

Histopathological Changes in the Liver and Kidney of Freshwater Teleost, *Channa striatus* (Bloch) on Exposure to Lead nitrate

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Abstract: The present study was conducted to investigate the histopathological changes in the liver and kidney of freshwater teleost, *Channa striatus* after exposure to 28 mg/l (10% of 96 hrs LC₅₀) of lead nitrate for a period of 30 and 60 days under laboratory conditions. The resultant histopathological changes in the liver and kidney were recorded by light microscope. The most common changes in the liver of fishes were severe loosening and necrosis of hepatic tissue, cytoplasmic vacuolation, expansion in cell size, eccentric and enucleated hepatocytes. Kidney of fishes exposed to 28 mg/l of lead nitrate was characterized by loosening and damage in haemopoietic tissue, deshaped and damaged renal tubules, necrosis, shrinkage in glomerulus, necrosis and enlarged Bowman's space. The present investigation illustrates that these histopathological changes would serve useful purpose in evaluating the toxic effects of lead nitrate.

Keywords: Heavy metals, Lead nitrate, Histopathology, *Channa striatus*, Liver, Kidney.

1. Introduction

Metals are naturally present in very low concentrations in aquatic environment, but day by day their load is increasing due to anthropogenic pressure. Lead is ubiquitous in the environment and has gained considerable attention due to its potential human health hazards. Lead pollution has become a major environmental problem in many developing and industrializing countries due to both occupational and environmental exposure (Yucebilgic *et al.*, 2003). It has many undesirable effects, including neurological (Sharma *et al.*, 2011), behavioural (Adeniyi *et al.*, 2008), immunological (Bunn *et al.*, 2001 and Rosenberg *et al.*, 2007), renal (Vargas *et al.*, 2003 and Rastogi, 2008) and hepatic (Patra *et al.*, 2001).

Fishes are very sensitive to exposure of various pollutants and when these pollutants are not metabolized by the body, they cause damage to many organs of the fish. Liver is most affected by pollutants in the water, due to its function, location and blood supply (Rodrigues and Fanta, 1998). The teleostean kidney is one of the first organs to be affected by pollutants (Thophon *et al.*, 2003). Hence, this study was undertaken to observe the effect of lead nitrate on histological aspect of liver and kidney of fresh water teleost, *Channa striatus*.

2. Material and Methods

Fish Collection: Live specimen of *Channa striatus* measuring about 20-25 cm and weighing 50-60 gm were collected for experimental study from different fish markets of Bhopal, Madhya Pradesh.

Experimental Fish: Before introducing in the aquarium, fishes were treated with 0.1% KMnO₄ solution to avoid dermal infection. They were acclimatized in laboratory

condition for 15 days prior to the start of experiment. The fishes were divided in two groups having 10 fish in each aquarium. The first group was kept as control with plain fresh water while the second group contained 28 mg/l (10% of 96 hrs LC₅₀) lead nitrate. Exposure concentration was decided on the basis of 96 hrs LC₅₀ value of lead nitrate which was observed to be 284.32 mg/l. Water was renewed on every alternate day and lead nitrate was maintained throughout the experiment duration of 30 and 60 days.

Histopathological Procedure: On the 30th and 60th day of exposure, fish from control and treated group were sacrificed. Liver and kidney were removed and washed in saline water to remove blood and fixed in aqueous Bouin's fixative for 48 to 72 hours. Preserved tissues were washed under tap water, dehydrated in graded series of ethanol and embedded in paraffin blocks. Sections of 5-6 micron thickness were taken using rotatory microtome and stained routinely with Hematoxylin and Eosin (H&E) for histopathological examination by light microscope.

3. Results and Discussion

The histopathological changes were noticed in treated fish exposed to lead nitrate and were not observed in the control fish. After 30 days histological examination revealed that exposure of fish to 28 mg/l of lead nitrate, several changes were noticed in the histology of liver of fish *Channa striatus* as cytoplasm of hepatic cells has become vacuolated, loosening and necrosis of hepatic tissue were observed. Hepatocytes showed eccentric placed nuclei and enucleation (Figs. 1 & 2). While severe loosening of hepatic tissue, cytoplasmic vacuolation, damaged hepatocytes, expansion in cell size, eccentric nuclei along with enucleation of hepatocytes were the common histopathological changes observed after 60 days exposure of lead nitrate (Figs. 3 & 4).

