TOXICITY OF CANNED TUNA

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ABSTRACT: The paper presents aspects regarding the conservation of tuna as food, their qualitative and quantitative analysis, nutrient of tuna, information presented on the preservative label to ensure food safety and the composition of different types of canned tuna, preparation with vegetable oil or brine. Due to natural and anthropogenic sources, canned tuna can be contaminated with: heavy metals (mercury, lead, cadmium), histamine, monosodium glutamate, radioactive cesium and bisphenol A.

KEY WORDS: tuna, conservation, toxicity, contaminated

1. INTRODUCTION

Fish is a food that is an important source of healthy proteins and fats, whose consumption reduces inflammation in the body and reduces the risk of chronic diseases. To ensure an optimal nutritional content, it is necessary to incorporate it in the weekly diet (the mediterranean diet is one of the healthiest, fish being the basis of this diet).

Given that out of 150,000 deaths that occur annually in Romania, 60% are caused by cardiovascular disease, it has been shown that the risk of death caused by the incidence of coronary heart disease decreases by 17%, following the consumption of small amounts of fish. In this regard, is recommended consumption of herring, mussels, oysters, wild trout, sardines, Alaskan wild salmon, small fish, as the amount of methylmercury accumulated is much lower than that found in large prey fish (swordfish, king mackerel, tuna, tuna Bigeye, Albacore tuna, yellow-winged tuna).

The small fish contains significant amounts of Omega 3 fatty acids, which have the role of reducing the risk of cancer, autoimmune diseases, allergic diseases and mental disorders.

Tuna is a pelagic and predatory fish that colonizes most of the planet's seas and oceans. The name tuna comes from *Thunnus*, the genus to which the different species of fish belong, the most appreciated tuna being bluefin tuna (*Thunnus thynnus*).

Canned tuna is a product that comes from cutting, cooking, sterilizing and packing fish muscle or muscle fragments. There are 2 types of product (Figure 1):

- tuna in oil (tuna is preserved in seed and olive oil, which penetrates the tuna fillet; it is tasty, has more calories (190 calories / 100 g product)
- natural tuna (in its own juice or brine; natural tuna is preserved in boiling water; contains few calories (100 calories / 100 g product), but contains a lot of sodium; is not a source of Omega 3 and protein and does not taste good

Figure 1. Canned tuna in oil and brine

The tuna is packed in glass containers or in boxes of different sizes. Large boxes are best, because a small box cannot contain a real muscle block, but only fragments of muscle that remain from the packaging in large containers.

The method by which the tuna is caught influences the quality of the meat: an intense muscular activity during the capture produces the accumulation of lactic acid in the muscles and the reduction of the pH. Lactic acid attacks muscle proteins by changing their consistency and reducing their commercial value.

2. QUALITATIVE AND QUANTITATIVE ANALYSIS OF CANNED TUNA

In the *qualitative and quantitative analysis of a canned tuna*, it is evaluated:

- canned tuna content
- amount of protein, fat and salt / 100 g product
- the can only contain salt, oil and water
- the place where the fish was caught (given that the tuna caught in the Pacific Ocean is irradiated with Cs137, following the 2011 Fukushima nuclear accident)
- packaging (must not be bulging, hitting, rusty or stained)
- the anatomical part of the tuna from which the canned meat was produced (canned tuna is prepared from different parts of the fish; the fillet is weak and the belly is fat; the non-qualitative parts are those near the head and neck)
- expiration date
- storage conditions

Nutritional characteristics of tuna, called *dead food* = low nutritional intake, are:

- noble proteins = 100-190 kcal / 100 g product
- does not contain carbohydrates
- average cholesterol = 63 mg / 100 g
- Omega 3 fatty acids
- P, K, Na, Fe and I salts = sufficient quantities
- vitamin A and niacin
- vitamin B12 (destroyed in the sterilization process)

Based on the *information presented on the label of several types of canned tuna*, an informative study was carried out, following which the following were found (Figure 2 and Table 1):

- canned tuna analyzed come from several countries: 30% Thailand, 21% Philippines, 15% Spain, 6% Ecuador, 6% Cote D Ivory, 3% Bulgaria, 3% Vietnam, 3% Ghana, 3% Seychelles, 3% Mauritius, 3% Greece and 3% Italy
- 40% of canned tuna analyzed do not contain all the information necessary to comply with food safety
- 40% of the canned tuna analyzed did not mention the fishing area on the label
- 64% of the analyzed cans contain vegetable oil, of which: 15% do not specify the type of vegetable oil; 3% use rapeseed oil; 18% use sunflower oil; 15% use soybean oil
- tuna species used in canning: 55% use *Katsuwonus pelamis*; 27% do not declare the species of tuna; 15% use *Albacora* tuna; 3% use *Tonggol* tone

