The Eurasia Proceedings of Health, Environment and Life Sciences (EPHELS)
ISSN: 2791-8033

The Eurasia Proceedings of Health, Environment and Life Sciences (EPHELS), 2022

Volume 6, Pages 6-10

ICGeHeS 2022: International Conference on General Health Sciences

Monitoring of Heavy Metals Concentration in European Hake

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Abstract: Fish consumption ensure health benefits, nevertheless the existence of heavy metal pollution in seafood still deputize public health concerns. These study aims to evaluate the concentration levels of cadmium and chrome in muscle tissue of European Hake (*Merluccius merluccius*) with different size. Fish samples were collected and purchased regularly from the central fresh fish market of Tirana whereas a total of 44 samples of muscle tissue were evaluate by using atomic absorption spectrophotometer (AAS). The results of the investigation showed that, cadmium concentration levels (p=0.001) varied significantly between fish sample size of European Hake. According to the results concentration levels of cadmium made an exception (0.04 mg/kg ww), over passing (large fish size) the maximum permitted level for human consumption set by EC legislation. Based to the results of the investigation it will be of great interest the further evaluation and monitoring of European hake specie with the aim to protect Albanians consumers' health by cadmium contamination.

Keywords: Heavy Metals, European Hake, Muscle Tissue, Cadmium

Introduction

Fish are an excellent food source to consumers they are rich on proteins, polyunsaturated fatty acids, vitamins and minerals (Copat et al., 2010: Storelli, 2008). At the same time fish represent an important source in Iodine, vitamins B complex or D, phosphorus, calcium and trace minerals that are beneficial for health and growth. Therefore many doctors recommend the consummation of the fish at least twice in a week. Fish consumption is considered one of the key components of a cardioprotective diet (Mozaffarian et al., 2011). In 2008, the world production of fish reached 140 million tons (115 for human consumption), for an average per capita consumption of 17 kg/person/year (Hosomi et al., 2012).

Metal contaminants are naturally present in the environment but can be increased through industrial activity and pollution (Erasmus et al., 2004). During the last decade development of high technology has brought not only benefits but also negative impact on natural aquatic environment. Organisms at the top of food chain are the most exposed ones to environment pollution such as heavy metals, pesticides and also micro plastics. Fish especially benthic species tend to accumulate these chemical substances in their tissues. Heavy metals such as cadmium, mercury, lead, and arsenic pose a number of hazards to humans, these metals are also potent carcinogenic and mutagenic (IARC, 2009). Although heavy metals have no biological function in humans, but

they can be very harmful to due to bio-accumulative and biomagnification potentials. Based on the capacity of such substances to accumulate in tissues of fish represents a serious threat to humans whereas these values are above the standards. Both essential and harmful minerals and metals present in the environment can be absorbed into living organisms from the surrounding water, sediment and diet (Munoz et al., 2001). One of the most dangerous ones is cadmium; it easily ingested and has the ability to bio accumulate. Cadmium concentrations are revealed to be higher in benthic fish species which lives into close contact with the sediment.

Albanian possesses 450 km costal area in diverse sea systems reach with a large variety of wild fish species that are consumed locally. European hake is a benthic important local species but not only while this specie has excellent and tasteful white meat. European hake is one of the most consumed fish species in Albania. Many studies have been conducted in the recent years in Albania to determine the quantity of heavy metals existence in fish by local authors (Ozuni et al., 2021, Ozuni et al., 2010). Nevertheless, there was no research to evaluate the presence of cadmium (Cd) and chrome (Cr) in European Hake. Based on the importance of the specie in human consumption the purpose of the study was to monitor and evaluate the concentration level of cadmium (Cd) and chrome (Cr) in muscle tissue of European hake, and then compare the results with the EC legislation limits for human consumption.

Method

The fish species named European hake (*Merluccius merluccius)* was collected and purchased during summer 2020. Fish samples of red mullet originated from Adriatic Sea, were purchased directly from the fisherman of Durres. The study included 44 samples of muscle tissue (small fish size, mean weight - 60 gr, and large fish sized, mean weight 140 gr). The fish samples were first, identified, weighed, catalogued and conserved at - 18°C and then they were sent for further investigation to the Laboratory of Toxicology, Institute of Veterinary and Food Safety, Tirana. A total of 44 samples of muscle tissue of were evaluated for the concentration level of cadmium (Cd), and chrome (Cr) by using an Atomic Absorption Spectrophotometer (AAS). Fish tissue was homogenized in a blender; and then they were dried at 100 ºC. One g of sample was weighed and then treated with 10 ml of HNO_3 and 5 ml of concentrated H_2SO_4 and let in overnight. The next day they were dried at 150º C for at least, 30 minutes and 50 ml of it were put into a normal flask, and filled with tap water. The heavy metals were measured by ICP-OES, Optima 2100 Dv produced by Perkin Elmer.

