



HISTOPATHOLOGICAL ALTERATION IN LIVER AND KIDNEY OF FRESHWATER FISH, *CYPRINUS CARPIO* EXPOSED TO COPPER

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Abstract: The present investigation was carried out to study intestine, liver and kidney histopathology in the freshwater fish, *Cyprinus carpio*, exposed to copper for 96h. Several histopathological alterations were observed the changes in intestine, Liver and kidneys was observed microscopically showed damages in the experimental tissues while intestine, liver and kidneys of control groups exhibited a normal architecture.

Key-Words: copper, Histopathology, intestine, Liver, Kidney, *Cyprinus carpio*

INTRODUCTION: Copper is an essential trace metal which plays an important role in several fish metabolic functions. It represents a crucial role in several enzymatic processes (e.g. enzymes involved in cellular respiration, free radical defense, neurotransmitter function, connective tissue biosynthesis and other functions), as well as, into some structural proteins (Baker, 1969 ;WHO, 1998) . Environmental pollution from heavy metals has been examined in freshwater ecosystems due to the bioaccumulation and toxicity of these metals (Wang *et al.*, 2014). Regardless of its important role in cellular metabolism, copper (Cu) is of particular interest because it is extremely toxic for aquatic animals if elevated concentrations are introduced into the water (Wurts & Perschbacher, 1994; Grosell, 2012) . High copper levels can cause fast generation of reactive oxygen species (Harris & Githlin, 1996). It also

binds histidine, cysteine- and methionine-containing proteins, resulting in dysfunction (Grosell & Wood, 2002) . Histopathological investigations have been recognized to be reliable biomarkers of stress in fish (Van der Oost, Beyer, & Vermeulen, 2003). Copper was reported to cause severe histopathological changes in gills of teleost fish (Olsson *et al.*, (1998). Copper poisoning can cause pathological injury in various tissues such as liver, kidneys (Nawaz, 2005; Al-Bairuty *et al.*, 2013). Hence, Copper stress is known to induce histopathological changes in the freshwater fish *Cyprinus carpio*.

MATERIALS AND METHODS: Freshwater fish, *Cyprinus carpio*, weighing 120-180 gm and measuring 7-8 cm were collected from nearby nursery pond at Nanded. They were safely brought to the laboratory. Fish were acclimatized for about 5 to 6 days before the commencement of the experiment. During

acclimatization period, fish were fed with rice bran and ground nut oil cake in the form of dough once in daily. Water replaced every 24h after feeding. Ten healthy fishes were introduced into each tub. The mortality of fish in control and copper treated tubs was recorded after each 24h and the concentration at which 50% mortality of fish occurred was taken as the median lethal concentration (LC_{50}) for 96h which was 3.34mg. fishes were dissected after each 24h samples of liver, kidney and intestine were isolated washed

with distilled water, soaked with tissue paper and preserved in 10% formaline as preservative, blocks were prepared as per as standard techniques. Sections were taken using Rotary Microtome. Sections were stained using Haematoxylin (Delafield) and Eosin (Gray, 1958; David, 1991). Permanent slides were prepared using DPX as mountant. Slides were observed and changes were noted. And the results are discussed in relation to copper toxicity.

RESULTS AND DISCUSSION:

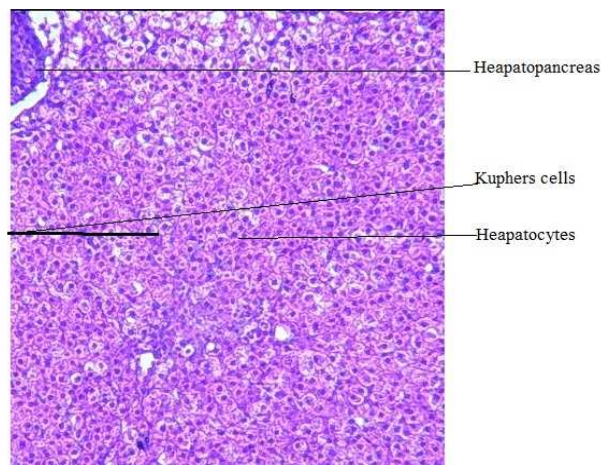


Plate1:
T.S. of Liver *Cyprinus carpio* (Control)
Showing normal histological structure and hepatopancreas

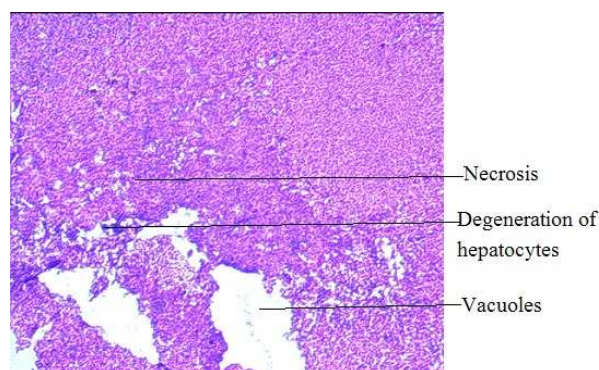


Plate2:
T.S. of Liver *Cyprinus carpio* exposed in copper at 96h
Showing alteration of histological structure