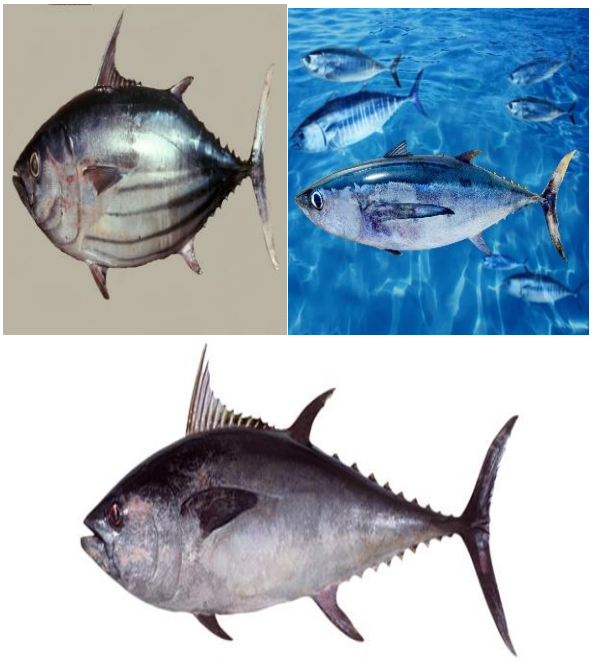

Figure 2. Tuna species used in canning: *Katsuwonus pelamis*, *Albacora* and *Tonggol*

Table 1. Composition of canned tuna analyzed

The amount of tuna (% from the net amount of the can)	Energy value (kcal / 100 g product)		The amount of protein g/100 g product *	The amount of lipids g/100g product	The amount of salt g/100 g product
	for canned tuna in its own juice	for canned tuna in vegetable oil or vegetable oil and brine			
60-70,5	70-118	132 - 496	13-27	0,2-35	0,17-1,8

* high values of protein in some types of canned tuna are also given by the proteins of vegetable origin in vegetable oils used in some recipes

3. CONTAMINATION OF CANNED TUNA

Canned tuna contains the following *contaminants*:

a. Mercury Hg

- abundant in large fish due to environmental pollution; has natural origins (due to erosion and volcanic activity) and anthropogenic (industry, pesticides, medicines)
- in water, the inorganic form of this element is transformed by marine microflora, plankton and crustaceans, in the organic form thiomethylmercury, which accumulates in the muscle tissue of fish and transforms into methylmercury-cysteine, a compound present in all aquatic organisms, especially in those at the top of the food chain (tuna, swordfish, shark) (Figure 3)
- canned tuna contains methylmercury CH_3-Hg, Hg being a heavy, toxic metal, which accumulates in the kidneys, lungs and skin, and in large quantities produces tachycardia, hypertension, hearing loss, memory, hair, teeth, nails, neurological problems, which is why they should not be consumed by pregnant women (Figure 4)

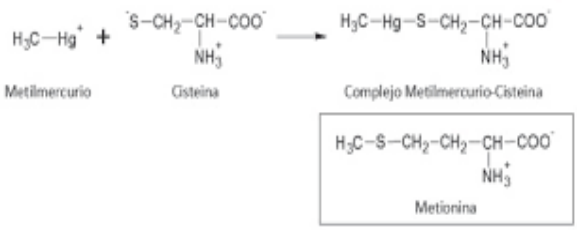

Figure 3. Transformation of mercury into the aquatic environment

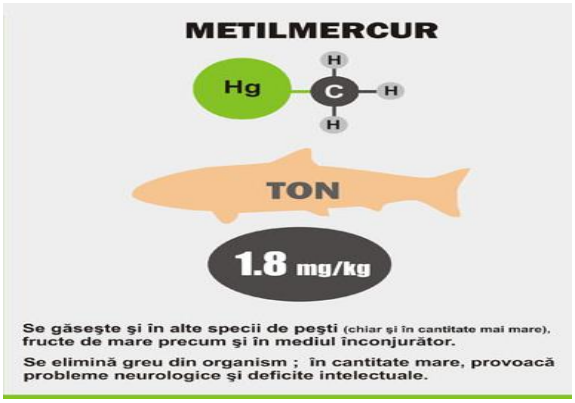

Figure 4. Contamination of tuna with mercury

- for tuna, European legislation has set the limit = 1 µg CH3-Hg / 1 g meat
- daily intake of an amount of Hg = 0.1 µg / kg is safe for all categories of people, including pregnant women
- a study carried out on tuna specimens caught in the Strait of Messina showed average values = 3 µg / g, so much higher than the allowed limit
- weekly dose = 1.3 µg methylmercury / kg body weight
- it is recommended that pregnant women consume a maximum of 170 g tuna per week and a healthy adult a maximum of 340 g tuna
- in the last 50 years, it has been found that the Hg level has increased 6 times in the tone with yellow wings
- a portion of light tone = 18.11 µg CH_3-Hg / 150 g; a portion of *Albacore* tuna = 49.53 µg CH_3-Hg / 150 g; a portion of tuna *Steak* = 97.49 µg CH_3-Hg / 150 g

b.Lead Pb și Cadmium Cd

- pregnant women, the elderly with chronic diseases and children should avoid consuming canned tuna (*Albacora Tuna*) due to the content of heavy metals (lead and cadmium)

c.Monosodium glutamate

- E 621 is a food additive that accentuates the taste, being toxic to the brain or other organs (Figure 5)

