Indian Farmer
Volume 9, Issue 03, 2022, Pp. 95-99.
Available online at: www.indianfarmer.net
ISSN: 2394-1227 (Online)

ORIGINAL PAPER

Heavy metals and their impact on aquatic life

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Article Received: 24 February 2022 *Published Date: 01 March 2022*

ABSTRACT

Heavy metals (HM) are naturally occurring trace elements in water, but their levels have risen as a due to industrial waste, geochemical structure, agricultural, and mining activities. All of these pollution sources impact the physicochemical properties of water, sediments, and biological components, affecting the quality and quantity of fish stocks. Environmental pollution is the major issue, and heavy metals are one of the most significant pollutant threats. The advancement of industry has led to an increase in pollution emissions into the ecosystem. Poisoning, illnesses, and even death can occur as a consequence of environmental pollution. Different biological systems absorb and accumulate different contaminants in different ways. As a consequence, the current review paper has three aims: first, to highlight the impact of heavy metal bioaccumulation in various organs of fish, as well as the factors that influence their spread. The second goal is to keep track of the biomarkers that are used to determine and diagnose heavy metal toxicity and pollution.

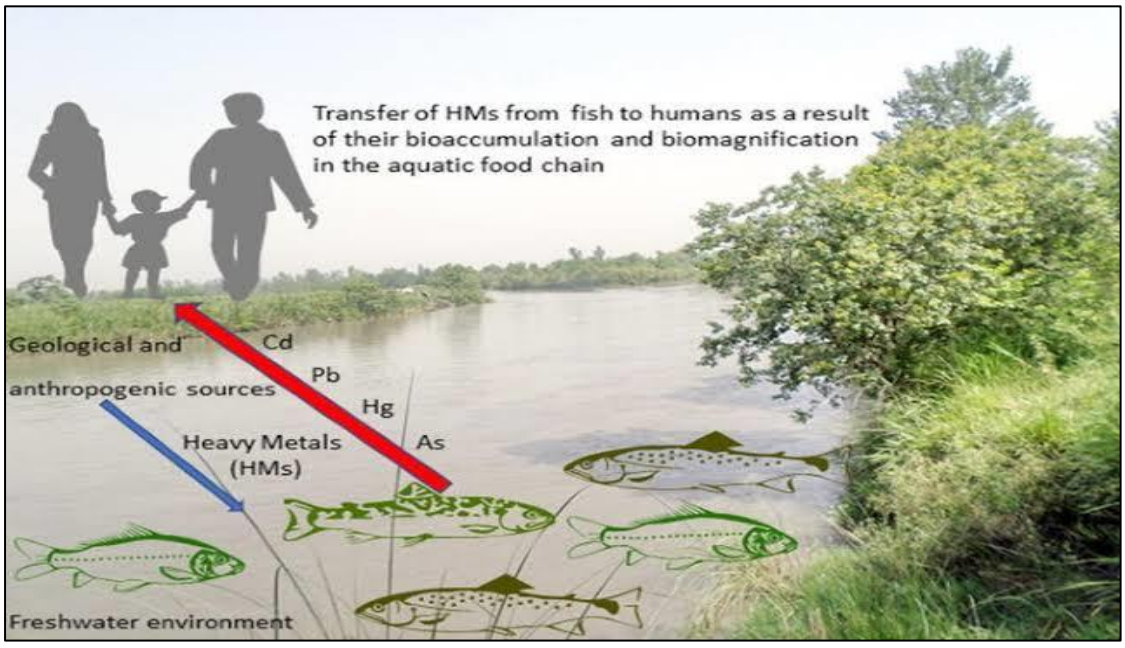
INTRODUCTION

The worldwide problem is the environmental pollution. Heavy metals are the most important contaminants in the aquatic ecosystem because of their toxicity, accumulation, and bio-magnification by marine animals. Heavy metals may be released into natural aquatic systems as a result of domestic, industrial, and anthropogenic processes. Heavy metals, for illustration, accumulate in the environment in the food chain and lead to adverse, including death, so fish and other wild creatures are used to assess the health of the aquatic ecosystem. Because of fish's ability to bio accumulate

metals, some species get more accumulation patterns than others. Heavy metals in fish are primarily derived from their diet, and levels of contaminant bioaccumulation are higher in fish which are higher in the food chain. Metal residual issues in the fish epithelial cells are severe, because of the presence of higher metal content in water and sediments. Heavy metals, on the other hand, are a major source of concern in this regard because of their ability to easily accumulate in the food chain due to bioaccumulation processes. Heavy metals are major pollutants for fish because they are not removed from aquatic systems through natural phenomena, such as organic pollutants, and are abundant in mineral organic compounds. Through the smelting process, effluents, sewage, and waste leaching, metal pollutants are mixed in the aquatic system, causing serious harm to the aquatic system.

