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Investigation of heavy metals in common carp (*Cyprinus carpio*) netted from River Kabul district, Nowshera

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Abstract
Objective: The aim of the present study was to determine the levels of zinc, copper lead, chromium and cadmium in the gills, liver, intestine and muscles (flesh) of *Cyprinus carpio* netted from river Kabul of district Nowshera. As high level of these metals influence the water quality and might be toxic to the fish and consumers (humans) in other hand.
Material Method: Fish samples were collected from the most polluted water of river, dissected, digested and then brought to the laboratory and analyzed the levels of metals using flame Atomic Absorption Spectrophotometer (AAS, Unicam 969).
Results: Gills of *Cyprinus carpio* had the concentrations of metals as lead was found with mean value 215.20, Cd with mean value 86.6, Cr with mean value 145, Cu with mean value 304.60 and Zn was found with mean value 1230.4 µg/g wet weight. In muscles of Cyprinus carpio lead was found with mean values 245.8, Cd with mean value 31.20, Cr with mean value 128.40, Cu with mean value 411.80 and Zn with mean value 799.2 µg/g wet weights. Concentration of metals in liver of Cyprinus carpio Pb was found with mean value 307.40, Cd with mean value 39.8, Cr with mean value 218.60, Cu with mean value 452.6, and Zn was found with mean value 1419.2 µg/g wet weights. Bioaccumulation of heavy metal in the intestine of Cyprinus carpio Pb concentration was recorded with mean value 251.4, Cd concentrations with mean value 41, Cr with mean value 138.2, Cu with mean value 352.8 and Zn concentration was found with mean value 1063 µg/g wet weight.
Conclusion: Based on the above results, it can therefore be concluded that metal bioaccumulation in the fish body cause the physiological and hematological deformities.

Keywords: Bioaccumulation; heavy metals; fish; nowshera, River Kabul

1. Introduction
The accumulation of heavy metals in aquatic life indicates the way of Water pollution and fishes are commonly used as bio-indicators of heavy metals contamination [1]. Heavy metals accumulate in many organs of fish body and indirectly become part of human metabolisms, causing severe health problems [2].
Aquatic system is a grave yard of many pollutants that are discharged from manufacturing industries, manure, sewage, Agriculture and drainage and commencing from city, town and municipal, all these are considered lethal for aquatic organisms, including fishes [3]. Heavy metals are the most effective pollutants as they make their bio-aggregation in the tissues of fish. All of these trace metals are important for their harmful, mutagenic properties [4]. Heavy metals increase metabolic rate that stimulate a cellular alteration in the affected fish lead to parasitic necrosis and inflammatory defensive reaction [5]. Heavy metals have high mass density elements, density more than 5.00 to 6.00g/cm3, which may have dangerous effect on plants and animals ecosystem [6]. Metals are environmentally safe, but when they come inside the aquatic environment, bioassembly may occur in fish body and other, marine organisms. Heavy metals like iron, copper and zinc have important role in fish metabolism, although greater ingestion of the needful metals can initiate harmful effect [7]. Greater concentrations are available in the sediments and enter the food chain through the feeding of benthic invertebrates which are important in the transfer of trace metals to higher trophic levels due to their dependent [8]. Aquatic micro plants and micro animals, which comprises fish food, efficient in collecting and contamination of heavy metals pollution into their cell from their surroundings eaten by Small and little fish, they have been eaten by predatory fish, commonly shows greater

quantity of heavy metals as compared to their prey and the man are consuming the predatory and voracious fish, showing increased accumulation of heavy metals at higher trophic [9]. Fish is well-known to be a good and rich source of protein loaded in necessarily amino acids [10]. The dietary display of toxicants by the fish is usually ignored, however fish is important in the uptake of heavy metals and them of transferring toward the next trophic level of the marine food chain [11]. Bioaccumulation of heavy metals is eminent to harmfully affect, liver, kidney, muscle and other tissues of fish, upset metabolism and impede improvement and growth of fish [12]. Several studies show that the absorption and accumulation of metals in various organs of fish is not uniform [13]. Who has found higher concentration of metals (Pb, Co and Cd) in liver as well as in kidney of *Cyprinus carpio* (Common carp) whereas muscles have a least accumulation of heavy metals. The intensity of metals such as Mn, Zn, and Cr are poisonous beyond a definite value, while Pb, Ni and Cd are harmful even in a minute quantity [14, 15]. The quantities of metals like Cd and Cr, significantly varies in *C. catla*, *L. rohita* and *C. mrigala*, that depend upon fish species, the kind of tissues, organs and location [16]. *Cyprinus carpio* favors bulky and large bodies of slow or standing water of temperature 1.6-30 ˚C. A mature fish can give 300,000 eggs in a single spawning. Due to their high productivity and feeding routine they may harm submerged foliage and plants creating severe harm to duck and fish population [17]. Common carp are believed to be highly inhabitant to aquatic pollution [18]. The purpose of the present study was to check heavy metals in the gills, muscles liver and intestine of Cyprinus *carpio*.

