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Effect of malathion toxicity on the kidney of *Labeo rohita*

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Abstract- Malathion is a nonsystemic, wide-spectrum organophosphate insecticide very common in Madhepura in crops. The insecticides also flow into the water bodies and effecting the aquatic organisms. In the present investigation, toxicity has been studied on *Labeo rohita*, the favourite fish of the region. Malathion has been found to be highly toxic to various non-targeted aquatic organisms, including fish. Contributing factor to the sensitivity of fish to malathion exposure seems to be its high rate of gill absorption due to lipophilicity. The main mode of its action is neurotoxicity, and its capacity to induce oxidative stress or alteration of antioxidant system and lipid peroxidation.

Key words: Acute, chronic, pesticides, toxicity, *Labeo rohita*

INTRODUCTION

In recent years, the fast rate of industrialization and the high rate of population growth have made it hard to get rid of wastewater. Pollutants like heavy metals, pesticides, and many organic compounds, along with untreated or partially treated industrial effluents from homes, have caused many fish to die in aquatic ecosystems. As a result, the water quality has changed because of these dangerous chemicals and metals, hurting fish and other aquatic life. People and animals are most likely to be hurt by pesticides because they are in the environment and are concentrated in the food chain. Organochlorine, organophosphate, and carbamate pesticides are bad for the environment in the long run. Because of this, a new generation of pesticides with less persistence has been made. Malathion is a nonsystemic organophosphate insecticide with a wide range of activity.

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Malathion is a wide-spectrum organophosphate insecticide that was one of the first insecticides made with organophosphates (introduced in 1950). Malathion is suitable for sucking and chewing insects on fruits and vegetables. It is also used to eliminate mosquitoes, flies, household insects, animal parasites (ectoparasites), and head and body lice. Malathion can also be mixed with many other pesticides to make new ones. The use of Malathion is widespread in the agriculture of Bihar, especially Madhepura district.

The Malathion also get mixed in the water bodies due to use in agricultural fields and becomes dangerous to fish and other aquatic animals that are not its intended target. Due to its lipophilicity, Malathion seems absorbed quickly by fish gills, which may be why fish are so sensitive to it. Neurotoxicity and the ability to cause oxidative stress, changes in the antioxidant system, and lipid peroxidation are the main ways it works. The objective of the present study is to look at how non-synthetic Malathion affects the fish. Malathion is very dangerous to aquatic organisms, especially fish.

LD_{50}/LC_{50}

Malathion is slightly toxic when taken by mouth. The oral LD_{50} for rats is between 1000 mg/kg and more than 10,000 mg/kg, and for mice, it is between 400 mg/kg and more than 4000 mg/kg. It can also be absorbed through the skin, and the dermal LD_{50} in rats was found to be more than 4000 mg/kg. One dose of Malathion may change how the immune system works; it has been said. Acute exposure to organophosphates or cholinesterase inhibitors can cause numbness, tingling, lack of coordination, headache, dizziness, tremor, nausea, abdominal cramps, sweating, blurred vision, trouble breathing or slowed breathing, and a slow heartbeat. High doses can cause unconsciousness, incontinence, seizures, or even death. The short-term effects of Malathion depend on how pure the product is and how it is used. Malathion is very toxic to the walleye (96-hour LC_{50} of 0.06 mg/L), highly toxic to the brown trout (0.1 mg/L), and only slightly toxic to the goldfish (10.7 mg/L). Malathion is very bad for aquatic invertebrates and the stages of amphibians that live in water. Malathion is not thought to build up in aquatic organisms because it has a short half-life. In two different samples, however, the average concentration of brown shrimp was 869 and 959 times the concentration of the water around them. How it affects other living things: It breaks down quickly in soil and groundwater. Its half-life in the field is between 1 and 25 days. The soil degradation rate depends on how well the soil holds things together. Breakdown happens through biological breakdown and chemical reactions with water that do not involve living things. Malathion will break down quickly in sunlight if it gets into the air. Its half-life in the air is said to be about 1.5 days. It sticks to soils pretty well and dissolves in water, so it could contaminate groundwater or surface water in places where it is less likely to break down. The half-life of Malathion in river water is less than a week, but it stays stable in distilled water for three weeks.

It is important to look into how pesticides hurt fish since they are an essential part of the food chain, and getting pesticides on them can throw off the balance of the aquatic system. However, few studies[1] have been done in Saudi Arabia to determine how much of this pesticide is in green vegetables in the Qaseem region. Mohamed *et al.* (2009)[2] and Zhang *et al.* (2010)[3] found out how Malathion breaks down in the water. Malathion has been found in surface and groundwater in Arabia, many researchers have studied its effect on animals other than fish.[4-7] Malathion hurts the central nervous system, immune system, adrenal gland, liver, and blood, according to toxicological tests and examined the effects of Malathion on the kidneys and liver. The present study aims to look at how non-synthetic Malathion affects the fish.

MATERIAL & METHODS

Labeo rohita fish that were healthy and full-grown were collected local fish farm in Madhepura, Bihar. A 0.1% solution of potassium permanganate was used to wash it. Rinsed with water and put in glass aquaria for two weeks to get used to the conditions in the lab. During the acclimatization process, fish were fed commercial pelted feed every day. Ten fish were given 0.8 ppm of Malathion for four days to study the histopathology of their different tissues. A separate area was also kept for the control group. After 96 hours, fish from both groups were taken out and knocked out with a blow to the head. Their kidneys and livers were cut out and put in aqueous Bouin's fixative for 24 hours. The material was washed well under running water until the yellow colour of the picric acid was gone. The material was then dehydrated in different grades of alcohol, cleaned in xylene, and paraffin blocks of different thicknesses were made. With the help of a microtome, paraffin sections were cut at 6 m. Hematoxyline and Eosin were used to stain the sections, which were then put in DPX and looked at under a microscope.

