**International Journal of Zoology and Applied Biosciences** **ISSN: 2455-9571**
**Volume 3, Issue 2, pp: 220-223, 2018**
**https://doi.org/10.5281/zenodo.1314258**
**http://www.ijzab.com**

**Research Article**

# HISTOPATHOLOGICAL CHANGES IN LIVER AND KIDNEY OF CATFISH, *CLARIAS BATRACHUS* EXPOSED TO ALUMINIUM

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**Article History:** Received 7th April 2018; Accepted 28th April 2018; Published 30th April 2018

**ABSTRACT**

The present study was carried out to analyse the histopathological changes in freshwater catfish *Clarias batrachus* (Indian magur) in the presence of aluminium. Fishes were exposed to aluminium with three different concentration level (8.75µg, 17.5µg, 35µg) for 96 hours in water. During this period fishes were fed with Laboratory prepared food. After 96 hours, fishes were taken out and sacrificed. The tissues like liver and kidney were removed for study. Histopathological changes like loss of hepatic cells in liver of fish, cytoplasmic vacoulation, and loss of glomerular structures in kidney of fish were observed. It was noticed that the histopathological alterations were found to be dose dependent in the tissues, changes were more pronounced with higher concentration of aluminium chloride like nacrosis of hepatic cells at concentration 35µg/l was observed in liver. In the same way under high concentration of aluminium clustering of cells were observed in kidney.

**Keywords:** Aluminium, *Clarias batrachus*, Histopathology, Liver, Kidney.

## INTRODUCTION

The availability of water is very essential for human as well as for other animal's existence. Due to explosion of population, natural resources are exploiting day by day. Further, increase in environmental pollution has adverse effect on humans as well as on other organisms which are clearly seen. Among environmental pollution, water pollution is one of the most concerns which directly affects serious public health problem as well. Water pollution is occurring due to mainly by human activities like discharge of sewage and industrial effluents in fresh water pond, rivers and in canals. The release of discharge added large number of pollutants, especially heavy metals and pesticides which causes serious problems for aquatic animals to human life (Saikia *et al*., 1988). These metals are deposited in their body shows great impact on their vital organs. Aluminium is the third most abundant element on earth's crust and is commonly used in water purification, cosmetics and medications. It may enter into the river and other fresh water streams through natural and anthropogenic activities like coal strip mining, industrial effluents. Thus, when aluminium reaches the organisms through acidification of surface water, it becomes toxic for fish (Driscoll *et al*., 1980).

Histopathological changes were used to study the toxicity of metals and other pollutants in fish as these act as suitable biomarker in evaluating the health status of laboratory organisms and in field study (Van der Oost *et al*., 2003). One of great advantage of this type of biomarker is that these biomarkers are used to examining specific target organs, including gills, liver and kidney that are responsible for vital functions, such as respiration, excretion and accumulation and biotransformation of xenobiotics in fish (Gernhofer *et al*., 2001). Gills and gastrointestinal tract are the main primary targeted organs because they act as passage of sediments. Other organs like liver and kidney are also adversely affected by these pollutants which directly affect respiration and excretion in fishes (Gernhofer *et al*., 2001). Hence, the present study was undertaken to examine the effect of different aluminium chloride concentrations on histological aspects of liver and kidney of fresh water catfish *Clarias batrachus*.

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## MATERIALS AND METHODS

Experimental fish *Clarias batrachus* was obtained from Gazipur, near Anand vihar metro station, Delhi and transported in Zoology Department of M.D.U, Rohtak, Haryana. Healthy and disease free fishes were taken out from market and acclimatized under laboratory conditions for 14 days. Fishes were fed with laboratory prepared food. During experimental period an average temperature was 25ºC and pH of water was 7± 0.1.

### Experimental Design

A total of 20 Indian catfish, *Clarias batrachus* of both sexes male and female were used for the study. The experiment was conducted in aquariums which were well aerated, each aquarium hold 5 fish in 35 L water. The fish were exposed to dissolved aluminium for 96 hours (Table 1).