2. Materials and Methods

2.1 Study area and fish collection

Common carp fish *(Cyprinus carpio)* were collected from extremely polluted and contaminated part of River Kabul with the help of fisherman. River Kabul at Nowshera District of Khyber Pakhtunkhwa Province. In Pakistan, the River Kabul passes through various industrial and domestic effluent and contaminated site. The net or gear that was used for netting is called gill net locally known as Patti, (40×6ft) with a cork line at the top rope and metal line with the ground rope made nearby nylon thread and a wooden craft.

2.2 Fish identification and dissection

Fish samples were placed in ice container and were shifted to the Department of Zoology Islamia College Peshawar, for identification, morphometric measurement and dissection. Fish were identified and acknowledged by prof. Dr. Ali Muhammad Yousafzai, following Butt and Mirza refrence method [19]. Fish samples were weighted, measured and washed down with distill water. Dissection was done to remove muscle, liver, intestine and gills and store in freezer at (-20 ^{0}C) for further investigation.

2.3 Digestion of Fish Samples for Heavy Metal Determination

The muscle, liver, intestine and gills of each fish samples (1gm) were dried oven at 1050 ˚C. The dried samples were ground with porcelain mortar and a pestle. The ground fish tissues were moved to a porcelain basin and put into a Thermicon P muffle furnace at a temperature of 550˚C for 3 hrs. Samples were digested with mixture of (HNO3: HClO4·H2SO4 = 10:4:1) at a rate of 5 mL/per 0.5 g of sample and were placed on a hot plate at 100˚C temperature until the liquor become clear. The clear digested liquors were filtered using Whatmann 541 filter paper and diluted tor 25 mL with distilled water. .50 ml of twice over distilled water. Determination of $Pb^{2+,}$ $Cd^{2+,}$ Cr^{3}+ Cu^{2+} and, Zn^{2+}, in the samples of Common carp (*Cyprinus carpio*) tissue were made directly on each final solution using Perkin-Elmer AAnalyst 300 Atomic Absorption Spectroscopy (AAS).

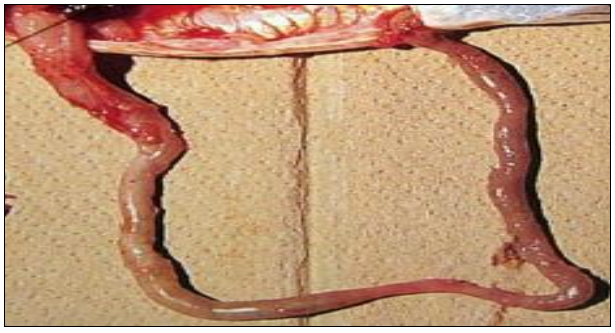
2.4 Statistical analysis

Mean and standard error of the mean of the data was taken.

Gills

Liver

Muscle



Intestine

3. Results

The present study was aimed to investigate the deposition of some heavy metals like of Pb, Cd, Cr, Cu and Zn in various organs such as gills, liver, muscles and intestine of *Cyprinus carpio* of River Kabul, Nowshera receiving Industrial effluents as showed in table no1.

In gills the deposition of metals was zinc> copper> lead> chromium> cadmium zinc> cupper> lead> chromium> cadmium. It shows that in gills zinc was found in highest concentration and cadmium was found in lowest.

Muscle tissues of *Cyprinus carpio* also have the highest concentration of zinc and lowest of cadmium. The order of the metal bioaccumulation in the muscle was the same as that of gills. The liver of fishes was processed for the further estimation and analyzing of Pb, Cd, Cr, Cu and Zn. This organ liver showed higher concentration of zinc, while cadmium was the lowest. The order of this bioaccumulation in this organ was zinc> copper> lead> chromium> cadmium. In fish intestine metal showed increasing tendency to accumulate. Table no 1, showed that the bioaccumulation of zinc was noted highest while cadmium was found lowest in intestine.