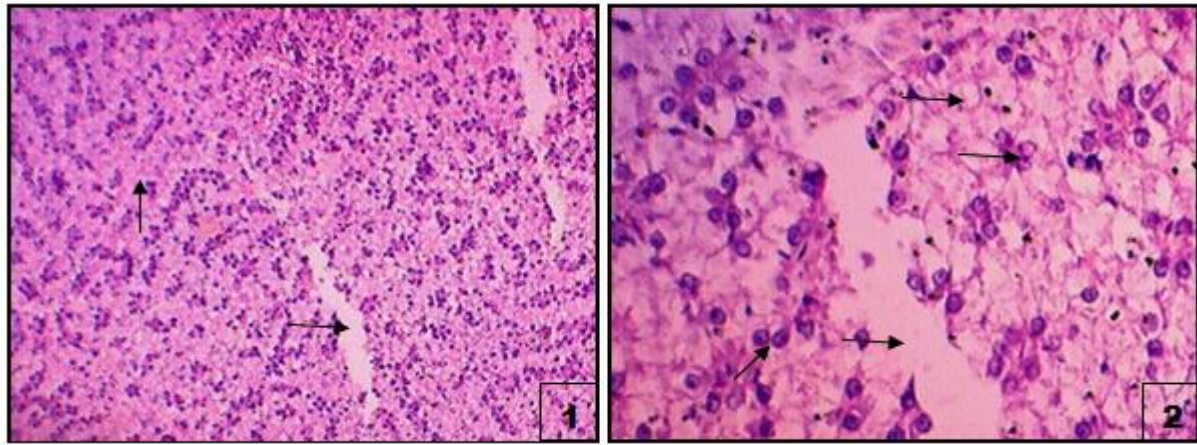


Figure 1 & 2 Microphotographs showing cytoplasmic vacuolation, loosening and necrosis of hepatic tissue, eccentric nuclei and enucleation of hepatocytes in the liver after 30 days exposure of 28 mg/l lead nitrate (100X & 400X)

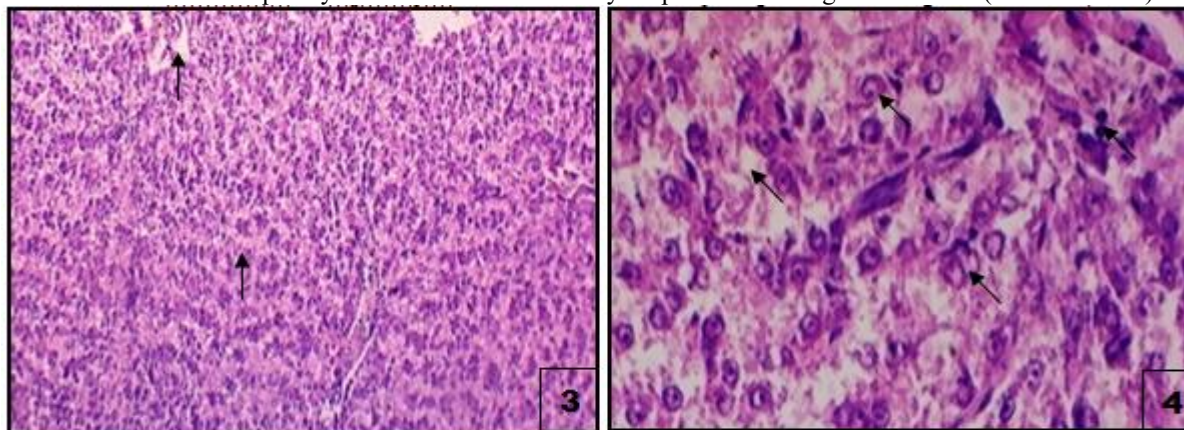


Figure 3 & 4 Microphotographs showing severe loosening of hepatic tissue, cytoplasmic vacuolation, damaged hepatocytes, expansion in cell size, eccentric nuclei and enucleation of hepatocytes in the liver after 60 days exposure of 28 mg/l lead nitrate (100X & 400X)

Similar results have been reported by Olojo *et al.* (2004) in the liver of African catfish, *Clarias gariepinus* exposed to 7 mg/l lead nitrate for 21 days, Rani and Ramanmurthi (1989) in *Tilapia mossambica* (*Oreochromis mossambicus*) exposed to cadmium chloride at 5 and 50 ppm for 1, 7, 15 and 30 days, Mishra and Mohanty (2008) in liver of *Channa punctatus* exposed to hexavalent chromium and Thopan *et al.* (2003) in White Sea bass, *Lates calcarifer* exposed to 5 mg/l cadmium chloride for 3 weeks. Sharma *et al.* (2014) also observed deshaped hepatocytes, necrosis of hepatocytes, loosening of hepatic tissue and cytoplasmic

vacuolation in the liver of *Channa striatus* exposed to 20 mg/l and 30 mg/l of lead nitrate for 30 and 60 days. In the present investigation loosening of haemopoietic tissue, deshaped renal tubules, shrinkage in glomerulus and enlarged Bowman's space were observed in the kidney of fish examined after 30 days exposure to 28 mg/l of lead nitrate (Figs. 5 & 6). However, at 60 days exposure, extensive damage in haemopoietic tissue, necrosis, damaged renal tubules and deshaped glomeruli were observed (Figs. 7 & 8).