**Table 1.** Average length and weight of *C. batrachus* exposed to different concentration of aluminium chloride.

| S.No. | Aluminium Concentration | FL(Av.) (cm) | FW(Av.) (g) |
|---|---|---|---|
| Aquarium 1 | 8.75µg | 11.0cm | 6.7g |
| Aquarium 2 | 17.5µg | 10.7cm | 5.8g |
| Aquarium 3 | 35µg | 11.0cm | 6.9g |
| Aquarium 4 | Control | 10.4cm | 6.2g |

Av = Average.
FL= Fish length.
FW= Fish weight.

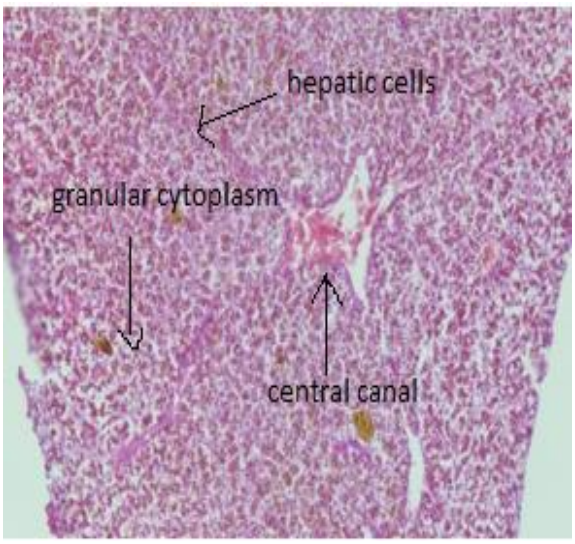
### Histopathological study

After 96 hrs, fishes from controlled and treated were sacrificed. Liver and kidney were fixed in 10% formalin solution (histological fixative) for 24 h (Tao *et al*., 1999).

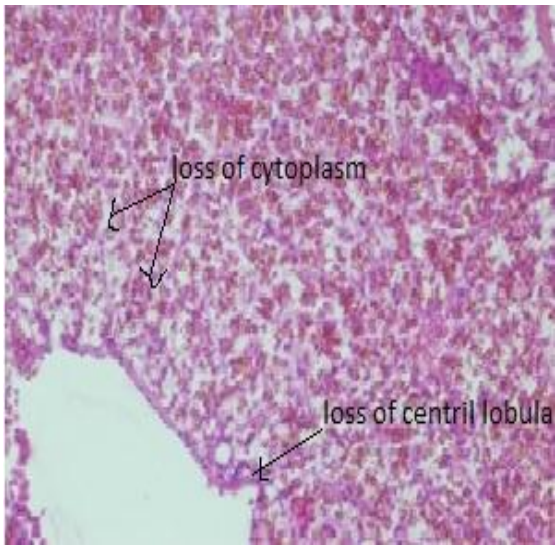
For study of histopathological study (Singh *et al*., 2012) procedure was followed. In this preserved tissues were washed in tap water to remove the formalin, dehydrated, cleared in xylene and finally embedded in paraffin wax and make blocks. These blocks were sectioned at 5 µm using a rotary microtome. Specimens were stained with haematoxylin and eosin. Finally, the prepared sections were examined under the microscope

