

RESEARCH ON THE FISH CONTAMINANTS AND CHEMICAL COMPOSITION VARIATION

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Abstract

Food quality and safety are the major problems of the food industry. Currently the focus is on investigating the presence of contaminants that can be transferred from the environment, particularly heavy metals in fish and other marine products, with serious implications for public health. Nowadays, a significant contribution to the diet is brought by the fish products coming from the sweet or salty water.

The aim of this study was to follow the heavy metal contamination of four species of fish, two predators (zander and tuna) and two freshwater fish (crucian and trout). The research goal was to detect the possible presence of lead and cadmium, near other metallic elements. For experimental analyses it was used a mass spectrometer with inductively coupled plasma, ICP-MS AGILENT SERIA 7500ce, witch could measure trace elements up to parts per trillion (ppt) or quickly scan for more than 70 elements to determine the composition of unknown samples. The experimental results showed that of the four species evaluated, zander contains the highest amount of Pb and crucian contains an insignificant amount of Pb. Zander not contain Zn while tuna has a significant amount (7.85 mg / kg) which is recommended for consumers with zinc deficiency. Sample crucian was the only uncontaminated with Cd.

Keywords: trout, crucian, zander, tuna, heavy metals

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1. INTRODUCTION

According to the specifications proposed by the International Committee of the Food Microbiological Safety, the fresh fish is generally seen as a safe food stuff so the analysis for the total number of viable bacteria, coliforms and staphylococci are recommended only in microbiological specifications as a consequence of the fact that the incidence of fish and fish by products poisoning is generally low in ratio with the quantities consumed (Byrne et al., 2001, Banu C., 2006, Bondoc et al., 2002).

Otherwise the presence of at least 3% salt and the storage at a temperature of 10°C offers security preventing the botulism even though the fish is consumed without a proper chemical treatment for the alteration is perceivable long before the toxins formation (Boișteanu P., 2002, Dan V., 2000, Cason J., 2000).

Under the action of some proteolytic bacteria the fish meat can develop histamine the common cause for food poisoning that does not

occur along with an olphactive modification (Ciotău C., 2010, Davenport et al., 2003).

The production of histamine depends on the temperature. The monitoring of the histamine level in the fish meat can be a guide for its safe consumption (Demska et al., 2005, Fingerman at al., 2000).

According to the CE Committee rule no. 1881/2006 from 19.12.2006 regarding the establishing of the maximum level for certain contaminants in the foods- in this case the lead, CSA adopted at 19.06.1992 (2) a paper by which it approves the weekly provisory tolerable dose (DSTP) of 25 µg/kg body mass proposed by OMS in 1998. CSA concluded in the paper that the average level in the food stuff doesn't represent a reason of concern (Beaumont et al., 2003)

2. MATERIALS AND METHODS

In this study we observed the heavy metals contamination of several fish species available on the market (perch, tuna, crucian and cod).

The device used: ICP-MS AGILENT 7500ce series is an inductive coupled mass spectrometer. It can measure traces of elements up to trillion parts (ppt) or it can scan rapidly more than 70 elements to determine the composition of an unknown sample. The standard solutions for the elements: Pb, Cu, Cd, Zn, Sn, Fe, Mn, Co, Ni are prepared from concentrated solutions(1000mg/L).

The standard solutions for the elements: Pb and Cd are prepared from concentrated solutions (1000 mg/L) in the following way: from each standard solution we measure up a volume of 10ml with a AS class dropper, and each is brought with nitric acid of $c=0,1\text{ mol/L}$ at 100 mL in flasks being well mixed.

These are base solutions that contain $100\mu\text{g/ml}$ (100ppm). The standard solution used on GFASS (ppm): from the base solution (100mg/l) Pb it is prepared a solution with a concentration of $1\mu\text{g/ml}$, the measurements having to be led accurately.

The base solution of $1\mu\text{g/ml}$ is prepared with $0,1\text{ mol/l}$ nitric acid in a flask of 50 ml and it can be used maximum three weeks. From the base solution of $1\mu\text{g/ml}$ we accurately prepare the solution for use of $50\mu\text{g/l}$ with HNO_3 $0,1\text{ mol/l}$ in a 50 ml flask.

The solution for use is freshly prepared for each set of determinations.

