# A review on the effects of heavy metals on aquatic animals.

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## Abstract

**The development of industries and the uncontrolled increase of population, the development of agricultural areas and the use of fertilizers and pesticides have caused industrial and municipal wastewaters as well as agricultural effluents with heavy metals to enter water ecosystems. After entering aquatic ecosystems, heavy metals accumulate in aquatic tissues and eventually enter the food chain. After entering aquatic ecosystems, heavy metals accumulate in aquatic tissues and eventually enter the food chain. Research on heavy metal pollution in aquatic ecosystems is important from a public health perspective, maintaining the balance of those ecosystems and preventing biodegradation due to the adverse effects of pollutants. So, researchers have focused on determining the level of pollution of various water sources, how metals are absorbed by aquatic animals, bioaccumulation of heavy metals in various aquatic tissues and the possibility of using aquatic animals as biological indicators based on pollutant monitoring. Due to the importance of this issue, the present study has investigated the effect of heavy metals on fish.**

**Keywords:** Heavy metals, Elements, Aquatic, Pollutants.

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## Introduction

Heavy metals as a hazardous problem of various dimensions and can seriously endanger human life and other living organisms. One of the main sources of these factors are mines and volcanic dust, but in addition to these, humans themselves in various forms such as dyeing industry, metal plating and battery making in the release of heavy metals[1-9].

The presence of these factors in the environment in the long run leads to a decrease in aquatic reproductive capacity, respiratory and neurological problems, etc., and also due to its accumulation in the body (bioaccumulation) and their transmission to subsequent consumers, including humans, can have side effects. Create irreparable. One of the important sources of heavy metal transfer is the feed consumed by farmed fish. By measuring the two metals lead and iron, it is possible to understand the presence of these factors in the food and possibly their highness above the standard. Also, the study of the amount of these metals in the water and fish of farms in terms of comparison can give us a good solution in how to use these water resources or even fish farmed in these waters [10-14].

## Heavy Metals

In addition to carbohydrates, lipids, amino acids, and vitamins, some heavy metals are essential for the biological activity of cells. Some metals, such as iron, are vital to life, while others, such as copper, zinc, and lead, are essential for the activity of enzymes in small amount [15,16]. These metals are called heavy metals due to their high atomic weight. If the amount of these essential metals entering the body is too much, they can cause poisoning. Unnecessary heavy metals or seminiferous metals produce toxic effects in the body. In general, heavy metals in the environment are a potential hazard to living organisms. Humans and animals are always exposed to heavy metals. These metals bind to the body's essential compounds such as oxygen, sulfur, and nitrogen in groups such as S-S, SH, OH, COO, and COOH. Most of the essential compounds of the body, including enzymes and proteins, have such groups. As a result, heavy metals interrupt the activity of enzymes and disrupt the synthesis of essential compounds in the body [17].

## Origin of Heavy Metals

These metals are a natural constituent of seawater, and large amounts of them enter the sea naturally through a variety of sources, including mine erosion, wind, dust particles, volcanic activity, rivers, and groundwater. But what is problematic is the increase in the areas of these metals due to human industrial activities such as the increase of industrial effluents and industrial wastes, oil pollution, toxins, pests and so on. On the one hand, these pollutants reduce water-soluble oxygen, and on the other hand, the presence of toxins has a direct effect on fish and causes their losses. Water that passes through watersheds or riverbeds carries minerals or solutes with them, poisoning fish in the lower reaches of the river. This process causes certain parts of streams, lakes, or other waters to be drained of fish. Other causes of water pollution include metal ore mining industries, which drain large amounts of toxic metals during mining operations. The pH of some of these waters is slightly acidic and increases the solubility of metals. For example, coal mine drainage water dissolves metals in the mine bed due to its high acidity.

## Effect of Iron Pollution in Seawater and Fish

This element is present in surface waters in the form of divalent or trivalent oxides, and in low-temperature, iron-containing waters, iron-depositing bacteria multiply greatly on the gills and contribute to the oxidation of divalent iron and their filamentous clones. The gills become colorless at first, but later the iron settles, causing the filamentous colonies to turn brown. The precipitated compounds of iron and the filaments of the bacteria that draw it reduce the gills' useful surface area, causing damage to the lining epithelium.

