Original Research Paper

Volume-9 | Issue-5 | May-2019 | PRINT ISSN No 2249 - 555X

Zoology

QUINALPHOS INDUCED HISTOPATHOLOGICAL CHANGES IN THE FRESH WATER FISH OREOCHROMIS MOSSAMBICUS

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ABSTRACT Main focus of this study was on how an organophosphate (quinalphos) pesticide affects a vertebrate organism. For analyzing this histopathological aspects were studied using standard methods. Liver of pesticide treated fishes showed necrosis, hemorrhages, and lesions. Heterogeneous parenchyma was the most prevalent hepatic change, characterized by extensive areas of vacuolization. Foci of necrosis were observed, frequently associated with multifocal inflammatory processes, some of them spreading over large areas. Also degenerated hepatocytesand foci of necrosis were found in these tissues. All the changes recorded were time dependent. Longer the duration of exposure heavier was the damage caused.

KEYWORDS : Quinalphos, Oreochromis, Histopathology, Liver

INTRODUCTION

One of the greatest tragedies the current and future generation going to face is the result of what the modern industrial era done to our pristine environment. We poisoned our water bodies, air and land and filled all the ecological niches with plastic and other hazardous materials that are not supposed to be there. After the green revolution that happened last century our agricultural fields literally transformed into an endless reservoir of hazardous chemicals that are used in the form of pesticides, herbicides, fungicides and fertilizers. These chemicals eventually drains into our water bodies affecting the life forms there. Such toxic chemicals can accumulate within the cells of small planktonic organisms in trace amounts and can build up to a lethal level when moves to higher trophic levels in the food chain, affecting the top predators and consumers like us the most. Although toxicants impair the metabolic and physiological activities of the organisms, physiological studies alone do not satisfy the complete understanding of pathological conditions of tissues under toxic stress. By analyzing the tissues of test organism and comparing with control group an insight into the changes in histology caused by these chemicals can be achieved. In this study the main focus is on how an organophosphate (quinalphos) pesticide affects a vertebrate organism.

MATERIALS AND METHODS

The present study was designed with the aim to understand the harmful effects of an organophosphorus pesticide, quinalphos using fish as a model organism. For this histopathology of the liver of the test organism exposed to sublethal concentration of the pesticide was analyzed. Bioassays were conducted to determine the LC_{50} value and safe levels of the pesticide.

Healthy fishes were collected from local farms. Selected fishes weighing 50gm on average were kept in clean and well aerated tanks for a week for acclimatization under laboratory conditions. No mortality was observed during this period.

The fishes were starved one day prior to the bioassay tests. A group of 6 well acclimated fishes were introduced in the troughs containing 4 L of test medium. A wide-range toxicity study was conducted for short-term, i.e., 48 hrs. Organisms were exposed to a wide range of concentrations of quinalphos ranging from 1ppm to 3 ppm. Mortality was observed for every 12 hours in each trough and recorded. A narrow range toxicity study was conducted by preparing test concentrations of quinalphos as 0.2, 0.4, 0.6, 0.8, 1, 1.2, 1.4, 1.6, 1.8, and 2ppm. Fish mortality were observed and LC_{50} was calculated using Probit analysis (Finney, 1971). $1/10^{th}$ of LC_{50} is taken as the test concentration. A separate control population was also maintained. Fishes were sacrificed from both test and control on alternative days until 12^{th} day. The liver from each group of fishes were dissected out, washed in physiological saline and fixed in Neutral Buffered Formalin for 48 hours. They were subsequently washed in distilled water and processed through graded series of alcohol, cleared in xyline and embedded in paraffin wax. Sections of 5 micron thickness were cut; stained with Harris haematoxylin and eosin and mounted in DPX. Stained sections were examined with light microscope for histopathological changes.