Statistical Evaluation

The statistical evaluation of the data was evaluated by using SPSS (Statistical Package for Social Sciences) 25.0. The level of significance was set as ($p \leq 5\%$). The comparison values between groups were performed by using student test. The statistical data on the below table comprised average, standard deviation, standard error, p value and interval of confidence.

Results and Discussion

The maximum levels for cadmium (Cd) and chrome (Cr) in fishery products is manifested in The European legislation (EC 2006; 2008). The concentration level and (SD) of cadmium and chrome (mg/kg wet weight) in muscle tissue of European hake samples are given in the below tables (Tab. 1). The results of the study show that cadmium and chrome are present at different concentration levels in all sample tissues of European hake according to weight (Tab.1). According to the results the concentration level (mg/kg ww) of cadmium (Cd) in sample muscle tissue of small fish size of European hake resulted within the maximum permitted level for human consumption (EC, 2006 & 2008), set by EC legislation.

Table 1. Average mean values of cadmium and chrome in muscle tissue of European hake (mg/kg wet weight)

Heavy metals		N	Mean	SD	T	df	p value
Cd	small	22	.0052	.00737	-3.838	42.000	.001
	large	22	.0432	.04585			
Cr	small	22	.0340	.01736	-.716	42.000	.478
	large	22	.0585	.15977			

Cd is a nonessential element and is considered one of the most toxic elements to humans, fishes, and environment, due to its capability of producing a chronic toxic effect even at a low concentration level (Rajeshkumar et al., 2018). The average mean concentration and (SD) of cadmium (mg/kg ww) in small fish size of European hake was 0.0052 ±0.0073 and 0.0432 ± 0.0458 in large fish size. The average mean concentration and (SD) value of chrome (mg/kg ww) was 0.0340± 0.0173 in small fish size and 0.0585 ± 0.1597 in large fish size. Referring to the results (Tab.1) the average mean value concentration of cadmium and chrome (mg/kg ww) detected in muscle samples tissue of European hake resulted lower in small fish size compare to large fish size. This research display that Cd has modest tendency to accumulate in European hake muscles. Several studies have demonstrated that Cd preferentially accumulates in active metabolic organs, such as kidney and liver (Vieira et al., 2011).

The results of the study also indicate that cadmium concentration level (p=0.001) showed significant statistical difference between small and large fish size samples. Similar results on cadmium concentration levels in European hake reported Storelli, 2008 (0.04 mg/kg ww), while Perugini et al., 2014 reported higher levels of cadmium concentration in muscle tissue of fish (0.06 mg/kg ww). In a similar study conducted by Omeldo et al., 2013, Perugini et al., 2009, Storelli et al., 2005, Gaspic et al., 2002, cadmium was not detected by the apparatus (ND).

Generally other studies sustain that benthic fish species which lives into near contact with the sediment accumulate higher quantities of heavy metals than other fish species (Storelli, 2008, Gaspic et al., 2002). Also, other factors that influence metal uptake are, age, sex, size, feeding behavior and living environment (Zhao et al., 2012, Mustafa et al., 2003, Storelli et al., 2000). The results obtained from the study revealed that the concentration level of cadmium in European hake sample tissue resulted within the permissible levels for human consumption set by EC regulation (Cd - 0.050 mg/kg wet weight, EC, 2006 & 2008). In the case of chromium, the maximum levels for human consumption has not been yet determined in fish.

Conclusion

Environmental pollution from heavy metals constitute worldwide problem, due to their tendency to accumulate above threshold concentrations. The result obtained in this study revealed that muscle tissue of European hake is contaminated with cadmium and chrome. Nevertheless, the concentration levels of cadmium resulted to be within the permissible levels for human consumption set by EC legislation. Anyway, annual monitoring programs to determine the concentartion of heavy metals in water and fish are nessessesary to garantie food safety.

Scientific Ethics Declaration

The authors declare that the scientific ethical and legal responsibility of this article published in EPHELS journal belongs to the authors.

Acknowledgements or Notes

* This article was presented as an oral presentation at the International Conference on General Health Sciences (www.icgehes.net) held in Istanbul/Turkey on August 25-28, 2022

References

Copat, C., Bella, F., Casating, M., Fallico, R., Sciacca, S., Ferrante, M. (2012). Heavy metals concentrations in fish from Sicily (Mediterranean Sea) and evaluation of possible health risks to consumers. *Bulletin of Environmental Contamination and Toxicology*, *88*(1), 78–83.

EC, 2006: European Commission Regulation No 1881/2006 of 19 December 2006 setting maximum levels for certain contaminants in foodstuffs. *Official Journal of the European Union*, 20.12.2006.

EC, 2008: European Commission Regulation No 629/2008 of 2 July 2008 amending Regulation (EC) No 1881/2006 setting maximum levels for certain contaminants in foodstuffs. *Official Journal of the European Union*, 3.7.2008

Erasmus, C.P., Rossouw, G & Baird, D. (2004). The concentration of ten heavy metals in the tissues of shark species *Squalus megalops* and *Mustelus mustelus* (Chondrichthyes) occurring along the southeastern Coast of South Africa. Population (English edition), University of Port Elizabeth.

