

Heavy Metal Levels of Two Cyprinid Species (*Cyprinus carpio* and *Capoeta trutta*) Populated in Almus Dam Lake, Turkey

MEHMET KARATAS*, YASAR SEKER† and METIN SEZER†
Department of Fisheries and Aquaculture, Faculty of Agriculture
Gaziosmanpasa University, 60250, Tokat, Turkey
E-mail: docdrmehmetkaratas@gmail.com.

The object of this research was to investigate the heavy metal (Al, Cd, Cr, Cu, Fe, Ni, Pb, V, Zn) levels of two Cyprinid species (*Cyprinus carpio* and *Capoeta trutta*) inhabiting Almus Dam Lake (Tokat, Turkey). Heavy metal contents of muscle, gill and gonad tissues was detected in fresh matter by atomic absorption spectrophotometer and counted in mg kg⁻¹. The amounts of all heavy metals in gonad and gill were higher than those in muscle. Except Cu concentration, all the other heavy metal concentrations were lower in *Capoeta trutta* than in *Cyprinus carpio*. The results indicate that the fish of Almus Dam Lake are not contaminated with heavy metals and are suitable for human consumption.

Key Words: Heavy metals, Almus Dam Lake, Fishes.

INTRODUCTION

Fish is considered as one of the main protein sources for human consumption. All heavy metals are potentially harmful to most organisms at some level of exposure and absorption. Fish are at the high level in the food-web and may accumulate large amounts of some metals from water. Fish may acquire a flavour that make their flesh unfit for food use with mild pollution, whereas with more severe contamination, the fish become sick and then die¹. Moreover, the accumulation of such pollutants in certain tissues of the fishes may cause further risks to human health, rendering fish stocks unsafe for human consumption.

Heavy metals may enter fish tissues in several ways. Small amounts are absorbed directly from water through their gills and other tissues. However, most of the pollutants found in aquatic organisms are accumulated in fat and tissues through the food chain. Accordingly, aquatic organisms are also used to biologically monitor the variation in environmental levels of anthropogenic pollutants^{2,3}. Fish are ideal indicators of heavy metal contamination in aquatic systems. The increasing levels of pollution in aquatic systems and their influence on the biota have been widely reported^{4,5}. There are some studies concerning the levels of heavy metals for fish in Turkey⁶⁻⁸.

†Department of Animal Science, Faculty of Agriculture, Gaziosmanpasa University, 60250, Tokat, Turkey.

Primary activities of the people living in Almus City are agriculture, cage culture and fishing. Hence, it is very important to know the concentration of heavy metals in fishes of Almus Dam Lake. Two species of edible fish, which are the dominating and mainly consumed species of the lake, were taken for the present study. The object of the present study is to:

1. Survey the concentrations of some heavy metals (Al, Cd, Cr, Cu, Fe, Ni, Pb, V, Zn) in muscle, gill and gonads.
2. Describe the differences of heavy metal levels of the two species (*Cyprinus carpio* and *Capoeta trutta*) inhabiting Almus Dam Lake (Tokat, Turkey).

EXPERIMENTAL

Cyprinid species (*Cyprinus carpio* and *Capoeta trutta*) used in this study were sampled by local fisherman. The fishes were brought to the laboratory immediately in ice and then frozen at -25°C 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 were digested with macro-Kjeldahl tubes using Kjeldahl racks until a clear solution appeared. After digestion, the samples were 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 determined 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 the analyzed fishes (age, total length and weight) are listed in Table-1.

TABLE-1
CHARACTERISTICS OF ANALYZED FISHES

Species	N	Fork length (cm)	Weight (g)	Age (years)
<i>Cyprinus carpio</i>	8	22-39	261-1974	2-4
<i>Capoeta trutta</i>	12	20-28	145-382	3-6

The concentrations of the heavy metals are given in Table-2 and Fig. 1. In general, different tissues showed different capacity to accumulate heavy metals. Metal concentrations of both species were the highest in gonad and gill samples. However, the muscles tended to accumulate less heavy metals. The variability was high in gonad of *Cyprinus carpio* for Zn, ranging from 0.019 to 262 mg/kg. Pb, Ni and Cd were not detected in samples of *Capoeta trutta* (Table-2).