Although the toxic effects of iron and its salts are rare, the lethal effects of the presence of these substances in prolonged exposure to fish in waters with low buffering and low pH are significant. As mentioned, the indirect effects of iron toxicity are mainly limited. It is due to the deposition of ferric hydroxide or ferric oxide on the gills of fish. Deposition of ferric hydroxide on eggs of growing embryos may also cause asphyxiation and mortality of the embryo. Oxygen enters the egg through the fetal chorionic membrane [18].

## Heavy Metals and their Effect on Aquatic Animals

Heavy metals are among the environmental pollutants that some human exposure to through water and food can cause chronic and sometimes acute toxic poisoning, including metals such as lead, cadmium, Mercury, silver, copper and zinc in a variety of fish are mentioned, which is summarized below. Many elements in seafood are essential for human life in small amounts; however, these substances can be in high densities. Therefore, many consumers consider the presence of these elements in fish as a danger to human health. These elements are mostly present in aquatic environments. This is in contrast to the residues of organic matter in water, all of which are externally anthropogenic Xenobiotic and have entered the environment under the influence of human activities, except for dioxins and polyaromatic hydrocarbons, which are formed as a result of combustion and natural processes in the environment. Heavy metal resulting from the development of industry and its release into the water are resistant to decomposition and its amount accumulates in fish as one of the human food chains [19,20].

The presence and concentration of heavy metals in the environment, especially in aquatic environments and in aquatic animals, i.e. in aquatic animals and plants that are consumed as human food, depends on human nature and activities. The natural concentration of these elements in the oceans and freshwater resources of the world is due to the abnormal activities of the earth, earthquakes and volcanoes and the thermal processes of the earth and pollution caused by human activity, which was created in the industrial revolution it has been a source of pollutants. As a result, acid rain caused by industrial pollution washed away heavy metals from minerals, causing them to increase in concentration in natural environments, especially water.

Fish and other seafood always contain some heavy metals as a result of living in water. The ratio between the natural concentration of heavy metals and heavy metals due to human activity in fish varies from element to element. This ratio can be stated that in the high seas, which have not yet been affected by pollution caused by human activity, fish have only a normal amount of heavy metal concentration. In polluted areas, where water does not exchange enough with the world's oceans, the concentration of heavy metals is much higher than normal in estuaries, rivers, and especially in places close to industrial activities [21-23].

Fish and other aquatic animals absorb heavy metals from their food as well as from the water that passes through their gills. The absorption of heavy metals often depends on the amount eaten and the amount of heavy metals in the food or prey. It has been found that in marine areas where there is a high density of phytoplankton, it leads to high concentrations of these elements in larger and older fish than in areas where the amount of phytoplankton is lower. The accumulation of heavy metals takes a long time, and as a result, large amounts of these metals accumulate in large fish. Some fish species, especially predatory species, which usually have a longer lifespan, accumulate higher amounts of heavy metals in their various organs. This time-dependent accumulation of heavy metals leads to the accumulation of large amounts of heavy metals in large species such as goldfish or sea urchins, Pacific halibut, tuna, sharks, marlin, swordfish and other predatory species. They can reach the age of 25 or even more. High concentrations of heavy metals are rarely found in fish muscle. When this condition occurs, it indicates that a high degree of contamination has occurred in the environment, such as (cadmium and mercury). The main organs that fish use to store and detoxify heavy metals include the liver, kidneys, and bones, etc. These organs will not be usually used for the human consumption in Europe (except for canned cod liver) and the United States, because the part that is mostly consumed is the fillet or muscle tissue [24- 26].

Among the heavy metals that can be mentioned are: Mercury, cadmium, lead, zinc, copper, tin and aluminum are briefly described here.

Mercury: In the environment by agricultural activities (fungicides and seed preservatives), pharmaceutical factories, as paper and paste preservatives, catalysts in the synthesis of organic matter, in the production of batteries and thermometers in the production of metal mixed with mercury and Chlorine is released in caustic soda factories. It is estimated that the annual inflow is 40,000 to 50,000 tons in the atmosphere and approximately 4,000 tons in the sea. The first poisoning by mercury-infected fish was called Mina Mata disease, which after a thorough investigation revealed methyl mercury poisoning. The toxicity of mercury depends on its chemical form (organic, metallic, and ionic). Mercury is mainly present in fish in its organic form, or dimethyl mercury [27].

Lead: Lead, as a toxic and dangerous element, enters the natural environment in large quantities through human activities, and despite its low geochemical mobility, the metal has spread throughout the world. Lead is mainly deposited in fish bones and soft tissues such as the heart, gonads and digestive organs do not show high levels of lead. Environmental lead contamination in some parts of the world can be determined by analyzing and measuring the amount of lead in fish bones, not muscles.