Gaspic, Z.K., Zvonaric, T., Vrgoc, N., Odzak, N., Baric, A. (2002). Cadmium and lead in selected tissues of two commercially fish species from the Adriatic Sea. *Water Research, 36*, 5023-5028.

Hosomi, R., Yoshida, M., Fukunaga, K. (2012). Seafood consumption and components for health. *Global Journal of Health Science, 4*, 72-86.

IARC, 2009. International Agency for Research on Cancer. A review of human carcinogens: Metals, arsenic, dust and fibres. *The Lancet Oncology*, 10,453-454.

Mozaffarian, D., Appel, L.J., Van, H.L (2011). Components of a cardio protective diet: new insights. *Circulation, 123*, 2870-91.

Munoz-Olivas, R., and Camara, C. (2001). Speciation related to human health, in Trace Element Speciation for Environment, Food and Health, ed. by Ebdon L, Pitts L, Cornelis R, Crews H, Donard OFX and Quevauviller P. *Royal Society of Chemistry*, Cambridge, pp. 331–345.

Mustafa, G., Guluzar, A. (2003). The relationships between heavy metal (Cd, Cr, Cu, Fe, Pb, Zn) levels and size of six Mediterranean fish species. *Environmental Pollution, 121*, 129-136.

Olmedo, P., Pla, A., Hernandez, A. F., Barbier, F., Ayounil, L., Gil, F. (2013). Determination of toxic elements (mercury, cadmium, lead, tin and arsenic) in fish and shellfish samples. Risk assessment for the consumers. *Environment International, 59*, 63-72.

Ozuni, E., Andoni, E., Beqiraj, D. & Sulce, M. (2021). Heavy metals in edible tissue of red mullet from Tirana market. *The Eurasia Proceedings of Health, Environment and Life Sciences (EPHELS), 4*, 1-4.

Ozuni, E., Dhaskali, L., Abesh, J., Zogaj, M., Haziri, M., Beqiraj, D and Latif, F. (2010). Heavy metals in fish for public consumption and consumer protection. *Natura Montenegrina, 9*(3), 843-851.

Perugini, M., Manera, M., Olivieri, V. (2014). Heavy metal (As, Cd, Hg, Pb, Cu, Zn, Se) concentrations in muscle and bone of four commercial fish caught in the central Adriatic Sea, Italy. *Environment Monitoring Assessment, 186*, 2205-2213.

Perugini, M., Visciano, P., Manera, M., Zaccaroni, A., Olivieri V., Amorena, M. (2009). Levels of total mercury in marine organisms from Adriatic Sea, Italy. *Bulletin of Environmental Contaminaton Toxicology, 83*,244-248

R. C., & Valencia, R. R. (1991). *APA guide to preparing manuscripts for journal publication*. Washington, DC: American Psychological Association.

Rajeshkumar, S., and Li, X. (2018). Bioaccumulation of heavy metals in fish species from the meiliang bay, Taihu Lake, China. *Toxicology Reports, 5*, 288–295.

Storelli, M.M. (2008). Potential human health risks from metals (Hg, Cd, and Pb) and polychlorinated biphenyls (PCBs) via seafood consumption: estimation of target hazard quotients (THQs) and toxic equivalents (TEQs). *Food and Chemistry Toxicology, 46*(8):2782-8.

Storelli, M.M., Giacominelli-Stuffler, RR., Marcotrigian, G.O. (2005). Mercury speciation in the muscle of two commercially fish important fish, hake and striped mullet from the Mediterranean Sea. Estimated daily intake. *Food Chemistry, 89*,295-300.

Storelli, M.M., Marcotrigiano, R.G.O. (2000). Fish for human consumption, risk of contamination by mercury. *Food Additives and Contaminants, 17*, 1007-1011.

Vieira, S., Morais, S., Ramos, C., Delerue-Matos, and Oliveira, M. B. P. P. (2011). Mercury, cadmium, lead and arsenic levels in three pelagic fish species from the Atlantic Ocean: Intra- and inter-specific variability and human health risks for consumption. *Food and Chemical Toxicology*, *499*(4), 923–932.

Wagner, J., Lawrick, E., Moore, K., Anderson, M., Soderland, L., & Brizee, A. (2010, May 5). *General format*. http://owl.english.purdue.edu/owl/resource/560/01/

Zhao, S., Feng, C., Quan, W., Chen, X., Niu, J., Shen, Z. (2012). Role of living environments in the accumulation characteristics of heavy metals in fishes and crabs in Yangtze River Estuary. *China Marine Pollution Bulletin, 64*, 1163-1171.

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To cite this article:

Ozuni, E, Beqiraj, D., Dhaskali, L., & Andoni, E. (2022). Monitoring of heavy metals concentration in European Hake. *The Eurasia Proceedings of Health, Environment and Life Sciences (EPHELS)*, *6*, 6-10.