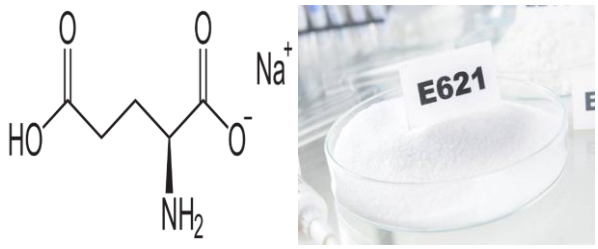

Figure 5. Monosodium glutamate

d.Histamine

- molecule derived from the carboxylation of the amino acid histidine (Figure 6)

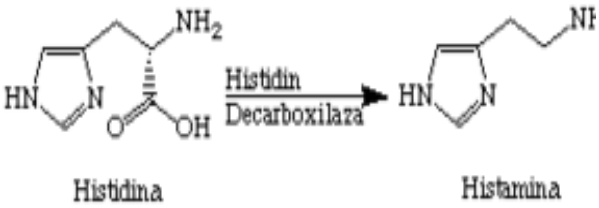

Figure 6. Histamine formation reaction

- in the human body it has the role of neurotransmitter and chemical mediator of inflammation
- in excess may be responsible for triggering allergic reactions (consumption of canned tuna is not recommended for children suffering from allergies or histamine intolerance)

e.Radioactive Cesium Cs 137

- on March 11, 2011, following the disaster at the Fukushima nuclear power plant, Japan, the largest radioactive discharge in history took place; the incident took place in the immediate vicinity of the Pacific Ocean and at least 80% of the waste resulting from the accident was dumped into Pacific waters
- every day, 300 t of radioactively contaminated water is discharged into the waters of the Pacific Ocean
- freshwater fish and living things located on the ocean floor near Fukushima show a contamination with radioactive Cs, compared to many other types of ocean fish in the same area; it was estimated that the concentration of Cs 137 increased, registering higher concentrations than those at Cernobîl
- radioactive contamination in Asia, Oceania, Australia and North America, has a negative effect on food, especially canned tuna, fish oil, semi-prepared fish products, which have an increased radioactivity
- the tuna caught from FAO areas 61, 67, 71, 77, 81, 87 and 88 is radioactive; the fishing area is indicated by the name FAO followed by the numbers: FAO area 71 = Central Pacific, western part, FAO 51 and FAO 57 = Indian Ocean, FAO 61 = Pacific area, which also includes Japan with Fukushima; most canned tuna is yellow-winged tuna and comes from areas 71, 51, 57; 50% of canned tuna contains fish contaminated with Cesium 137 (Figure 7)

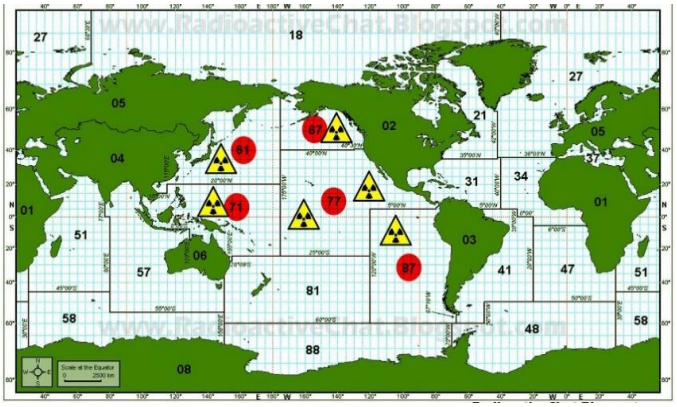

Figure 7.Tuna fishing areas contaminated with Cs 137

f.Bisphenol A BPA

- endocrine disruptor used in the manufacture of metal cans, lined with a thin layer of plastic, which has the role of preventing rusting the box and storing products (Figure 8)

Figure 8. The chemical formula of bisphenol A

- BPA passes from the plastic layer into the canned food and is rapidly absorbed into the body
- consumption of a single can increases 20 times the level of bisphenol in the blood
- in the European Union the use of bisphenol A is prohibited only in the manufacture of bottles; BPA is toxic https://www.foodsafetynews.com/2020/05/histamine-poisoning-in-sweden-linked-to-tuna-from-vietnam/and interferes with the action of hormones in the body, manifesting itself in the form of U: strong effects at low doses; fewer effects at moderate doses; more effects at large amounts of exposure

4. CONCLUSIONS

- Starting from the premise that live foods are the most effective medicines and that we are what we eat, it is recommended to eat fresh fish, simple, traditional, grilled or baked, regardless of its variety, white or red.
- It contains light proteins and minerals, is easily digested, is clean (if it comes from running water, it is catching and does not come from farms).
- To ensure food security, tuna fillet is recommended, which has its origins in sustainable, sustainable and controlled fishing, caught one by one by fishing rod and preserved in sea salt, spices and extra virgin olive oil.
- Tuna's a great source of iron, zinc, omega 3 and protein, but it's also a fairly reliable source of mercury.

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