Environmental and Health Risks by Heavy Metals

The heavy metals are accumulated in living creatures when they are taken up, and stored faster than they are broken down (metabolized) or released. Industrial and consumer goods, as well as acidic rain that breaks down soils and releases heavy metals into streams, lakes, rivers, and groundwater, all contribute to heavy metal contamination of the water supply. Pb, Hg, and Cd are the three most polluting/environmental heavy metals that have been recorded, however other heavy metals can also harm the environment. Heavy metal toxicity has been linked to a variety of sources, including pollution of drinking water (Pb pipes), high ambient air concentrations near anthropogenic emissions, and food chain contamination. Because heavy metals bioaccumulation, they are poisonous. The term "bioaccumulation" refers to the increase in the level of a chemical or toxin in a biological organism over time when compared to the level of the chemical or toxin in the environment.



Heavy Metals Effects on Fish

Heavy metal toxicity can impact fish growth rates, physiological functions, mortality, and reproduction. Heavy metals can enter the bodies of fish in three ways: through the gills, the digestive tract, or the body surface. The gills are thought to be the most important site for direct metal uptake from the water, despite the fact that the body surface is only thought to have a minimal role in heavy metal uptake in fish. Heavy metal accumulation can also be produced by the food source, which can lead to bio-magnification, or the augmentation of pollutants up the food chain.

Chromium's Effects on Fish

Heavy metal accumulates in fish as a result of intake of food in the environment or from the surrounding water. This metal has contaminated natural water as a result of anthropogenic activity. According to the EPA, chromium concentrations in rivers and lakes range from 1 to 10 µg/L, with a permitted maximum of 50 to 100 µg Cr/L for public health and aquatic life protection. Anemia, eosinophilia, and lymphocytosis, as well as bronchial and renal disorders, are all symptoms of chromium poisoning in some fish species. Chromium is renowned for its lower accumulation in fish bodies, however higher Cr concentrations disrupt the gills of fish swimming near a Cr disposal site.

Effect of Chromium on Humans by Fish Consumption

Fish at the top of the food chain collect huge amounts of metals, which are dependent on their intake and excretion from the body. Cr is toxic to humans, particularly those who work in the textile and steel industries. Tobacco smokers are also more likely to disclose to Cr. Chromium has a wide range of health implications. Chromium in leather items can induce a rash similar to an allergic response on the skin. Cr can cause irritation and produce nosebleeds when breathed.

Other health problems caused by Cr are: Faded immune system, Skin diseases, Cause ulcer and upset stomach, Respiratory track problem, Alteration in genetic material, Lung cancer, Liver and kidney damage and Death.

Cadmium's Effects on Fish

Cadmium is a non-essential and highly toxic heavy metal found in the aquatic environment and the earth's crust. Lead, mercury, and cadmium are among the heavy metals which are thought to be detrimental to public health. Cadmium can also be released into the environment by smelters of zinc, lead, or copper. It can get into fresh water through industrial and domestic waste disposal. Cadmium is commonly found in fertilisers. Exposure to heavy metals can alter aquatic creatures' reproduction rates, which can lead to the systematic extinction of generations in contaminated waterways. Cd and mercury (Hg), for example, disrupt the kidneys and lead to chronic toxicity symptoms such as decreased reproductive capacity and kidney function, cancers, hypertension, and hepatic dysfunction. Fish is one of the most important sources of protein for humans. Fish are an important element of the human diet, thus it's not

surprising that numerous studies on metal pollution in various edible fish species have been studied.

Human Health Effects of Cadmium from Fish Consumption

Unfortunately, chemical pollutants are stored in the fish's lipid component, so they are well protected when they enter the human body. It's possible that wild fish from polluted areas are significantly contaminated. Non-essential metals such as cadmium, mercury, arsenic, and lead have hazardous effects on living organisms. These heavy metals accumulate at larger quantities in aquatic species' tissues and bodies than in water, and are bio accumulated in the food chain, causing physiological damage at higher trophic levels and in human consumers. Cd is primarily ingested by humans through food. Higher Cd levels in food materials can substantially enhance Cd levels in human bodies. Fish liver, shellfish, mushrooms, dried seaweed, and other foods high in Cd are examples. Cd is initially carried to the liver via the bloodstream, where it binds to proteins to form complexes, which are then transported to the kidneys, where it damages the purification systems. As a result, carbohydrates and important proteins are excreted from the body, further damaging the kidneys. It takes time for Cd to build up in the kidneys and be eliminated from the human body.

