western Europe and mostly through wet deposition increase the level of soil contamination. Atmospheric deposition of contaminants (heavy metals) derived from the atmosphere accumulates and is concentrated mainly in the upper soil layer **(Steinnes et al., 2005; Hovmand et al., 2008)**. It is very difficult to discern the amount of heavy metals taken by root system and leaf area, especially for lead **(Hovmand et al., 2008)**.
The surface water and groundwater is natural resource of almost all metals. Many of them are indispensable in trace amounts, but in higher concentrations can pose a risk. The occurrence of some of them (Cd, Pb, Hg and Cr) is currently the greatest risk, and their impact on all ecosystems is a huge risk. The greatest contributor to contamination of the environment is heavy industry, metallurgy as well as agriculture. Just last mentioned sector significantly affects aquatic ecosystems as much as possible **(Dercová et al., 2005)**.
Heavy metal contamination of fish has two major aspects. First, it is hygienic and sanitary aspect, linked to consumption of fish as food and second is bioindication that arising out of position and the inclusion of fish to environmental and energetical trophic chain in the aquatic ecosystem. Heavy metals in the bodies of fish accumulate in various organs in varying degrees, with the highest concentrations accumulated in the kidneys, liver, gills. The greatest risk in view of fish as food poses the muscle **(Stráňai, Andrei, 2004)**.

MATERIAL AND METHODS

Analysis of the heavy metal content, we subjected 19 samples of canned seafood from various retail chains in the Slovak Republic. We analyzed the following species: sprat (*Sprattus sprattus*), sardine (*Sardina pilchardus*), tuna (*Katsuwonus pelamis*), herring (*Clupea harengus*) and mackerel (*Scomberomorus Cavalla*). Samples analysis was performed to ascertain the presence of following heavy metals: cadmium, lead, zinc, copper, cobalt, chromium, nickel and mercury.
We collected at the homogenization analysis 3-5 g of sample parts which were then used for analytical purposes. The determination of the content of heavy metals was carried out by the method time and was expressed in $mg.kg^{-1}$. Before the determination of the observed risk was performed mineralized metal pretreatment of samples, which was carried out in wet environments of concentrated nitric acid using microwave digestion. Mercury content, expressed as the total - Hg, we investigated by the single-purpose analyzer AMA 254 (Altec, Czech Republic), without pretreatment of the sample, immediately after weighing the amount of sample. Description of samples analyzed, and their essential characteristics are shown in Table. 1.

RESULTS AND DISCUSSION

In the present work we aimed to determine the level of contamination, respectively. Content of monitored hazardous metals in canned marine fish that are commercially available in Slovakia, which represent different parts of the world's oceans and seas, and thus represent different environmental laden sites globally. Measured levels of heavy metals were compared with the limit values - the maximum level (HPL), according to Codex Allimentarius SR, respectively. Commission Regulation EC no. 1881/2006 sets maximum levels for certain contaminants in foodstuffs. This legislation defines the maximum value for Cd in the muscle of fish and products thereof (0.10 $mg.kg^{-1}$) , lead to 0.3 $mg.kg^{-1}$ and mercury 0.50 $mg.kg^{-1}$, respectively. For other risk elements, this piece of legislation does not specify a limit value. Other elements are due to undetermined HPL compared with each other and then determine species in which individual elements accumulate the most. All limit values were aplied to fresh muscle of each animal species.

Table 1 The basic characteristic of canned fish samples

Sample No.	Commercial name	Netto weight	Fishery place	Species
1	Baltické sardinky	112g	Estonia	Sprattus sp.
2	Isabel	90g	Marocco	Sardina sp.
3	Eva sardinky	81g	Croatia	Sardina sp.
4	Hamé Ocean	85g	Peru	Sardina sp.
5	Baltické ryby	168g	Estonia	Sprattus sp.
6	Giana, údené šproty	112g	Estonia	Sprattus sp.
7	King Oscar,	77g	Baltic sea	Sprattus sp.
8	Údené šproty Hamé	112g	Latvia	Sprattus sp.
9	Tuniak drtený	130g	Thailand	Katsuwonus sp.
10	Rio mare	52g	Non-marked	Katsuwonus sp.
11	Tuniak Isabel	52g	Spain	Katsuwonus sp.
12	Tuniak Sun & Sea	52g	Spain	Katsuwonus sp.
13	Tuniak Giana (drvený)	130g	Ecuador	Katsuwonus sp.
14	Tuniak Giana (kúsky)	130g	Philipine	Katsuwonus sp.
15	SeaSide tuniak	130g	Thailand	Katsuwonus sp.
16	Deepblue tuniak	130g	Philipine	Katsuwonus sp.
17	Sokra herring	112g	Estonia	Clupea sp.
18	Sleď filety Giana	119g	Poland	Clupea sp.
19	Sokra	112g	Estonia	Scomberomorus

Among the heavy metals, which globally represent the greatest risk when consumed, is mercury. Our content found this element ranged 0.02202 ± 0.05197 mg.kg^{-1} (median± st.dev.). At the level of mean we did not overrun HPL, as confirmed by us found the highest measured concentration of Hg 0.23388 mg.kg^{-1}. Tuna fish in a sample 11, to which the HPL 1.0 mg.kg^{-1} fresh weight. The values of Hg content in all samples is a graph in Figure 1. Our obtained data show claim that tuna as predator is characterized by elevated concentrations of mercury compared to other surveyed species, which represent the nutrient base for predatory species **(Bajčan et al., 2013)**.

