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EFFECT OF WATER POLLUTION ON FISH HEALTH

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Abstract:

Heavy metals (HM) are traces of the aquatic environment that occur naturally; nevertheless, because of the presence of mining operations, agricultural practises, geochemical structures, and industrial waste, their concentrations have increased. The physicochemical characteristics of the water, sediments, and biological components are all negatively influenced by the combined effects of all of these distinct forms of pollution, which in turn has a negative effect on the quality and quantity of fish populations. One of the biggest challenges created by polluting contaminants is heavy metal pollution. The issue of environmental contamination is one that the entire world must deal with. An increased amount of pollution has been discharged into the environment as a result of the growth of industry. Environmental pollution may increase fish's susceptibility to disease and even cause their demise. The ability of diverse biological systems to absorb and accumulate different pollutants varies greatly. The current review article therefore has three main goals: first, to explain the effects of heavy metal bioaccumulation in different fish organs and the variables influencing their dispersal; second, to highlight the causes of heavy metal bioaccumulation; and third, to give an overview of these goals. Second, we must monitor the biomarkers used in assessments and diagnoses of heavy metal toxicity and pollution. Last but not least, the role that histological examinations play in the diagnosis of fish illnesses contributed to the presence of heavy metals.

Key words: *Heavy Metals, Fish Pollution*

INTRODUCTION

There are several locations across the world that are appropriate for fish farming. Fish are creatures that live in saltwater, have scales on their bodies, and swim. Because there are not enough sources of protein for the aquatic environment and because fish are susceptible to metal contamination due to the vastly increased population in the countries of the third world, fish farming has gained popularity as an alternative source of effects of metal pollution in waters. This is because there are not enough sources of protein for the aquatic environment. This might be interpreted as a reflection of how widespread the biological impacts of metal contamination in waterways have become. a source of protein that doesn't break the bank

Having said that, with respect to a handful of these Because fish is a healthy and economical source of protein, many nations' fish farming operations make use of recycled water from agricultural drainage, industrial drainage, or even sewage. This is because fish is an excellent source of both. Fish has a high economic value for a number of reasons, and this is one of them. These minerals, together with a richness in non-saturated fatty acids and sources of recycled water, make up a health challenge known as Omega-3 fatty acids, which contribute to the reduction of blood cholesterol and help prevent heart dysfunction (arteriosclerosis).

The issue of environmental pollution is one that is relevant to the entirety of the earth. We may draw the conclusion that heavy metals are among the most significant pollutants given that water is the natural resource that is of the utmost importance.existence in this world and is necessary for both one's own survival and the The growth of contemporary technology has been accompanied by a rise in emissions due to the success of many sectors. Hence, a rapid introduction of contaminants into ecosystems [6]. Environmental pollution The industrialization of land and sea is one of the primary contributors to water pollution, which may result in toxicity, sickness, and even the death of fish. Wastewater that has been discharged has been utilised in, and the processes of absorption and buildup of contaminants by various biological tissues are distinct for each kind of tissue. The density of a heavy metal is often considered to be the defining characteristic of a heavy metal since this property is taken into account in the majority of biological situations involving the absorption of heavy metal components. HM are typically tissues found on contaminants, which is a significant concern in the field of biomedicine. HM are referred as as substances that have a particular density that is more than. When we talk about pollution, what we mean specifically is the introduction of 5g/cm of foreign matter. The most significant threat that HM poses to the health of humans is the introduction of new chemicals into the biosphere. It is possible for some of the xenobiotic chemicals that are associated with lead, cadmium, mercury, and other pollutants to enter the human arsenic (arsenic is a metalloid, although it is frequently classified as system through the food chain. There is a possibility that the body contains heavy metals and other pollutants. Heavy metals have been utilised in a wide variety of industries for thousands of years, and it is possible that some of these metals even undergo biotransformation, metabolism, and excretion.