Comparison of the two species (Fig. 1) revealed that mean concentrations of Al, Cd, Cr, Fe, Ni, Pb, V and Zn were higher while Cu concentration was lower in *Cyprinus carpio* samples than *Capoeta trutta* samples.

TABLE-2
 BIOACCUMULATION OF HEAVY METALS IN DIFFERENT
 TISSUES OF *CYPRINUS CARPIO* AND *CAPOETA TRUTTA*
 INHABITING ALMUS DAM LAKE

Heavy metals	The examples of organs	<i>Cyprinus carpio</i> (mean \pm S.D.)	<i>Capoeta trutta</i> (mean \pm S.D.)
Cd	Muscle	0.033 \pm 0.02	N.D.
	Gill	0.046 \pm 0.03	N.D.
	Gonad	0.227 \pm 0.03	N.D.
Cr	Muscle	0.012 \pm 0.01	0.008 \pm 0.01
	Gill	0.050 \pm 0.04	0.044 \pm 0.03
	Gonad	0.036 \pm 0.01	0.022 \pm 0.01
Cu	Muscle	0.597 \pm 0.42	1.572 \pm 0.78
	Gill	0.780 \pm 0.08	4.410 \pm 0.50
	Gonad	1.528 \pm 0.22	1.385 \pm 0.05
Fe	Muscle	6.591 \pm 3.74	5.993 \pm 2.45
	Gill	42.32 \pm 12.5	40.570 \pm 9.76
	Gonad	84.28 \pm 16.0	48.360 \pm 16.2
Ni	Muscle	0.034 \pm 0.03	N.D.
	Gill	0.294 \pm 0.10	N.D.
	Gonad	0.103 \pm 0.03	N.D.
Pb	Muscle	0.345 \pm 0.31	N.D.
	Gill	0.986 \pm 0.05	N.D.
	Gonad	0.433 \pm 0.30	N.D.
V	Muscle	N.D.	N.D.
	Gill	0.022 \pm 0.03	0.011 \pm 0.01
	Gonad	0.019 \pm 0.01	0.013 \pm 0.00
Zn	Muscle	8.354 \pm 3.52	4.510 \pm 1.15
	Gill	177.6 \pm 24.6	14.42 \pm 2.31
	Gonad	262.1 \pm 100	111.3 \pm 24.46
Al	Muscle	1.457 \pm 0.54	1.024 \pm 0.63
	Gill	5.123 \pm 1.26	4.403 \pm 1.20
	Gonad	6.686 \pm 5.48	5.463 \pm 4.23

N.D.: Not detected

It is generally accepted that heavy metal uptake occurs from water, food and sediment. However, the efficiency of metal uptake from contaminated water and food may differ in relation to ecological needs, metabolism and contamination gradients of water, food and sediment as well as other factors such as salinity, temperature and interacting agents⁹.