RESULTS & DISCUSSION

At the present level of Malathion, concentration does not kill the fish. The kidney of *Labeo rohita* changed severely. It has been found that the renal tubules were very degenerative, with severe necrosis and spaces in Bowman's capsule. When the liver was cut into sections, the hepatocytes looked like cords. These cords were wrapped around the veins that lead to the liver. Liver cells were giant and had a polygonal shape. Many blood sinusoids separated the hepatic cords from each other. *Labeo rohita*, which was exposed to Malathion for four days, caused the cytoplasm to break down and the hepatocytes to form vacuoles.

The kidney in fish is essential in balancing electrolytes and water and keeping the internal environment stable. Histological changes have been found in the tubular epithelium and glmerolus of fish exposed to poisons like pesticides. In this study, the kidney of a *Labeo rohita* showed that the glomeruli and renal tubules had shrunk. Renal tubules and collecting tubules were found to be breaking down. Because the glomeruli shrank, spaces in Bowman's capsule got bigger. Pesticides have an indirect effect on the kidney through the way blood circulates. Konar (1970)[8] found that giving heptachlor to *Labeo rohita* caused the renal epithelium to tear, the renal tubules to collapse, the kidney to swell, and the nuclei to change. Jayantha Rao (1982)[9] found that the kidneys of freshwater fish *Tilapia mosambica* that had been exposed to fenvalerate showed severe pathological changes. These changes may be caused by the kidneys getting rid of toxic fenvalerate. Under the toxic effects of Malathion, Dubale and Shah (1984)[10] saw the kidney of a freshwater teleost, *Channa punctatus*, swell up and die. In *Channa gachua* that had been exposed to endosulfan, Bhatnagar *et al.* (1987)[11] reported that the epithelial cells peel off, the nuclei move toward the lumen, and the cellular walls dissolve entirely. Basi *et al.* (1990)[12] found that DDT caused much damage to the kidneys of *Channa punctatus*.

In 1994, Dhanapkiam and Premaltha (1996)[13] studied the effects of Malathion and sevin on the kidneys of *Cyprinus carpio*. They found that the kidneys lost nuclei and gained vacuoles when dimethoate was given to *Channa punctatus*. After being exposed to organo phosphate and a related group of pesticides, different researchers and authors found toxic changes in the liver of catfish. Elezaby *et al.* (2001)[14] looked at how Malathion affected the fish *Oreochromis niloticus*. They found that Malathion caused many changes in the liver and gills of the fish. In the lungs, there was bleeding, necrosis, and the destruction of lamellae. In the liver, there was bleeding, necrosis, and lipidosis. Shukla *et al.* (2005)[15] noticed that when the catfish *Clarias batrachus* was exposed to a higher concentration (0.16/mL) of the organophosphate pesticide Nuvan, the size of the hepatocytes shrunk and cytoplasm gathered around the edges. After 20 days of being exposed to pesticides, the nuclei of the hepatocytes lost their round shape, and some of the cell boundaries disappeared. The liver bleeding was apparent because the sinusoidal space became large. Shukla *et al.* (2005)[15] looked into the harmful effects of the pyrethroid insecticide fenvalerate on the liver of the catfish (*Clarias gariepinus*) after it had been exposed to 1/10 LC for 5 and 10 days. The results showed that the main changes in the liver's histopathology were cytoplasmic vacuolization of the hepatocytes, constriction of the blood vessels, inflammatory leucocytic infiltration, necrosis, and fatty infiltrations. Many researchers looked at how insecticides affect the liver of different fish species. Mandal and Kulshrestha looked at what happened to the liver, kidney, and intestine of *Clarias batachus* when a small amount of summation was given to it. They saw liver necrosis, the formation of vacuoles, and the breaking down of the cell walls. In the kidney, they saw vacuolization of the epithelial cells of the uriniferous tubules and degeneration of the glomeruli. In the intestine, lesions form in the villi, and mucous cells get more prominent. These changes included liver cord disarray, cytoplasmic vacuolization of the hepatocytes, damage to the blood sinusoids, blood vessel congestion, and inflammatory leucocytic infiltrations. Couch (1975)[16] found damage around the blood vessels in the livers of fish exposed to organic contaminants and pesticides. Gingerich (1982)[17] states that the vacuolization of hepatocytes could indicate an imbalance between how fast they make substances and release them. In this study, all of the effects that were seen in the liver made *H. fossilis* less healthy in general at concentrations that were not lethal. Organophosphorous insecticides like Malathion affected *Labeo rohita*'s organs that get rid of waste, like the kidneys and liver.

CONCLUSION

When organisms are exposed to pesticides for a long time, the population's health is always at risk. So, eating these fish that have been poisoned puts people at high risk. This means that people who use pesticides should be careful to protect the lives of fish and other animals that live in water. It is likely that molecular biology techniques will change toxicology in ways that are cheaper and don't need to use animals to find out what is harmful to the environment. For example, several people have studied the effects of pesticides on fish. They have found that pesticides cause oxidative damage at chronic levels, stop AchE from working, cause histopathological changes, and cause developmental changes, mutations, and cancer. With reports of toxicants being used and having harmful effects on non-target organisms like fish, it is essential to make strict rules against using this pesticide without a clear purpose. Since pesticide is in the environment with other organophosphate compounds similar to them, the combined effects of organophosphate compounds may kill or make fish sick. Because of this, it is essential for public health to regularly check for pesticide residues in food and people to determine how much the population is exposed to this pesticide. Also, for the safe use of these pesticides, more experiments should be done to determine the concentration and amount of time that fish can be exposed without having significant sub-lethal effects.

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