## RESULTS AND DISCUSSION

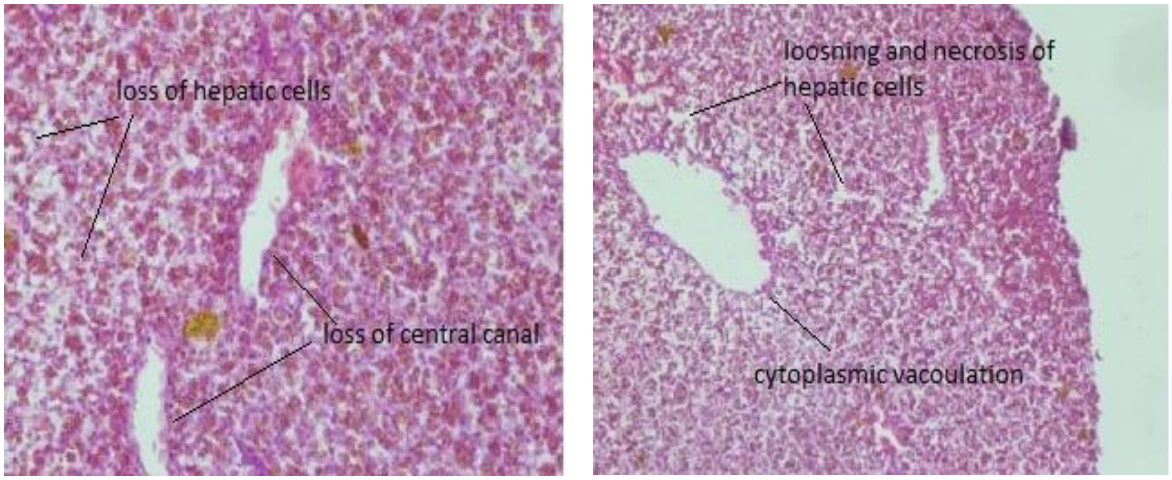
The present study showed that exposure of aluminium chloride causes alteration in kidney and liver of fresh water catfish, *Clarias batrachus*. The control group fish showed normal liver structural like other vertebrates i.e. dark polygonal hepatic cells, granular cytoplasm and a well characterised central canal Figure 1(a). After treated with different concentration of aluminium chloride liver structures changes gradually with increasing concentration of aluminium chloride. At minimum concentrations of aluminium chloride (8.75 µg) the liver structures alteration are like loss of cytoplasm from different parts of liver and loss of centrilobular was observed, Figure 1(b). After increasing concentration of aluminium chloride, liver showed loss of central canal, loss of hepatic cell Figure 1(c), ctyoplasmic vacoulation and loosing and necrosis of hepatic cells Figure 1 (d).




(a)