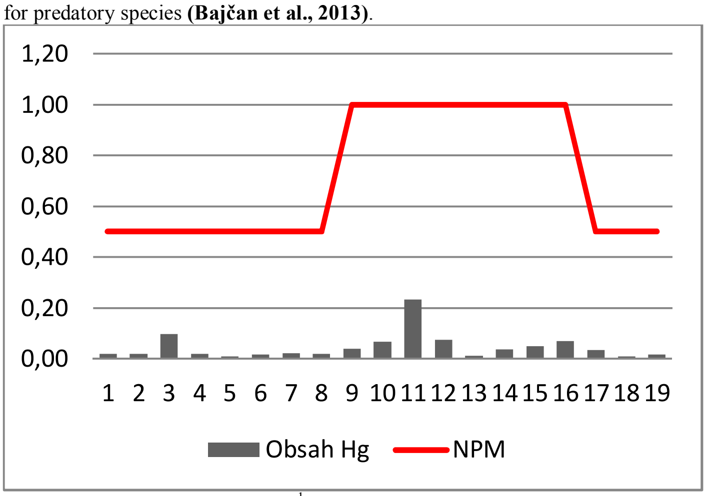

Figure 1 Mercury content (mg.kg^{-1}) in each samples compared with limit value

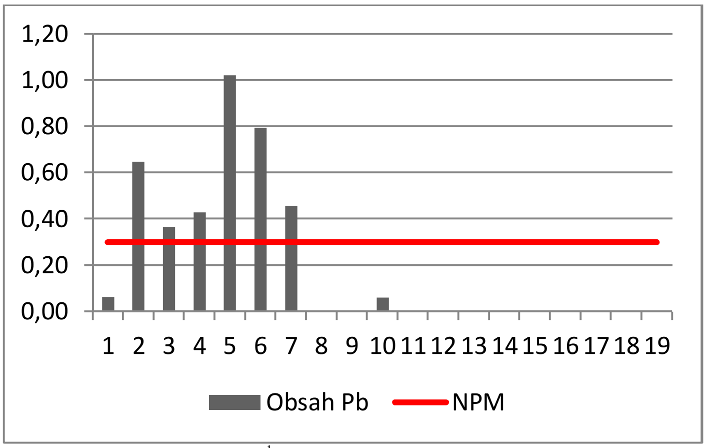

Figure 2 Lead content (mg.kg^{-1}) in each samples compared with limit value

The lead content in the analyzed samples was around 0.44 ± 0.34 mg.kg^{-1} mean, the relatively large standard deviation shows large differences in the levels of lead in samples of fish. In most samples the lead content was below the detection limit of the instrument, but for samples in which we were able to measure the content of the element, we observed excess HPL 0.3 mg.kg^{-1} (samples 2-7). In the case of the highest concentration of Pb detected by us (sample no. 5 to 1.02 mg.kg^{-1}) has been exceeded HPL by more than 200%.

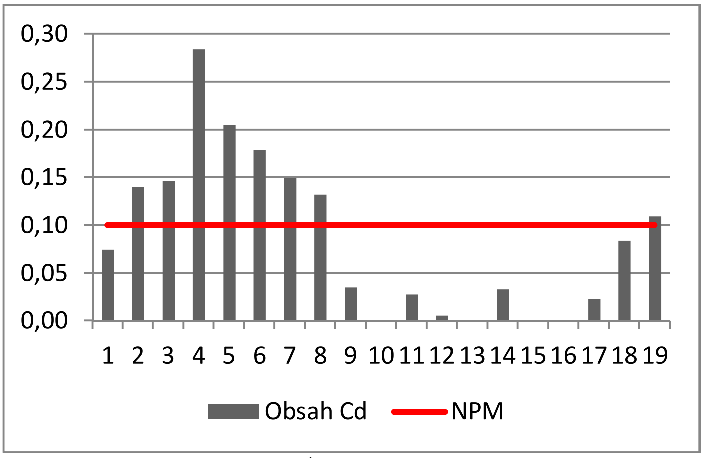

Figure 3 Cadmium content (mg.kg^{-1}) in each samples compared with limit value

In the case of cadmium the situation is similar to that for lead. The highest measured concentration was observed in the same samples as for lead, the sample was no exception. Our found Cd concentrations varied at the mean value in the range of 0.11 ± 0.08 mg.kg^{-1}, with exceeded the maximum level in samples 2-8 and 19 In the case of sample no. 4. We had overrun the legislation specified limit by 180%. Graphical representation of the content of Cd in all samples preserved fish is shown in Figure 3.

CONCLUSION

The results observed contents of heavy metals show a variety of levels of contamination us of selected samples of preserved marine fish that are commonly available commercially in Slovak Republic. Analyzed 19 samples represent different locations catch respectively. Our results provide relatively global view of the level of contamination of the ecosystem and food chain, which is an integral part. Species diversity us to provide insight into the level of contamination of the trophic chain at its various levels. We can observe in our environment most dangerous heavy metals include cadmium, lead and mercury in particular. In the case of cadmium and lead was recorded exceeding the maximum level, defined by Commission Regulation EC no. 1881/2006 in six, respectively eight cases, which are the Pb at the highest concentration had an excess of more than 200 % and for Cd by almost 180 % . In the case of mercury have been recorded crossing of HPL.

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