3. RESULTS AND DISCUSSIONS

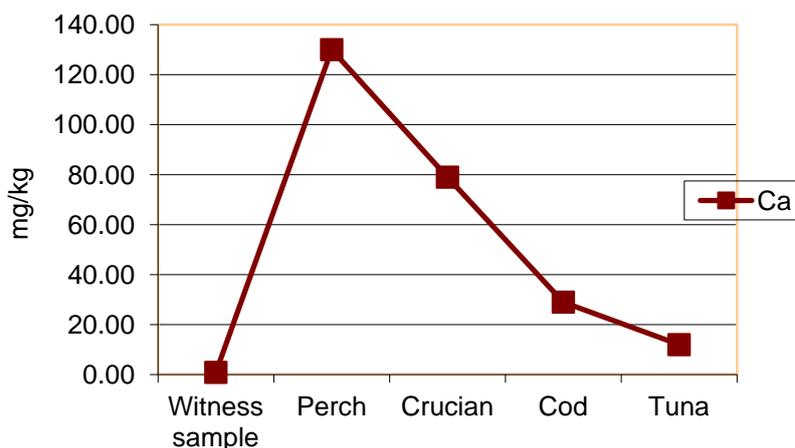


Fig. 1. Content of Ca

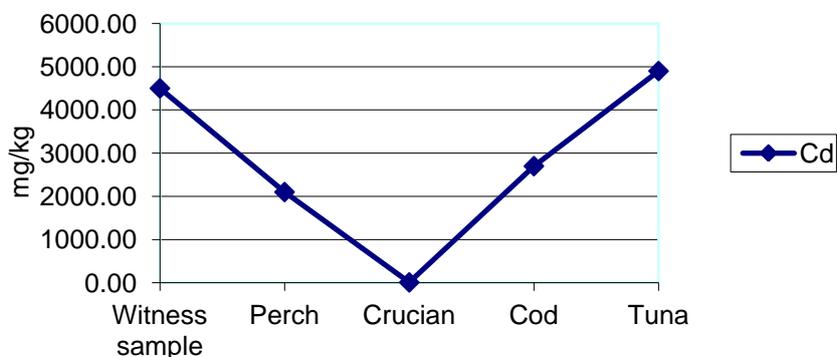


Fig. 2. Quantities of fish with Cd

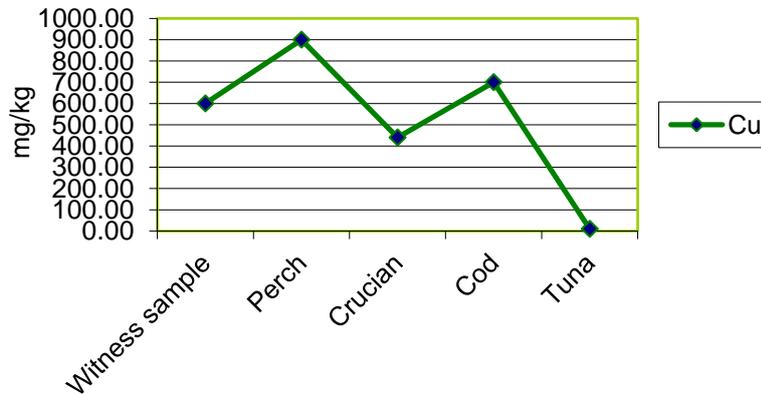


Fig. 3. Content of Cu in fish

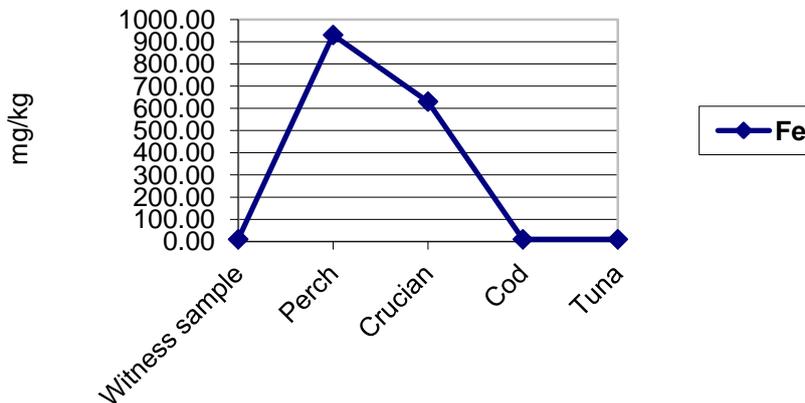


Fig. 4. Content of Fe in fish

From the figure 1 it is seen that the perch has a higher Ca content than the crucian, tuna and cod. It is recommended in the diet and it is necessary for the body for the Ca is an absolutely essential element especially in the first years of life when the bone tissues formation takes place.