Lead has been used in building materials for at least 5000 years without the risk of toxicity, although this is dependant on the chemical that was used at the time, the characteristics of these compounds, and the dose that was utilised. materials for glazing ceramics, including pigments and other materials, as well as pipes for Despite this, some of the pollutants are resistant to transfer by chemical means and those that include water. In ancient Rome, lead acetate was used to sweeten old wine, and it underwent a biological transition and accumulated in the tissues as a result. This might have led to poisoning in a number of organs and tissues, including the liver, kidney, and nerves . ingested up to one gramme of lead every single day. Mercury was in the The term "water pollution" refers to the introduction of harmful substances or energies into the aquatic environment as a result of human activity. It is believed that the Romans applied a substance or energy, either directly or indirectly, to alleviate the discomfort caused by teething in infants. This practise was later (during the 13th to 18th centuries) used as a treatment for syphilis. It has been known for a considerable

amount of time that the continuous exposure to heavy metals and the reduction in climate change have adverse health effects, such as hazards to human health and the impediment of fish activities. Climate change has also reduced the amount of oxygen in the atmosphere, which has further reduced the amount of oxygen available to fish.

These impacts are a direct result of the deterioration in the quality of the water as well as the deterioration in the climate. In addition, pollution is produced wherever there is an input from mining present in a number of places throughout South America. Even though the naturally occurring background level for that region and for those uses has significantly decreased in the developed organisms, arsenic is still a common constituent in wood preservatives and tetraethyl fresh or seawater, sediments, and organisms above the lead remains a common additive to gasoline. This is the case despite the fact that arsenic is still a common constituent in wood preservatives. The growth of manufacturing in the world's less developed nations. From the middle of the 19th century, industrial and underdeveloped nations have resulted in heavy metal pollution of local water. This contamination has persisted for more than a century and has been caused by a rise in the concentration of heavy metals. Pollution from metals may be harmful to the environment, especially when combined with other emissions .

aquatic animals (either fresh or sea water) at the HM infiltrate our bodies through the cellular levels and perhaps alter the ecological equilibrium. to a minor degree. food/drinking water and air are both necessities. Exposure to polluted aquatic and marine heavy metals (such as copper, selenium, and zinc), which are essential as trace elements, can cause a variety of health problems in the human body and interfere with its ability to properly maintain its metabolism. This can occur both through consumption of the polluted heavy metals and through exposure to the heavy metals through exposure. Examples of such products include seafood. neurological conditions affecting humans and animals, both Nonetheless, research has shown that exposure to them in greater doses might cause reproductive issues . Poisoning is almost always the result of contamination. HM poisoning could be the result of, for example, contaminated-drinking water (lead pipes), high ambient air billion (ppb=ng/L) concentrations and measured as "wet weight" concentrations near emission sources, or intake via the (contamination in moist water containing-tissues), or as food chain. HM poisoning could also be the result of intake via the (contamination in moist water containing-tissues), or as food chain. These factors are measured as parts per million (ppm=g/L) or parts per billion (ppb=ng/L). The tendency of heavy metals to bioaccumulate in the body makes them very hazardous. "Dry weight" refers to the contamination that occurs as tissues lose water. Bioaccumulation is defined as a rise in the concentration of a chemical in a biological system, and although water content may fluctuate quite a bit, researchers discovered that weight was a more accurate measurement . the evolution of a biological creature such as a fish over the course of time, compared The phrase "heavy metal" refers to any metallic chemical that has a high concentration of that chemical in its surrounding environment. element that has a high density compared to its size and is either poisonous or Chemicals are more likely to build up in living organisms if there is evidence that they are toxic at low quantities. Mercury (Hg), cadmium (Cd), and arsenic (AS) are some examples of heavy metals that may be metabolised or excreted. These heavy metals are also taken in and stored quicker than they are broken

down. The elements chromium (Cr), thallium (Ti), and lead are all capable of introducing HM into a water source (Pb).

The crust of the earth naturally contains heavy metals, which may come from a variety of sources including industrial and consumer waste, as well as acid rain. They couldn't be degrading the soil and releasing heavy metals into the environment in the process of doing so, can they? Heavy metals (HM) may be found in ground water, rivers, and streams that are natural [14]. Heavy metal is a trace component that is discovered in the aquatic environment; however, it is a member of a loosely defined collection of elements whose levels have grown as a result of industrial waste and demonstrates metallic qualities. Additionally, heavy metal is a component that is found in the aquatic environment. The principal components of this element are the geochemical structure, agricultural and mining activities, transition metals, some metalloids, and lanthanides. Other components include certain metalloids. All of these distinct kinds of pollution have an effect on the actinides. There are several other definitions that have been proposed, some of which centre on the physicochemical attributes of the water and sediments, others on an atomic number or atomic weight, and yet others on the chemical properties or toxicity quantity of fish stocks. In the absence of any definitive evidence, it seems that.

