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Evaluation of Heavy Metals in Fishes (*Cyprinus carpio* and *Barbus plebejus*) of Bedirkale Dam Lake, Turkey

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The level of heavy metals in two commercially important fishes (*Cyprinus carpio* and *Barbus plebejus*), water and sediments of Bedirkale Dam lake were determined using standard methods. The concentrations of the tested heavy metals were within the acceptable standards. The concentration ranges will not pose any serious threat to the life of biota or man as a consumer.

Key Words: Heavy metals, Pollution, Bedirkale Dam Lake, Fishes.

INTRODUCTION

Heavy metals are an important chemical pollutants in natural waters. Many dangerous chemical elements accumulate in the soil and sediments of water bodies[1]. Fish communities can be considered as one of the most signicant indicators in freshwater systems for the estimation of metal pollution level[2]. The lower aquatic organisms absorb and transfer them through the food chain to higher trophic levels, including fish. Under acidic conditions, the free divalent ions of many metals may be absorbed by fish gills directly from the water[3,4].

Pollution enters fish through five main routes: *via* food or non-food particles, gills, oral consumption of water and the skin. Pollutants transformed in the liver may be stored there or excreted in bile or transported to other excretory organs such as gills or kidneys for elimination or stored in fat, which is an extra hepatic tissue[5,6]. Hence, concentrations of heavy metals in the organs of fish are determined primarily by the level of pollution of the water and food[7].

There are some studies concerning the levels of heavy metals for fish in Turkey[8-14]. The purpose of this article is generalization of information about content of heavy metals in fish of Bedirkale Dam Lake.

EXPERIMENTAL

A total 98 fish samples were catched from different areas of Bedirkale Dam Lake. The fishes were brought to the laboratory immediately in ice

and then frozen at -25 ºC until dissection. Fork length (FL) and wet weight (W) of the captured fish were recorded with 1 mm and 0.01 g sensitivity, respectively. Scales were used for age determination. The muscle, gill and gonads were dissected using clean equipment. They digested with macro Kjeldahl tubes using Kjeldahl racks until a clear solution is appeared. After digestion, samples have been cooled and the volume of the digest was made up to 100 mL with distilled water. Level of heavy metals (Al, Cd, Cr, Cu, Fe, Ni, Pb, V and Zn) was carried out by using atomic absorption spectrophotometer (AAS). All data are presented as concentrations in per unit wet weight of the samples (as ppm).

RESULTS AND DISCUSSION

The characteristics of fishes (age, fork, length and weight) are listed in Table-1. The concentrations of the heavy metals are given in Table-2.

TABLE-1
CHARACTERISTICS OF ANALYZED FISHES

Species	N	Fork length (cm)	Weight (g)	Age (years)
Cyprinus carpio	53	19-36	243-1743	3-5
Leuciscus cephalus	45	13-41	40-579	2-7

The levels of heavy metals in most water samples for the different studied locations within following ranges: Cd 0.0004-0.0015, Cr 0.0023-0.098 ppm, Cu 0.035-0.0143 ppm, Fe 0.0755-0.7963 ppm, Ni 0.0001-0.0225 ppm, Pb 0.0002-0.0265. Concentration ranges of metals in sediments were: Cd 0.54-1.10 ppm, Cr 1.35-9.15 ppm, Cu 3.36-15.07 ppm, Fe 46.50-19.805 ppm, Ni 0.27-19.05 ppm, Pb 0.29-8.69 ppm.

The concentrarions of heavy metals in fish tissues were found to be higher in gills by gonads and the muscle of fish. The highest levels were determined in Zn and Fe in tissues. These results were expected because Zn is present in many enzymes in the fish's organism and Fe is used to transport oxygen throughout the fish's body. Oxygen is carried to the muscle tissue by erythrocytes in blood. It deliver oxygen *via* haemoglobin. Therefore, the iron contents were determined higher than the other organs.

The ranges of heavy metals levels recorded in fish in this study was low when compared to heavy metals levels recorded in some other fishes of dam lakes. The possible explanation for this could be differences in fish species; sizes, ages and sampling periods. The concentrations of metals in an organism's body, vary from organ to organ and is the product of an equilibrium between the concentration of the metal in an organism's environment and its rate of ingestion and excretion[15-17].

TABLE-2
CONTENTS OF HEAVY METALS IN DIFFERENT TISSUES OF *Cyprinus carpio* AND *Leuciscus cephalus* INHABITING BEDIRKALE DAM LAKE

Heavy metals	Organs	*Cyprinus carpio* (mean ± SD)	*Leuciscus cephalus* (mean ± SD)
Al	Muscle	1.320 ± 0.400	0.940 ± 0.05
	Gill	4.910 ± 1.200	3.940 ± 0.94
	Gonad	5.170 ± 4.300	2.810 ± 1.42
Cd	Muscle	0.037 ± 0.010	0.022 ± 0.01
	Gill	0.042 ± 0.020	ND
	Gonad	0.210 ± 0.010	ND
Cr	Muscle	0.020 ± 0.010	0.170 ± 0.01
	Gill	0.040 ± 0.040	0.030 ± 0.01
	Gonad	0.030 ± 0.010	0.020 ± 0.01
Cu	Muscle	0.480 ± 0.020	1.680 ± 0.93
	Gill	0.740 ± 0.070	3.160 ± 0.45
	Gonad	1.200 ± 0.250	1.470 ± 0.02
Fe	Muscle	7.800 ± 2.430	4.890 ± 1.37
	Gill	45.900 ± 9.700	34.400 ± 7.90
	Gonad	78.400 ± 13.000	45.500 ± 7.94
Ni	Muscle	0.010 ± 0.002	ND
	Gill	0.250 ± 0.020	0.120 ± 0.01
	Gonad	0.100 ± 0.010	0.050 ± 0.01
Pb	Muscle	0.250 ± 0.310	0.140 ± 0.07
	Gill	0.800 ± 0.050	0.430 ± 0.04
	Gonad	0.400 ± 0.300	0.220 ± 0.02
V	Muscle	0.010 ± 0.020	ND
	Gill	0.010 ± 0.003	ND
	Gonad	0.020 ± 0.001	ND
Zn	Muscle	7.900 ± 1.800	5.760 ± 1.34
	Gill	169.100 ± 21.900	16.220 ± 1.97
	Gonad	271.500 ± 79.000	108.200 ± 21.80

ND = Not detected.

The results indicate that levels of heavy metals are below the limits for fish proposed by FAO[18]. However, fish species and places of analysis should be increased to determine the effects of heavy metals on fish growth and population dynamics in the future. As a result, the fish of Bedirkale Dam Lake are not contaminated with heavy metals and suitable for human consumption.

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