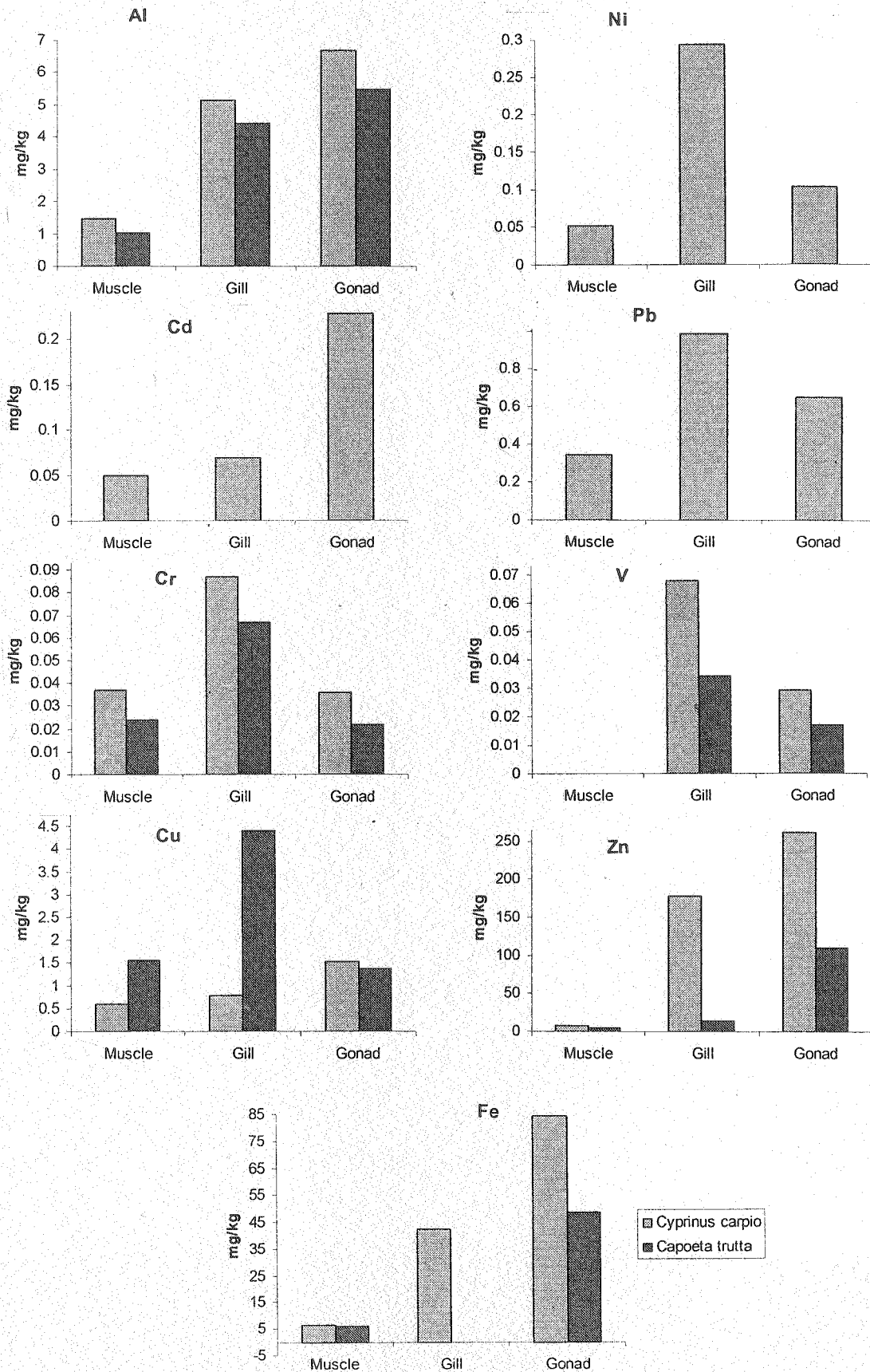


Fig. 1. Concentrations of heavy metals in fish tissues from Almus Dam Lake

The results indicate that the Almus Dam Lake fish are not contaminated with heavy metals and the levels of detected metals in all samples are below the limit values for fish proposed by FAO¹⁰ for human consumption. However, fish growth and its relation with heavy metal concentration in the aquatic environment should also be monitored occasionally in the field to understand the effects of heavy metals on fish development and population dynamics.

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For more information, contact:

Detlef Decker

Washington State University Extension

305 Hulbert Hall, PO Box 646230, Pullman, WA 99164-6230

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Website: <http://emmps.wsu.edu/firecongress/>