According to Alrumman et al. (2016), water pollution occurs when undesirable substances enter water bodies and cause a change in water quality. As a result, polluted water is hazardous to both the health of humans and the environment in which they live (Briggs, 2003). Water is an essential natural resource that is utilised for drinking and a variety of other developmental reasons. It also plays a vital part in the recycling of nutrients.

Aquatic systems are often used for the disposal of sewage and other polluted wastes, as well as the reutilization of these materials. Any surplus water is then drained into the ocean. Their assimilative volume has significantly decreased as a result of a rise in the level of pollution and, as a consequence of this, the overexploitation of water resources for a variety of developmental activities, such as agriculture, construction activities, industrial processes, and even in thermal power plants to meet the requirements of a large-scale population. These activities include things like agriculture, construction activities, and industrial processes. So, the biological groups that inhabit water bodies will ultimately have to deal with the twofold pressure that is exerted on water bodies. In general, fish communities are considered to be one of the most significant aquatic communities with regard to human beings. A change in the natural quality of any ecosystem that is brought about by differences in the ecosystem's physical, chemical, or biological constituents is referred to as "pollution." The word "pollution" refers to any undesired alteration in the natural quality of any ecosystem (Subhendu, 2000). The great majority of pollutants originate from domestic, municipal, and industrial sources (Figure 1), including a variety of farming operations, which lead to the discharge of pollutants into the system of rivers and streams. Because of this, aquatic ecosystems are in a precarious position and are exposed to a significant amount of danger (Kaur and Dua, 2014; Pinto et al., 2015; Byrne et al., 2015). Heavy metals and pesticides are the two categories of contaminants that are discovered in aquatic habitats more frequently

than any others. The majority of these pollutants may be discovered in water (Khoshnood, 2016).

Heavy metals are one of the most major pollutants because they are easily absorbed by the bodies of aquatic species, where they are then gradually broken down and ejected from the body. Heavy metals are one of the most significant contaminants. The vast majority of pesticides that are used in agricultural activities are released directly into the open atmosphere through the basic processes of drift spray, volatilization, and wind erosion of soil (Qiu et al., 2004). It is possible that the presence of these pesticides in aquatic environments will cause disruptions in the life cycles of aquatic organisms (Ventura et al., 2008). As the population rate has increased, which has resulted in an increase in the development rate, the urbanisation rate has also increased, which has resulted in an increase in the rate of water pollution caused by household activities, agronomic processes, municipal processes, and industrial processes. This has become a critical worry for the wellbeing of mankind. The water-soluble pollutants that were released into the environment as a result of a variety of commercial and municipal operations were initially leached into the soil, and then the atmosphere carried them quickly to natural bodies of water. This process was repeated until the pollutants reached their final destination.

The remaining toxins will precipitate and get mixed with the substrate on the bed surface, while a part of the toxins will breakdown or volatilize to generate insoluble salts. This will happen while creating insoluble salts. Fish species are the perfect model for sensing the presence of genotoxic toxins in aquatic ecosystems (Aich et al., 2015; Walia et al., 2015; Sharma et al., 2018). This is due to the fact that these aquatic organisms are extremely sensitive to small quantities of metals within the water body, that they are abundant, and that they also live in some different habitats. (Walia et al., 2015; Sharma et al., 2018) There is no better model for detecting the presence of genotoxic chemicals in aquatic environments than the many kinds of fish (Ali et al., 2008). It is possible for aquatic organisms like fish species to rapidly absorb these deadly chemicals, which is then perhaps followed by the metabolism of these toxic molecules, which creates more damaging byproducts. For example, bacteria have the potential to transform mercury into the extremely toxic compound known as methylmercury, which is subsequently ingested by a variety of species of fish (Bukola et al., 2015). Fish fry, fish larvae, yearlings, and fingerlings are among the life stages that are among the most sensitive to being adversely influenced by exposure to pesticides and heavy metal pollution. This is because fish fry and larvae are non-target aquatic organisms. Fry, larvae, yearlings, and fingerlings are the several stages that make up a fish's existence. The physiology, rate of survival, osmoregulation, buoyancy, reproductive processes, and other functions might possibly be disrupted by changes to the key organs, such as the gills, kidneys, and liver. This could then result in failures in stock conscription and changes to the population (Khoshnood, 2017). It has been revealed that certain aquatic species may concentrate the hazardous solutes that are prevalent in their ecosystem without appearing to incur any negative consequences as a result of doing so. This discovery was made possible because to recent advancements in scientific research. As a consequence of this, these animals serve as pollution amplifiers, which causes the poisonous compounds that are available to predators to be present at levels that are potentially hazardous.