In the figure 2 the crucian is the only species of fish that was not contaminated by this very toxic heavy metal but using insignificant quantities of fish with Cd for a long time can lead to some or other forms of Cd poisoning.

In the figure 3 the tuna is the only species of fish that was not contaminated with Cu. The

Cu salts help to maintain the integrity of the vascular walls and its lack can lead to osteopathy. At children the lack of Cu can lead at bad formation of the red cells that lead to the apparition of anemia.

In the figure 4 we can see that the perch has a high Fe content in comparison with the tuna and cod in which there is none. The main role of the Fe in the human body is the linking and transport of the atmospheric oxygen.

The presence of the Fe increases the disease resistance ensures the skin colour and fights against the fatigueness sensation.

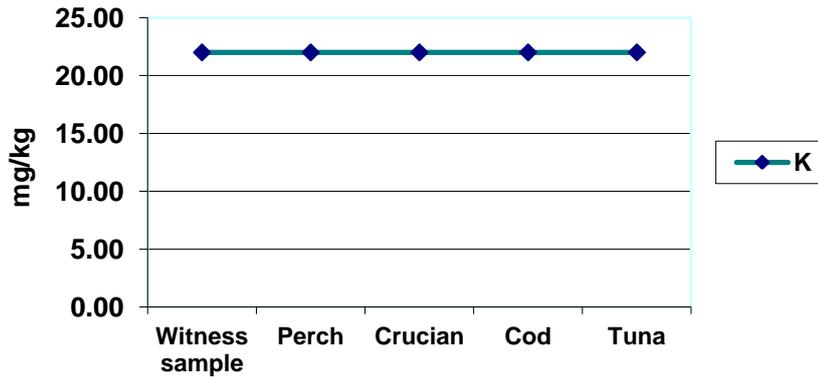


Fig. 5. Content of K

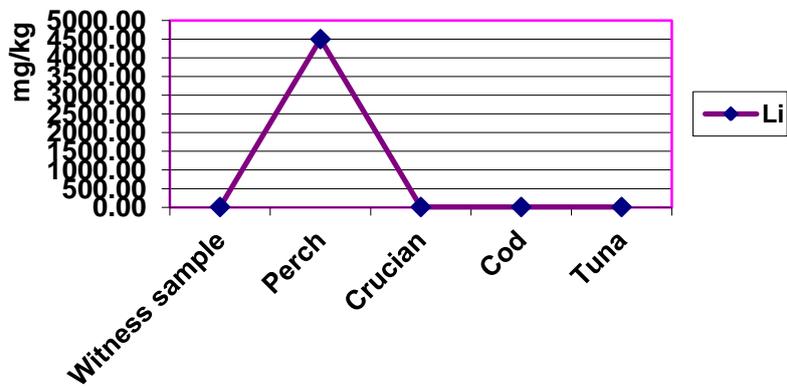


Fig. 6. Content of Li in fish

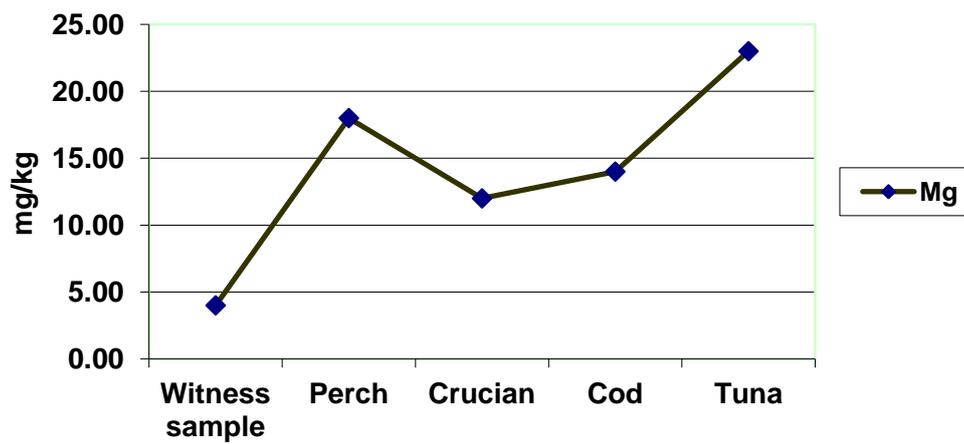


Fig.7. Content of Mg in all the fish species

In the figure 5 we can see that all the fish species have the same K concentration. The K is recommended in cases of muscular fatigue, in oliguria, chronic rheumatism, evolutive chronic polyarthritis, different lung diseases, premature aging, acute enteritis, burns, arterial hypertension, diabetes etc.