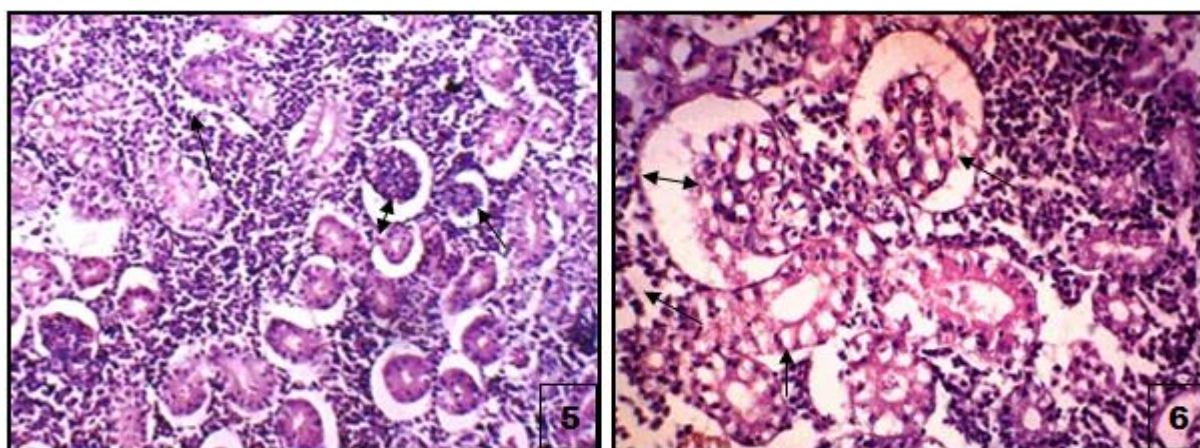


Figure 5 & 6 Microphotographs showing loosening of haemopoietic tissue, deshaped renal tubules, shrinkage in glomerulus and enlarged Bowman's space in the kidney after 30 days exposure of 28 mg/l lead nitrate (100X & 400X)

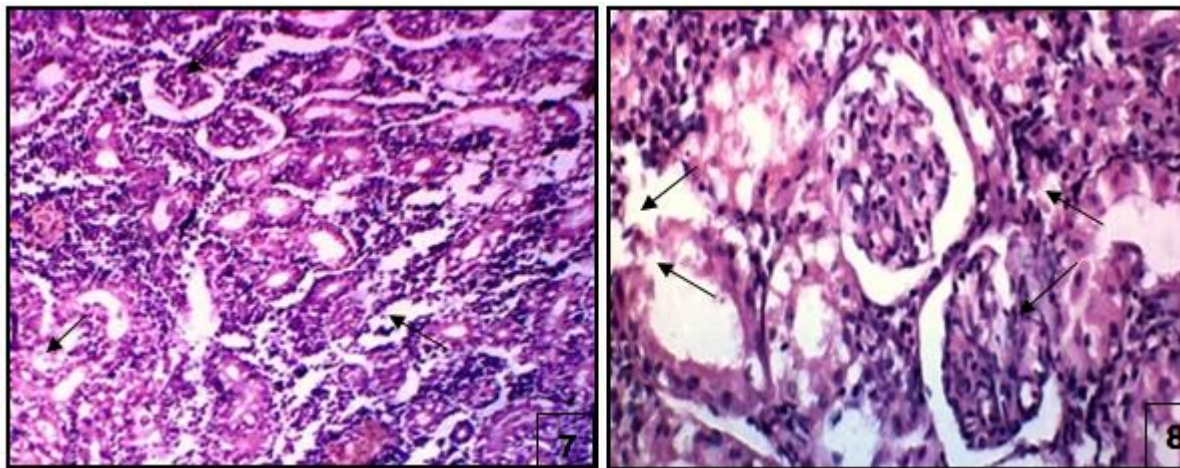


Figure 7 & 8: Microphotographs showing extensive damage in haemopoietic tissue, necrosis, damaged renal tubules and desheathed glomeruli in the kidney after 60 days exposure of 28 mg/l lead nitrate (100X & 400X)

Ahmad *et al.* (2011) also observed loosening of haemopoietic tissue, vacuolated cytoplasm, damaged uriniferous tubules, shrinkage in glomeruli and expansion of Bowman's space in the kidney of African catfish, *Clarias batrachus* exposed to 4 ppm of cadmium chloride for 30 and 60 days. Gupta and Srivastava (2006) noticed dilation, oedema, hypertrophied nuclei of renal tubules, vacuolated glomeruli and disorganized blood capillaries in the kidney of fresh water fish, *Channa punctatus* exposed to three sub-lethal concentrations of zinc (10 mg/l, 15 mg/l and 25 mg/l) for 15 days. Iqbal *et al.* (2004) studied histopathological changes in the kidney of a common carp following lead nitrate exposure and observed increase in Bowman's space, degeneration of glomeruli, shrinkage of proximal tubule cells with pycnotic nuclei in the exposed fish.

4. Conclusion

Present study indicated that exposure to lead nitrate caused histological alterations in the liver and kidney of *Channa striatus*.

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