

## HEAVY METAL LEVELS IN MEAT OF SPINY DOGFISH (*SQUALUS ACANTHIAS*) FROM BULGARIAN BLACK SEA

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### ABSTRACT

Environmental pollution with heavy metals and other toxic elements can serve as a predisposing factor for a various type of human diseases. Their accumulation in aquatic organisms used for human consumption increases the risk for daily intake of low doses of heavy metals. The Black Sea spiny dog (*Squalus acanthias*, Linnaeus 1758) is a cartilaginous fish predator belonging to the spiny shark family. This demersal fish belongs to the common monitoring species in Bulgaria and Romania in terms of pollution of the Black Sea. In this regard, the aim of the present study was to determine the concentrations of As, Pb, Cd, Hg, Mn, Zn and Al in shark meat samples, caught from our northern Black Sea coast (Varna region). The element with the highest concentration was arsenic. Mercury levels have been found to be above the permissible levels set out in European and national legislation, which poses a potential health hazard risk for the consumers.

**Key words:** heavy metals, spiny dogfish, *Squalus acanthias*, Black Sea.

### Introduction

Heavy metal accumulation in marine hydrobionts is the subject of numerous researches globally. Predators, especially those with a long-life cycle, accumulate more metalloids than other fish species (Domi et al., 2005). The spiny dogfish is a small predatory species of fish with an ovoviviparous type of reproduction. In Europe it is used for meat production and also as a source of liver oil (Endo et al., 2009). Generally, in the Bulgarian Black sea, *Squalus acanthias*, (Linnaeus 1758) is a fish with a high commercial value which appears as by-catch to the sprat catches or with special fisheries (Daskalov, 1998). Shark meat is a valuable source of many nutrients and substances especially protein (Barbosa-Filho et al., 2019) but consumption may pose a health risk due to the susceptibility of mercury accumulation (Domi et al., 2005; Endo et al., 2009).

To the our knowledge, there is no current scientific data based on studies related to heavy metal levels in spiny dogfish from Bulgarian Black sea. In this regard, the purpose of this study was to determine the main heavy metal concentrations in *Squalus acanthias* from Varna region.

### Materials and methods

The spiny dogfish samples (n = 6) were collected from commercial catches in the Black Sea along the Bulgarian northern coastal area, during fishing season 2020. All specimens were frozen at -20°C until chemical evaluation. The shark tissues included muscle without bones and skin and were tested as a mean sample.

The analysis was carried out after homogenization (Vortex homogenizer), followed by microwave assisted acid digestion procedure (ETHOS UP High-performance Microwave digestion system, Milestone Inc). After digested with nitric acid an appropriate spectroscopy determination with Inductively coupled plasma mass spectrometry (ICP-MS, Thermo Fisher TM) was performed.

## Results and Discussion

Heavy metals bioaccumulate in various organ systems, which poses a risk to the health of living organisms (Arnaudova et al. 2011). Determination of their concentration is one of the significant food safety criteria (Kim et al., 2019). To confirm the safety of spiny dogfish meat our data were compared with maximum permission levels laid down in Bulgarian and European legislation. The results for metal concentration in muscle of spine dog fish are shown in Table 1.

**Table 1: Heavy metal concentrations (mg/kg wet weight) in muscle of spiny dogfish (*Squalus acanthias*) from Bulgarian Black Sea coast**

Element	Unit	Varna region	Permissible values
As (X±SD)	mg/kg	5.28 ± 0.53	-
Pb (X±SD)	mg/kg	< 0.05*	0.30
Cd (X±SD)	mg/kg	< 0.05*	0.05
Hg (X±SD)	mg/kg	1.36 ± 0.14	0.50
Mn (X±SD)	mg/kg	0.12 ± 0.01	-
Zn (X±SD)	mg/kg	1.19 ± 0.01	-
Al (X±SD)	mg/kg	< 10.0*	-

\*Method detection limits; \*\*  $p < 0.05$

Arsenic (As) is a metalloid, widely distributed in aquatic ecosystems and it is an important ecological pollutant which poses a risk for human health. High concentrations of arsenic in the environment are a consequence of anthropogenic activity (Kumari et al., 2016). Arsenic ( $5.28 \pm 0.53$  mg/kg) was the second element with highest concentration after aluminium. It could be difficult to interpret the obtained data for aluminium and arsenic because the legislation did not specify reference values for these metalloids.

Zinc and manganese are important trace elements in human nutrition but their high concentrations can induce health issues (Medeiros et al., 2012). Available literature data related to the concentration of heavy metals in predator fish catching from the Black Sea showed that the element with the highest values was zinc with the following values range (29.48 – 35.33 mg/kg) (Tuzen, 2009; Bat et al., 2012). The current results for zinc ( $1.19 \pm 0.01$  mg/kg) in spiny dogfish meat were inconsistent with data from similar studies.

Cadmium, lead, and mercury are chemical elements belonging to the group non-physiological elements (Stancheva et al., 2014; Fazio et al., 2020). Heavy metals accumulation of cadmium, lead and mercury in hydrobionts which are part of the food chain can be particularly dangerous (Bat et al., 2017). Cadmium and lead levels (table 1) were well within the limits set by the recommendations of European Community (No 1881/2006).

Mercury is highly toxic heavy metal, with coal and pesticide origin which causes destruction of nerves, brain, kidneys and death in cases of intoxication (Nisbet et al., 2010, Stancheva et al., 2013). According European Community (No 1881/2006), the maximum mercury level permitted for sea fish is 0.5 mg/kg w.w. In this study Hg level is 2.72 times higher than permissible values. High levels of mercury in shark tissues are due to the fact that predator fish species are at the top of the trophic chain in seas and oceans (Lopez et al., 2013).

## Conclusion

The present study has demonstrated that metal levels in *Squalus acanthias* from Bulgarian Black Sea coast do not have inordinately high levels in the muscle tissue. However the concentration

of mercury twice the permissible values must be taken into account when assessing the potential adverse effects of the consumption of shark meat from the Black Sea.

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