In the figure 6 we can see that the perch has a high Li content while the crucian, cod and tuna lack it. The Li plays an essential role in the functioning of the nervous system. In the human body there is no Li for it was seen that it does not play any biological necessity for low Li quantities are to be found in the ocean waters and some living organisms.

In the figure 7 we can see that tuna has a high content of Mg as well as the other fish species. The Mg plays an important role in the Ca

fixation in the bones as well as it intervenes in the regulation of the cardiac rhythm, favors the lowering of the cholesterol level and regulates the intestinal transit.

In the Fig.8 we observe that perch has a high Mn content. The Mn can also be found in the human body. The lack of Mn is manifested by anemia, sterility and abortions, underdevelopment, low bone resistance and skeletal malformation, malfunctioning of the reproductive function, paralysis, the modifying of the lipid and glucidic metabolism, noises in ears and even deafness. From there we observe a high concentration for the perch in comparison with the other species. The Na contributes to the good functioning of the nervous and muscular system and it is essential for the normal process of growth.

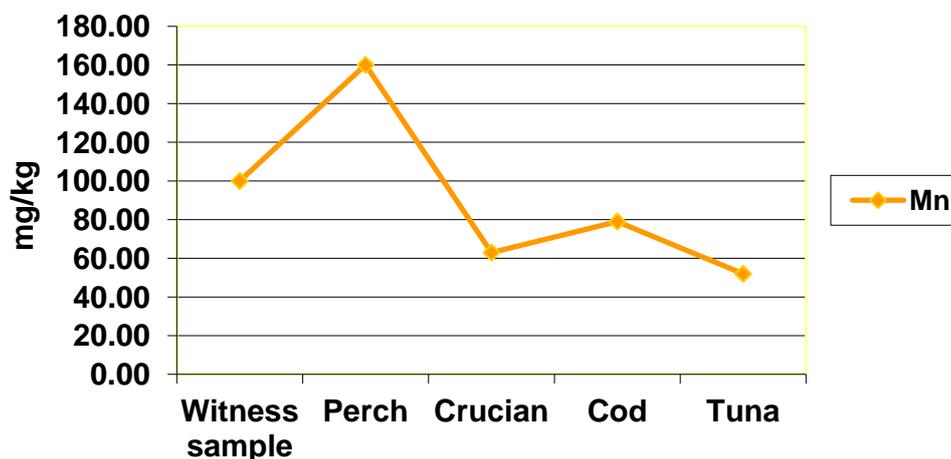


Fig.8. Content of Mn

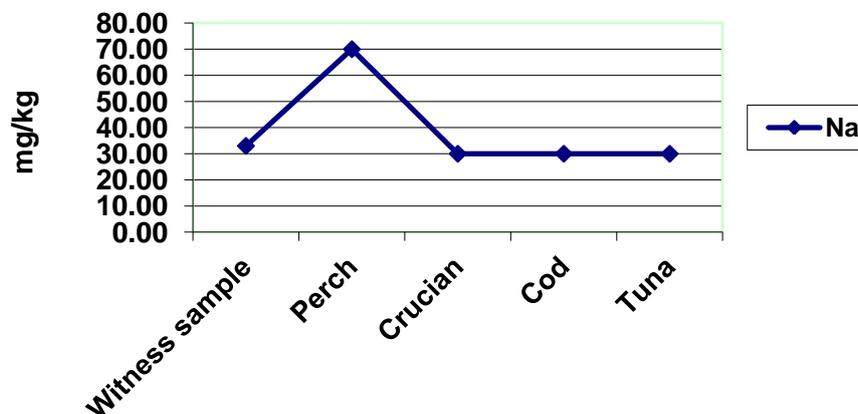


Fig.9. Concentration of Na in fish

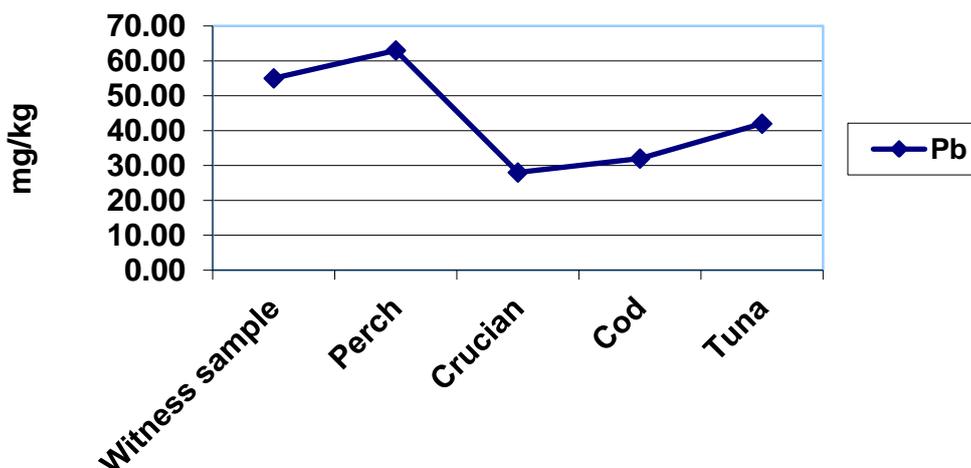


Fig.10. Content of Pb

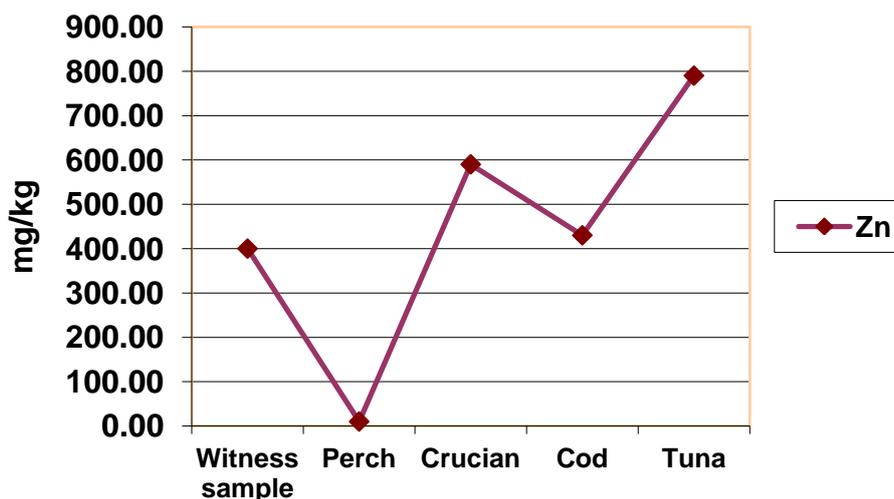


Fig.11. Content of Zn

In the figure 10 we observe a low content at the crucian for the Pb while for the perch the Pb content is high. The Pb in the human body can produce endarteritis by affecting the inner walls of the blood vessels and vascular contraction. The circulatory disfunctions can also explain the abdominal circulatory crisis that have as effect severe cramps. The Pb ions are fixed at the same time with the Ca ions in the bones and can produce plastic and functional diseases of the hematofom bone marrow.

