Pakistan Journal of Aqua Biosciences
Vol. 2 (1), Jul, 2025 pp. 12-22

Analysis of Heavy Metals in Common Fishes of River Panjkura Dir Lower

Islam Habib, Gul Nabi Khan* and Muhammed Ali Yousafzai
Department of Zoology
Islamia College University Peshawar
*[E-mail: gulnabi@icp.edu.pk]

Heavy metals are metallic elements that pose significant dangers and can be lethal even at low concentrations. Both humans and aquatic organisms, particularly fish, are adversely affected by heavy metal pollution. The accumulation of heavy metals is a leading cause of contamination in aquatic environments due to their persistent and non-degradable characteristics. This study aimed to investigate the heavy metal contamination present in the Panjkura River located in Dir Lower, Khyber Pakhtunkhwa, Pakistan. Fish samples were collected from various sites along the river during the months of July, August, and September 2017, and after taxonomic identification five primary fish species selected for further analysis were *Schizothorax esosinus, Schizothorax plagiostomus, Tor putitora* (mahseer)*, Cyprinus carpio,* and *Rita rita*. Four key organs of the fish—muscles, gills, skin, and intestine—were isolated and processed for the quantification of heavy metals. Atomic absorption spectrophotometry was employed to measure five representative heavy metals (mg/L), namely Chromium (Cr), Cadmium (Cd), Lead (Pb), Copper (Cu), and Zinc (Zn). The analysis revealed that Zinc (Zn) was present in higher concentrations, whereas Lead (Pb) was detected at lower concentrations across the various fish organs of all species. The highest concentration of Zinc (0.22±0.0212) was recorded in the muscle tissue of *Cyprinus carpio*, while the lowest concentration of Zinc (0.11±0.015) was found in the muscle of *Schizothorax esosinus*. Additionally, the highest accumulation of Lead (0.028±0.0007) was observed in the gills of *Schizothorax plagiostomus*. The order of heavy metal accumulation in the various organs of all analyzed species was determined to be Zn>Cu>Cr>Cd>Pb. Overall, the highest concentration of Zinc was detected in the tissues of the examined fish, while the concentrations of other heavy metals varied across different organs.

[**Keywords:** Heavy metals, Fishes, Muscle, and Skin, Gills, Intestine, River Punjkora]

INTRODUCTION

One of the significant ecological challenges confronting the globe today is the pollution of aquatic ecosystems (Nkwachukwu et al., 2013). The various pollutants affecting aquatic environments encompass a wide range of categories, including mineral substances (harmful NaCl, HCcl, and heavy metals), carbon-based compounds (solvents, fuel residues, pesticides, etc.), both positively and negatively charged ions (phosphate, NO2, SO2, Mg2+, Ca2+, and F−), water-soluble radioactive materials, and pathogenic microorganisms (viruses, bacteria, and small protists) (Hubbe et al., 2014). The presence of heavy metal contamination in rivers adversely affects both fish populations and human water consumption. The primary contributor to pollution in aquatic systems is the accumulation of heavy metals, which are characterized by their non-biodegradable nature in the food chain (Fashola et al., 2016). Most water bodies are tainted by human activities due to organic and inorganic pollutants that become associated with these water sources and are ingested by fish and other aquatic organisms (Vu et al., 2017). Understanding the types of trace metals present in fish through feeding and metabolic pathways necessitates a comprehensive grasp of pollution accumulation in aquatic species. Heavy metals have a detrimental effect on aquatic life, as the bioaccumulation of these metals serves as a technological method for detecting their presence in water bodies. As a result, there is a concerning migration of heavy metals into freshwater systems (Griboff et al., 2020). Water is one of the essential resources on Earth that sustains life as we know it (Dris et al., 2015). Unpolluted water sources are crucial for ecological advancement (Qin et al., 2019). Rivers are vital for the development of human societies as they provide water for various human activities (Singh et al., 2021). As the global population continues to expand, there is generally adequate production of resources for chemicals (Sarkis et al., 2020). Consequently, fish residing in aquatic environments serve as both wise and valuable sources of protein. Annually, there has been a rise in the demand for this product. Fish species contribute approximately 25% of the dietary proteins consumed by humans (Hovland et al., 2020). Globally, fish species represent a vital source of protein (Du Preez and Steyn, 1992). Essential fatty acids derived from fish can lead to heart issues and bleeding disorders. While they help