Cadmium: As one of the most toxic heavy metals for living organisms. Cadmium is found in the hard wall of the earth with the element zinc and has been in the environment for centuries through mining activities to extract zinc resources. Cadmium is also widely distributed in the aquatic environment and its bioaccumulation is well detected by aquatic organisms. The amount of cadmium in the edible part of fish (fish muscle) is generally low, while cadmium accumulates in organs such as the kidneys and liver. Slow, so the organs can be very contaminated and preferably should not be consumed [28,29].

Copper: The ability to transport copper in nature is much lower than that of zinc and cadmium. Low-density copper is not toxic to humans and is an essential element for living organisms. Their kidneys accumulate. The average amount of copper in fish muscle is 0.5-0.2 mg / kg of wet weight, while the organs that have more copper include the liver, scales, anal, kidney and gills, respectively. Excess on the aquatic need for copper is stored mainly in the liver [30].

Zinc: Zinc, like copper, is an essential element for humans and is a major component of enzymes. Zinc is commonly found in fish and other seafood in milligrams per kilogram, and no amount has been reported in fish edibles that could pose a risk to human health. The average amount of zinc is 3-5 mg/kg based on wet weight, and fresh fish is the most important source of this essential metal for humans

Tin: Evidence suggests that tin is essential for mammalian growth. Tin has been used to make cans in the canning industry. Tin can leak into the contents of the can and contaminate the contents of the can. This occurs when there is no or insufficient tin layer inside the can, or if the contents of the can have a high pH or the cans are stored in the soldier's yard. These conditions can cause tin to enter the contents of the can. The average amount of tin found in fish is between 0.4-8 mg/kg.

Aluminum: Aluminum has been considered since it was suggested that high aluminum uptake may cause Alzheimer's disease. In fish tissue caught from coastal waters near aluminum mining plants, the amount increases to 1 mg/kg wet weight. Higher concentrations have been reported in organs such as the gills. Research on canned products shows that the amount of aluminum in condiments, vegetables and sauces used in canned fish products is much higher than the amount of aluminum in dessert fish. Studies have shown that only after long storage (more than 4 years) the amount of aluminum in fish was higher than the amount of aluminum in other compounds in the can. New research has revealed that fish wrapped in aluminum foil (for grilling) absorbs significant amounts of aluminum.

Heavy metals resulting from the development of industry and its release into water, are resistant to decomposition and its amount accumulate in fish as one of the human food chains. The main disadvantage of heavy metals is that they are not metabolized in the body. In fact, heavy metals are not expelled from the body after entering the body and accumulate in body tissues. This causes many diseases and complications in the body. They also increase the growth and spread of viral, bacterial and fungal infections. Heavy metals also replace other salts and minerals needed by the body. For example, heavy metals build up in the tissues of arteries, muscles, bones, and joints, or are replaced by cadmium in the case of zinc deficiency in foods [31-39].

## Conclusion

In recent years, due to structural, climatic, managerial and environmental problems, the problems caused by diseases in the country have increased, and as a result, the effects of heavy metal residues have become more pronounced. The Veterinary Organization in charge of aquatic health and diseases in the country, while implementing the national program for monitoring and care of aquatic diseases, annually monitors pharmaceutical residues, organophosphate and organ chlorine toxins, heavy metals and dyes (including malachite green) in cold-water fish. Hot water and shrimp. Cadmium, as one of the most polluting heavy metals in the ecosystem, causes weakness in movement, abnormal behaviors and physiological, histopathological changes in aquatic organisms. Contamination of water and soil with heavy metals due to industrial activities is one of the most important threats to natural ecosystems and humans. Due to their non-degradability, these metals can easily enter the body of feeding organisms from contaminated pastures. Measuring the concentration of heavy metals in the edible muscle of fish is very important; Because it forms a large mass of fish that is consumed by humans, today, due to the advancement of technology and the excessive entry of pollutants into the habitats of fish, not only the consumption of valuable fish has decreased, but sometimes health risks. It leads to irreparability. Research on heavy metal pollution in aquatic ecosystems is important from a public health perspective, maintaining the balance of those ecosystems and preventing biodegradation due to the adverse effects of pollutants. For this reason, researchers have focused on determining the level of pollution of various water sources, how metals are absorbed by aquatic animals, bioaccumulation of heavy metals in various aquatic tissues and the possibility of using aquatic animals as biological indicators based on pollutant monitoring.

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