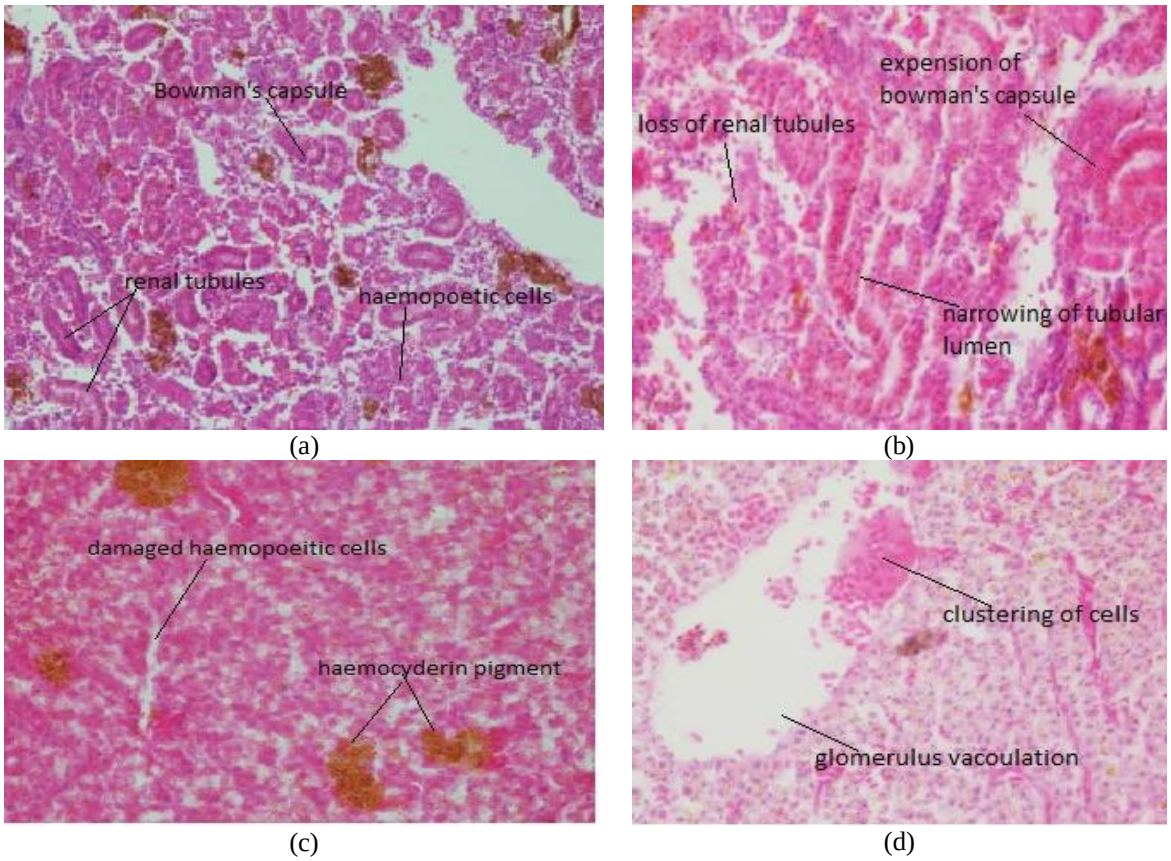



(b)




(c) (d)

**Figure 1.** (a) Liver of normal control fish showing hepatic cells, granular cytoplasm and central canal.
(b) Liver of experimental fish treated with aluminium chloride concentration (8.75µg), showing loss of centril lobular and loss of cytoplasm.
(c) Liver of experimental fish treated with aluminium chloride concentration (17.5µg), showing degenerative hepatic cells and loss of central canal.
(d) Liver of experimental fish treated with aluminium chloride concentration (35µg), showing loosning and necrosis of hepatic cells and cytoplasmic vacoulation.




(a) (b)

(c) (d)

**Figure 2.** (a) Kidney of normal untreated fish showing Bowman's capsule, renal tubules and haemopoeitic cells.
(b) Kidney of experimental fish treated with aluminium chloride (8.75µg) showing narrowing of lumen tubules, expansion of Bowman's capsule and loss of glomerulus.
(c) Kidney treated with aluminium chloride (17.5µg) showing damaged haemopoietic cells and appearing haemocyderin pigment.
(d) Kidney treated with aluminium chloride (35µg) showing clustering of cells and vacoulation.

Similar results on liver were observed extensive necrosis of liver in rainbow trout, *Oncorhynchus mykiss*, when exposed to 50µg/L aluminium, at pH 8.0 to 9.0. Aluminium interferes with important metabolic process in the cells. For proper functioning of liver cell, DNA synthesis is necessary. But due to its inhibition deletion of liver cells takes place. Also due to presence of contaminant the biology of cell is affected which leads its degradation. Cytoplasm and hepatocytes vacuolization takes place because the substances synthesised of in parenchymal cells is not equally release into the systemic circulation (Gingerich, 1982). Cytoplasmic vacuolation, cellular degeneration, congestion in blood sinusoids has also been reported in the earlier studies after exposure of aluminium in Tilapia zilli for 96 hours (Hadi & Alwan, 2012). Under present investigation kidney exposed to aluminium chloride for 96 hour in different concentrations. The normal untreated fish kidney showed normal structures without any alteration's normal bowman's capsule, renal tubules and haemopoetic tissues Figure 2 (a) but When kidney treated with aluminium chloride concentration different alterations appear in structures of kidney like expansion of bowman's loss of renal tubules, narrowing of tubular lumen Figure 2(b) at concentration 8.75µg, damage of haemopoetic cells and clustering of haemocyderin pigments at 17.5µg concentration Figure 2(c) and clustering of kidney cells and glomerulus vacoulation at concentration 35µg Figure 2(d). Similar results on kidney were observed in fish *Cyprinus carpio* when treated with dieldrin and BHC (Satyanarayan *et al*., 2012). Srivastava *et al*. (1990) also reported shrinkage of glomeruli and widening of nephritic tubules in catfish, *H. fossilis* exposed to chlorpyrifos at a concentration of 2 mg/litre.

## CONCLUSION

The present study showed that aluminium at different concentration causes histopathological changes in organs of catfish. The histopathological changes seen in all the tissues were more pronounced higher dose of aluminium than lower dose level. The study also showed that the degree of damages increase with increase in concentration of aluminium.

## ACKNOWLEDGMENT

The authors express sincere thanks to the Head of the Department of Zoology, Maharshi Dayanand University, Rohtak, Haryana, for the facilities provided to carry out this research work.

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