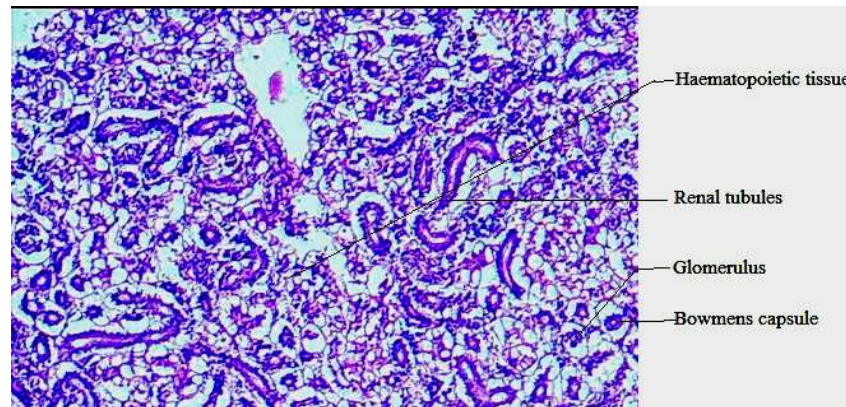


Plate3:
T.S. of Kidney *Cyprinus carpio* (Control)
Showing normal histological structure

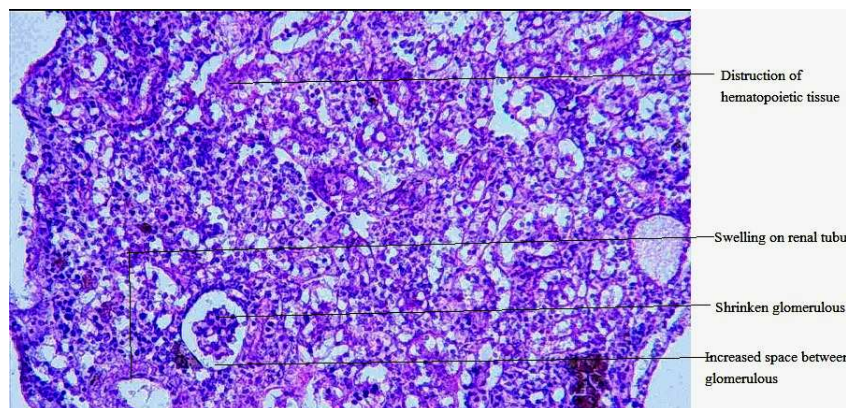


Plate 4:
T.S. of Kidney *Cyprinus carp* exposed in copper at 96h
Showing alteration of histological structure

In the present investigation when freshwater fish, *Cyprinus carpio* exposed in copper at 96h several histological changes were observed in liver and kidney when compared to control group. Copper is a serious pollutant in the environment. It is necessary to evaluate the toxic impact on every aspect of fish health. Therefore, in the present investigation we determine the structural damages caused by copper

on liver & kidney. The hepatopancreas of the control group showed a normal structure without any pathological lesions. The hepatocytes were polygonal cells with a homogeneous cytoplasm and a large central spherical heavily-stained nucleus, also the pancreatic area with its pancreatic acini was obviously normal along the portal vessels within the liver. The hepatic parenchyma of fish exposed to copper

sulfate exhibited histological alternations such as an increase of cytoplasmic vacuolation, number of hepatocytes nucleus was decreased and nuclear pyknosis was observed. The above changes agreement with the other researcher (Figueiredo & Carrola *et al.*, 2007; Chen & CX *et al.*, 2012; Velmurugan *et al.*, 2007) who investigate an increase of cytoplasmic vacuolation. Degenerative necrotic conditions are often associated with these histological changes. These alternations could be explained by Cu-induced oxidative stress in the tissue of the liver Hoyle, (2007) in the present study the rate of karyolysis increases with the increase of copper concentration and nuclear pyknosis. Many studies confirm the same alternations Figueiredo & Carrola *et al.*, 2007; Chen & CX *et al.*, 2012). Chen *et al.*, 2012; Braunbeck, 1990) suggested that the alterations in size and shape of nucleus may be considered as signs of increasing the metabolic activity. Histological study shows a typical structural organization of the kidneys in the control fish (Plate3). The kidney is one of the first organs to be affected by contaminants in the water Thophon *et al.*, (2003). The kidney composed of numerous renal corpuscles with well developed glomeruli and a system of tubules. The proximal segment covered by columnar epithelial cells with basal nuclei and brush border located along the cell apices. The distal segment lined with large, relatively clear columnar epithelial cells with central nuclei and the brush border absent. The collecting duct or glomerulus larger in diameter than the distal segment, containing columnar epithelial cells with

basal nuclei and no brush border (Peebua *et al.*, 2006). Our study demonstrated that concentrations of copper produce a variety of histopathological changes in the kidneys of exposed fishes (Plate4). Showed, shrunken glomeruli, increased space between glomeruli, destruction of haematopoietic tissue, swelling on renal tubules, in addition to the infiltration of edematous fluid between the tubules, hemorrhage and diffusion the erythrocytes in the interstitial fluid. The present results are in agreement with those observed in *Cyprinus carpio* exposed to sewage Kakuta, (1997), *Prochilodus lineatus* exposed to trichlorfon Veiga, *et al.*, (2002) and *L. calcarifer* exposed to cadmium Thophon *et al.*, (2003) Also, Velmurugan, *et al.*, (2007). observed necrosis of tubular epithelium, hypertrophied epithelial cells of renal tubules, narrowing of the tubular lumen, expansion of space inside the Bowman's capsules and contraction of the glomerulus in the kidney of *C. mrigala* exposed to fenvalerate.

CONCLUSION

From the present study copper is toxic even at low concentration and it is enough to elicit serious physiological and histological alterations in fish.

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