RESULTS AND OBSERVATIONS

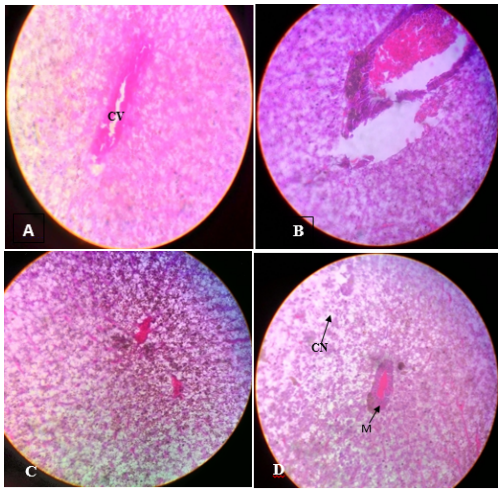
Histology of normal liver

The liver of *Oreochromis mossambicus* is a solid glandular organ, made up of polyhedral hepatic units called hepatic lobules. The surface is covered by a serous membrane and the hepatic lobules are made up of hepatic cells which are roundish polygonal in shape containing a clear spherical nucleus. They are located among sinusoids forming cord like structures known as hepatic cell cords. There is a central vein which drains blood away from the lobules. The wall of sinusoids contains phagocytic Kupffer cells. Sandwiched between the lobules, there are strands of connective tissue called portal canals carrying branches of portal vein, hepatic artery, bile duct and lymphatics

Histopathology of liver after 12 days of exposure to quinalphos

Heterogeneous parenchyma was the most prevalent hepatic change, characterized by extensive areas of vacuolization. Foci of necrosis were observed, frequently associated with multifocal inflammatory processes, some of them spreading over large areas. Also degenerated hepatocytes and foci of necrosis were found in the hepatocytes of the fishes exposed to quinalphos for 12 days

Plate 1- Photomicrographs of the liver of *O.mossambicus* (400 X)



A- control showing central vein (CV); B,C, and D after 12 days of exposure to sub lethal concentration of quinalphos showing cellular necrosis (CN) and melanomacrophage accumulation(M)

DISCUSSION

Tissue changes in test organisms exposed to experimental concentrations of toxicants are functional responses that provide information on the mode of action of the toxicant on them. Hepatic cells have many vital functions. Besides the secretion of bile, they play

an important role in protein, lipid and carbohydrate metabolism and serve as a storage site for many of the nutrients. They are the chief sites of detoxification and metabolism of pollutants. Hence, these pollutants or their toxic metabolites may get concentrated in hepatic tissue leading to its damage.

Histopathology provides a rapid method to detect effects of irritants in various organs. In this study the liver of pesticide treated fishes were examined for histopathological studies and it was found that sublethal concentration of quinalphos induced necrosis, hemorrhages, and lesions. This findings are in agreement with several previous authors. Heterogeneous parenchyma was the most prevalent hepatic change, characterized by extensive areas of vacuolization. Foci of necrosis were observed, frequently associated with multifocal inflammatory processes, some of them spreading over large areas. Also degenerated hepatocytesand foci of necrosis were found in the liver of the fishes exposed to quinalphos for 12 days. Srivastava *et al*., (2016) reported degenerative and necrotic changes in hepatocytes, inflammatory leucocytic infiltration, and cytoplasmic vacuolization of hepatic & pycnotic nuclei with devoid of fat within the cell. Aswin *et al*., (2016) reported degeneration of epithelial lining, degeneration of secondary lamellae, fusion of secondary lamellae with irregular lamellar spaces, various structural alteration, epithelial proliferation, and necrosis can be observed in the gills of *Anabas testudineus* exposed to sublethal concentration of quinalphos. They also reported dilation and congestion in blood vessels of gill filament and atrophy of secondary lamellae.

The great susceptibility of liver to damage by chemical agents may be a consequence of its primary role in metabolism of foreign substances. From the results obtained in the present study it is clear that the pesticide quinalphos at sublethal concentrations caused duration dependent damages to liver tissue, and the changes were similar to the findings of other workers.

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