Not only have there been reports of some cases demonstrating the bad impacts that environmental pollutants have had, but there have also been reports of some instances indicating the negative effects that environmental contaminants have had on the health of consumers of fish. A higher strain than ever before is being placed on the aquatic ecosystem as a direct result of the growth in the number of human activities. This underscores the crucial need for in-depth study on the harmful impacts of water pollution and the possible threats it presents to aquatic animals and the ecosystems in which they reside. Such research is essential and urgently required. Numerous scientific investigations have been carried out, and the findings of those investigations have demonstrated that aquatic organisms that inhabit water bodies have experienced a variety of potentially harmful effects of water pollution. These effects have been observed in the water bodies themselves. It is anticipated that the diminishing fish populations and the decreased number of fish harvested for commercial purposes would create substantial shifts in the aquatic environment..

OBJECTIVES

- To investigate the impact that water pollution has on the health of fish
- To investigate the histopathological alterations that water pollution has generated in fish organs

IMPACTS OF POLLUTANTS ON SURVIVAL OF FISH SPECIES

The usual behaviour of fish populations might be disrupted when there is a high concentration of contaminants that are floating in the water. Certain fish species, such as perch, brown trout, and others, are especially vulnerable to the large amount of suspended solids and display extremely severe avoidance behaviour as a result. This is because these fish depend on sight to swiftly grab their meal. While a fish species is able to thrive in an environment with turbid water, the presence of suspended particles may obstruct or damage the gill aperture, which in turn lowers the fish's resistance to a variety of diseases and parasites (EPA, 2012). Fish species may also eat these floating particles, which might result in disease due to exposure to any poisons or infections that are present on the sediment. It is possible for the fish species to experience changes to their blood profile as well as harm to their development even if they do not perish from swallowing the suspended particles (EPA, 2012). Pollutants in the water may reduce the egg and the embryo by lowering the amount of DO. Pollutants disrupt a wide variety of physiological processes, although they do not always lead to death. The whole mucous membrane of fish gills is covered in toxic components, and suspended dregs impede the normally occurring functions of the respiratory system. Mercury and lead are the two principal elements that are responsible for inhibiting the function of digestive enzymes.

WATER POLLUTION CAUSED CHANGES IN THE HISTOPATHOLOGY OF FISH ORGANS AND TISSUES

The organisation of body tissue is the subject of histopathology. Any abnormal alteration in the cells might be a sign of a number of diseases as well as the presence of dangerous substances. In their research, Abdullah et al. (2008) found that Tilapia nilotica reared in

contaminated water containing heavy metals exhibited a variety of histological alterations in their liver. These alterations included a pronounced coagulative necrosis, vacuolar and hydropic abnormalities of the hepatocytes, and hazy swelling. The clinical changes in the gills and liver of Alburnus alburnus and Perch from polluted Dame Lake were examined by Velcheva et al. (2010). They showed that the hepatocytes' cytoplasm was degenerating, leading to their final necrosis and infiltration by inflammatory cells. The fish species Tilapia nilotica had scratches that were fairly comparable, according to (Abdullah et al., 2008). The histological differences that occurred in the liver, kidneys, and muscles of cyprinid fish species from the polluted River Kor were recently described by Ebrahimi and Taherianfard (2011). These alterations in the fish organ and tissue comprised hemosiderosis, melanophages hyperactivation, biliary canaliculi dilatation, and perivascular edoema. Moreover, heavy metal pollution greatly harmed the skin of the tilapia species, showing hyperactivation of goblet cells, dermal melanosis, and dermal granuloma. Comparable interstitial nephritis, renal necrosis, and mononuclear cell infiltration were seen in the kidneys of carp fish that had been exposed to polluted water. Moreover, the brain exhibits gliosis and meningitis dermal granuloma symptoms.