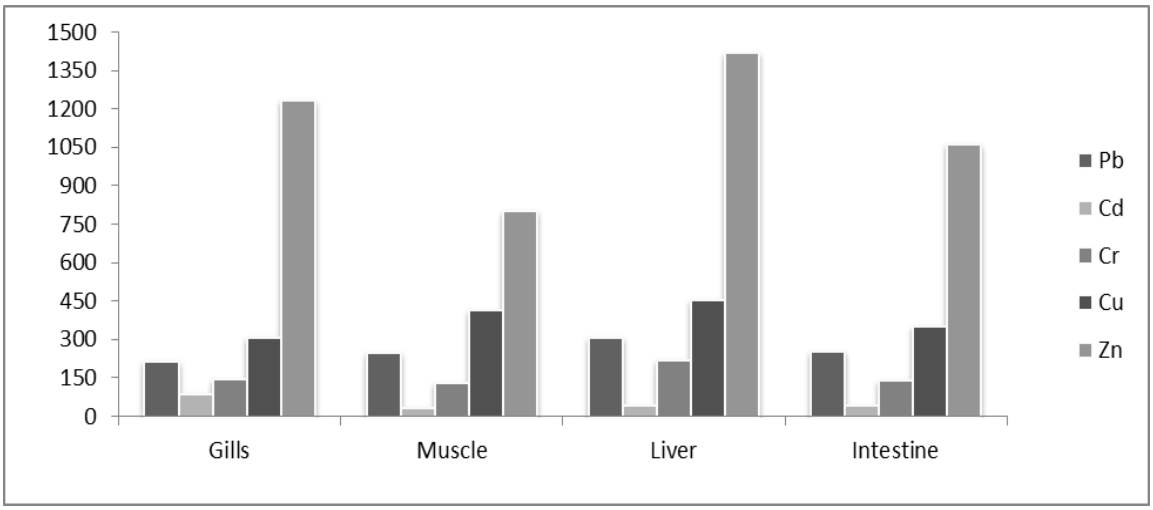


Fig 1: Heavy metals concentration (µg/g wet weight) in all parts of *Cyprinus carpio* from River Kabul Nowshera receiving Industrial effluents.

Table 1: Heavy metals like lead, cadmium, chromium, copper and zinc were analyzed in gills, muscle, liver and intestine of Common carp (*Cyprinus carpio*) netted from polluted water of River Kabul to estimate their bioaccumulation and possible toxic effects

Organs	Heavy metals (µg/g)	Mean	Mean±SE
Gills	Pb	215.20	215.20±41.38
	Cd	86.6	86.6±46.62
	Cr	145	145±28.77
	Cu	304.60	304.6±97.05
	Zn	1230.4	1230.4±464.69
Muscle	Pb	245.8	245.8±68.83
	Cd	31.20	31.20±5.33
	Cr	132.4	128.4±17.0
	Cu	411.80	411.80±67.65
	Zn	799.2	799.2±94.56
Liver	Pb	307.4	307.40±115.32
	Cd	39.8	39.8±9.32
	Cr	218.6	218.6±84.06
	Cu	452.60	452.60±214.93
	Zn	1419.2	1419.2±418.58
Intestine	Pb	251.40	251.40±73.64
	Cd	41	41±10.33
	Cr	138.8	138.2±.31.36
	Cu	352.8	352.8±111.25
	Zn	1063	1063±242.72

4. Discussion

Heavy metals like Pb, Cd, Cu, Cr, are distinguished to have deleteriously effects on muscle, liver, kidney and many others supplementary organs of aquatic organisms especially fish and cause abnormality in metabolism, development and intensification of fish species [20, 21, 22]. Therefore, current study was aimed to determine bio-amassing and harmful effects of these trace elements on Common carp (*Cyprinus carpio*) netted from most polluted water of river Kabul KPK, Pak, in Gills, Muscles, Liver and Intestine. Metal obtain through organisms by within a two stage progression, first exterior route absorption and then tissues incorporation, next is intra cellular transportation that makes easy their diffusion to a carrier protein of the cell membrane or else through active transport [23]. Gills are major osmoregulation and respiration organ in fishes hence greatly exposed to many of liquefy effluents, contamination and heavy metals [24, 25] who proved that gills are one of the most useable bio indicator to identify lead contamination. In the present study metal concentration in the gill was recorded as zinc> copper> lead> chromium> cadmium. This showed that zinc is the highest and cadmium is lowest in gills as compared to other metals [26, 27] have showed the greater accumulation of zinc in gills of fresh water Cray fish, *Astacus lepodactylus.* Similar study was conducted by Yousafzai [28] on metals like (Zn, Cr, Ni, Cu, Pb and Cd) in tissues of *Wallago attu* and *Labeo dyocheilus*. In both species the bio-accumulation of metals was different. In past studies [29] have recorded 388 (µg/g wet weight) of Zinc in the muscle of gray whale and Olaifa [30] has recorded 0.66 and 0.729 (ppm) of Zinc in the muscle of fish *Clarias garienus* from Eleiyelea lake and Zartech pond in Ibandan, Nigeria. Liver in fish is a defensive organ by job however it is a storage site for various metal contamination [31, 32]. In the present study liver of Common carp, *Cyprinus carpio* showed metal concentration in order of zinc> copper> lead> chromium> cadmium. This shows highest concentration of zinc and lowest of cadmium. Zinc might however spawn noxious to fish by getting in the way with calcium homeostasis [33, 34]. Recently Ahmad *et al*., [35] have recorded the highest level of zinc in the liver of *Aorichthys seenghala.* The intestine which is potentially very necessary part for Zn assimilation and absorption, but less is recognized about this uptake [36]. In intestine once again zinc was found highest in concentration while cadmium was noted lowest. The order of metal bioaccumulation in this organ was zinc> copper> lead> chromium> cadmium.

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6. Conclusion

Based on the result of this study, liver and gills accumulated the higher levels of heavy metals as compared to muscles and intestine in *Cyprinus carpio*. This accumulated levels did not exceeds the permissible limits set for heavy metals by FAO, FEPA and WHO). Therefore this fish did not pose any hazard to human upon their consumption. However the contamination of River Kabul, with toxic waste causes sub lethal effects upon *Cyprinus carpio* and thus diminishes the development of this fish population.

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