From the figure 11 we can observe that the perch doesn't have any Zn in its composition

while the tuna has a lot fact that makes it to be a part of the diet of those with Zn deficiencies. Zn is an essential element that offers many therapeutically benefits. The human body can contain up to 2 or 3 g of Zn in the bones, teeth, skin, liver and muscles. Zn stimulates the brain activity and helps to the brain good functioning.

4. CONCLUSIONS

The quality and safety of the food stuff represents major problems for the food industry, the food stuff being very important in any kind of society with significant economic

and social consequences upon the environment. Nowadays, a significant contribution to the diet is brought by the fish products coming from the sweet or salty water. At the same time it must be investigated the problem of the contaminants presence that can be transferred from the environment especially the heavy metals into the fish and other sea foods for they have a serious effect upon the public health.

Several studies led to the consumers awareness regarding the quality and safety of the food stuff. Due to some food safety problems the use of the growth hormones of pesticides residues has risen the human interest for the diet and foods. The situation in reality is more complicated for most of the consumers have no knowledge about the food safety.

The study revealed that from the microbiological point of view the steps that contribute to the fish contamination need a special attention for reducing the contamination degree.

After the study led we observed that the perch has a high content of Ca, Fe, Na, Mg and li fact that makes it proper for the daily human diet. The good fact is also that this fish contains no Zn and Pb in very small quantities due to the environment contamination. The crucian has no heavy metals concentrations in its structure that makes it proper for the daily human diet and it contains nutrients necessary for the human body development.

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