pollutants' effects on the liver of fish El-Naggar et al. (2009) found that all fish species' livers play a substantial role in the digestive activity that takes place during filtration as well as the storage of glucose. The gall bladder is in charge of storing the bile produced by the liver, claim Tayel et al. (2008). Bile is furthermore created by the liver. As one of the liver's main functions is to eliminate any toxins or pollutants from the circulation, fish liver can be used as a good indicator of aquatic pollution (El-Naggar et al., 2009). (El-Naggar and others, 2009) The liver is one of the organs that is most vulnerable to harm from toxins in water. This is due to the liver's intimate involvement in the biotransformation and detoxification processes (Mohamed, 2009). Hepatocytes can undergo a number of alterations, such as hemosiderin, necrosis, fibrosis, pyknosis, and fatty degeneration, all of which are mostly brought on by heavy metal contamination. The livers of the Mugil capito and Mugil cephalus fish from Lake Manzalah have the same histopathological abnormalities (Kadry et al, 2003). According to Mohamed (2001), intravascular hemolysis in the blood arteries results from cellular damage that happens in the liver as a direct result of a lack of oxygen. Intravascular hemolysis subsequently causes the blood to become stagnant. It is possible that the combined effects of nutrients and salts lead to hepatocyte necrosis and degeneration (Authman and Abbas, 2007). Moreover, the accumulation of hemosiderin in the liver cells may be brought on by the continual and fast destruction of erythrocytes (Ibrahim and Mahmoud, 2005).

IMPACT OF POLLUTANTS ON KIDNEY

Fisheries and fish In a fish's body, the kidneys play an important role. They are accountable for crucial procedures, including as controlling the body's Advances in Environmental Pollution Management, 2020, D.S. Malik et al 23 Fluid and temperature equilibrium. The kidneys are in charge of removing waste from circulation, performing tasks including selective reabsorption, controlling blood volume, and maintaining the pH of physiological fluids and blood (Iqbal et al., 2004). The findings of the study by Thophon et al. (2003) indicate that the kidney was one of the first organs to be affected by the contaminants in the

polluted water. Mugil cephalus and Mugil capito fish obtained from Manzalah lake had kidneys that had histopathological changes of varied degrees of severity (Kadry et al, 2003). According to research by Mahmoud et al. (2008), exposure to contaminants from industrial and agricultural operations, as well as sewage, led to kidney injury in many fish species that live in different parts of the Nile river. Similar results were seen in C. carpio species that were exposed to sewage effluent (Kakutta and Murachi, 1997). The haematological tissue and renal tubules of rainbow trout included a significant number of necrotic cells that were dispersed throughout due to alterations in the quality of the water, such as an increase in pH level, temperature, or hardness (Capkin et al., 2006). The water had been altered, which was the reason of this. The findings of Kadry et al. revealed that the kidney tissue of Liza Ramada fish that was collected from tainted water in Manzalah lake showed some damage (2003). In the injured kidneys, degeneration of the renal tubules and distortion of the glomerular capillaries were seen.

CONCLUSION

Water quality might be lowered and aquatic animal life cycles could be disturbed if toxins and other kinds of unclean material find their way into aquatic habitats. Some pollutants are highly active and may affect aquatic creatures in terms of morphology and metabolism when they come into touch with them. Despite this, there is no evidence that suggests the presence of pollutants and poisons in the water is the real cause of the spread of disease in aquatic creatures. The prolonged exposure of such species to toxins has resulted in a constant threat to the health of aquatic organisms. As a result, both now and in the future, various human activities pose a bigger threat to aquatic life. These problems make it clear that everyone must take the required preventative measures in order to safeguard the aquatic populations. Researchers have occasionally noted that different contaminants have a range of effects on the populations of distinct fish species. Also, according to these experts, a persistent pollution level would affect aquatic life in a variety of ways, including changes in histopathological and physiological damage, migration, changes in embryonic and developmental processes, and, more particularly, changes in fish species. When environmental pollutants, such as organophosphate compounds, which are made up of several hazardous chemicals, are discharged into the atmosphere, fish populations may be wiped out. Thus, it is crucial to create some plans that utilise molecular biology methods in order to address these problems. With the use of these methods, toxicological evaluations should be modernised in a way that is both affordable and eliminates the need for aquatic animals to recognise environmental stresses. To ascertain the concentration level and exposure duration of each pollutant, more research has to be done. Moreover, it is crucial to demonstrate significant sub-lethal and deadly effects on aquatic creatures.

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