Other related health effects caused by cadmium are: Diarrhea, Vomiting, Stomach problems, Fractures in bone, Damage to DNA, Failure in reproduction and fertility, Cause damage to nervous system, Damage to immune system and Cause cancer.

Zinc's Effects on Fish

Zinc can build up in their bodies of fish, when they live in zinc contaminated water courses. When zinc enters into the bodies of the fishes, causing bio magnification up the food chain. The Zn concentrations in fish tissue decreased significantly with increasing length of the fish, is regarded as a controversial subject, Zinc, an essential element, is one of the most prevalent heavy metal contaminants. Changes in ventilatory and cardiac physiology are also caused by zinc pollution. Fish hatchability, existence, and haematological strictures have all been documented to be adversely affected by sub-lethal zinc levels. Zinc has the potential to alter fish behaviour in the long term. Restless swimming, air guzzling, periods of lethargy, and mortality are all observed behaviours. Because it only changes oxidation states or organic complexes and cannot be removed biologically, the Zn threat is regarded as particularly significant. Zinc is a possible toxicant to fish, causing acid-base and ion regulation problems, as well as gill tissue damage and hypoxia.

Effects of Zinc on Humans Health Due to Fish Consumption

Its need of time to determine the concentrations of heavy metals in commercial fish and shrimps in order to determine the possible risk of human intake. Heavy metal build up in tissues is primarily influenced by metal concentrations in water and exposure time, however other environmental parameters such as salinity, pH, hardness, and temperature also play a role. Zinc is a one-of-a-kind element that isn't absolutely necessary for human health. When people are exposed to low levels of Zn, they may feel

a loss of taste and smell, as well as a lack of appetite, poor wound healing, and skin sores. Zn deficiency can even result in birth abnormalities. Although humans are capable of handling high quantities of Zn, too much Zn can cause serious health problems such as stomach pains, anaemia, vomiting, and nausea. High Zn levels harm the pancreas, disrupt protein metabolism, and lead to arteriosclerosis. Respiratory problems can be caused by prolonged exposure to Zn chloride.

Lead's Effects on Fish

Accumulated heavy metals in the tissues of aquatic animals can become poisonous when they reach a significant level of accumulation. Heavy metals may be taken up in large quantities by aquatic organisms exposed to greater concentrations of heavy metals in water. Bio-magnification of a contaminant can result in toxic levels in higher-trophic-level species and freshwater systems. Lead (Pb) is a dangerous contaminant in the environment. Because of the significant risks it poses to human health, lead toxicity has gained a lot of attention. Fish is usually one of the most popular foods. Food ingestion and breathing are the primary routes of Pb exposure for both fish and humans. Lead builds up in the muscles, bones, blood, and fat of the body. Even low levels of lead can be dangerous to new-born and young children.

Effected organs - The liver, kidneys, brain, nerves, and other organs are all badly damaged by Pb. Pb poisoning can also cause problems with reproduction. bone thinning (brittle bone disease)

Affects the blood and heart -Heart disease and high blood pressure are linked to pb exposure, especially in men. Anemia is another symptom of Pb poisoning.

Affects the nerves system and brain - Pb exposure causes memory issues, behavioural disorders, and mental retardation in adults, while low levels of Pb harm the nerves and brain in foetuses and young children, resulting in reduced IQ and learning deficiencies.

Effects on Fish - Runoff, industrial, and sewage waste streams can introduce lead to water systems. Increased Pb levels in the water can harm aquatic life and induce blood and neurological system alterations in mammals, fish, and other aquatic creatures.

CONCLUSION

Cd, Cr, Pb and Zn are the poisonous heavy metals to humans, animals, fish, and the environment. Substantial quantities of heavy metals are extremely harmful. Although some heavy metals are necessary for the survival of animals, plants, and other organisms, all heavy metals have harmful consequences that are manifested through metabolic interference and mutagenesis. Pb causes severe poisoning in everyone. Fish are not immune to heavy metal contamination, and they may be extremely polluted, causing serious issues and side effects. Heavy metals have a variety of harmful impact on different organs. They can enter the water in a variety of ways, including drainage, the atmosphere, soil erosion, and all human activities. As heavy metals accumulate in the environment, they enter the biogeochemical cycle, causing toxicity in animals, including fish.