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Effect of mercuric chloride on histological structure of hepatopancreas of fresh water prawn, *Macrobrachium lamarrei lamarrei* (H. Milne Edwards, 1837)

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ABSTRACT
The *Macrobrachium lamarrei lamarrei* is a small prawn widely distributed all over India and has commercial importance. The freshwater prawn *Macrobrachium lamarrei lamarrei*at different duration (0.002 mg/l $HgCl_2$ for 20, 40 and 60 days) of exposure of mercuric chloride observed such as, absence of glycogen content, loss of clear cell junction and dysplasia in B-cells. In case of R-cells development of numerous granular inclusions in lipid vacuoles and cell cytoplasm and F-cells show dilated rough endoplasmic reticulum and dilated cisternae of Golgi bodies.

Keywords: Freshwater prawn Exposure, Mercuric chloride, Toxicity, *Macrobrachium*

1. Introduction
Aquatic organisms absorb the pollutants directly from water and indirectly from food chains. Some of the toxic effects of heavy metals on fishes and aquatic invertebrates are; reduction of the developmental growth, increase of developmental anomalies, reduction of fishes survival-especially at the beginning of exogenous feeding or even cause extinction of entire fishes population in polluted reservoirs. These consequences can affect on geological, hydrological and finally on biological cycles [1].
There are some heavy metals and mercury (Hg) is one of the most toxic heavy metals in our environment including the lithosphere, hydrosphere, atmosphere and biosphere [2]. So, Hg was the most toxic of all metals in *Penaeus monodon*, followed by Cu, Cd and Zn and that Cd toxicity was the most rapid [3]. Mercury (Hg) is potentially toxic to aquatic animals. A recent report indicates that even safe concentration of Hg is also deleterious to fish [4].
Yamuna A [5] observed the hepatopancreas of prawn (*Macrobrachium sp*.) exposed to mercury – chloride. Verma RS [6] studied acute toxicity of nickel to fresh water prawn. In his study, the LC_{50} of nickel and its impact on the behaviour of 2 species of freshwater prawns, *Macrobrachium lamarrei* (H. Milne Edwards) and *Macrobrachium dayanum* (Henderson) was evaluated. Kaoud HA [7] studied the effect of exposure of mercury (Hg) on mortality, resistance and bioconcentration in the tropical freshwater *Macrobrachium*. Mahajan PR [8] study of impact of mercuric chloride on protein content of hepatopancreas of prawn. It was found that protein content of hepatopancreas was decreased due to mercuric chloride after 7, 14 and 21days. Soegianto A [9] studied bioaccumulation, elimination, and toxic effect of cadmium on structure of gills and hepatopancreas of freshwater prawn *Macrobrachium sintangese*.

2. Material and Methods
2.1 Collection and Acclimation
Macrobrachium lamarrei lamarrei (H. Milne-Edward, 1837) is small in size (2.5 to 5 cm), widely distributed and abundantly available species of prawn. It is found in fresh water streams, ponds and lakes not only in India but also in some other countries. *M. Lamarrei lamarrei* with average length of 30-40 mm were procured from Upper Lake, Bhopal. The prawns were brought to laboratory and kept in the glass. The prawns were then treated with 0.1 $KmnO_4$ solutions to obviate any dermal infection before introducing them into the aquaria; the prawns were acclimatized to laboratory conditions for two weeks prior to exposure to mercuric chloride.

During this period, the prawns were fed 4% of their body weight twice daily. Each aquarium was supplied with dechlorinated, well-aerated water, an aerator and holed piece of PVC pipes for hiding as the prawns are nocturnal. Water was changed after every third day. After the acclimatization period, the prawns were randomly selected and stocked at the rate of 40 prawns per aquarium in two glass aquaria for the experimental runs.

Fig 1: *Macrobrachium lamarrei lamarrei* (H.Milne-Edward, 1837)

2.2 Preparation of heavy metal solution

Mercuric Chloride (Ranbaxy, India) in original package form, by mixing with distilled water was used as stock-solution by adopting the dilution techniques [10]. Different test doses were prepared making dilution of the stock concentration.

2.3 Determination of LC_{50}

Prawns were transferred to each aquarium and were exposed to different concentrations of $HgCl_2$. The mortality of the prawns was recorded at logarithmic time intervals that is, after 24, 48, 72 and 96 hours of exposure. The test media was renewed daily during the experimental period. The effect of each concentration was tested in duplicate to verify reproducibility. The data obtained in course of the investigation was analyzed statistically to see whether there is any influence of different treatments (concentrations) on the mortality of prawn. The median lethal concentration (LC_{50}) values and their 95% confidence limits for different exposure time were calculated by using the computer software "Probit Analysis", EPA version 1.5, USA. The LC_{50} value came out to be 0.02 mg/l.

2.4 Dose of heavy metal used in experiment:

The experiment was set for 60 days in aquaria of 200 L capacity. The prawns were divided into two groups. Group I^{st} was kept as unexposed control; II^{nd} Group was exposed to sub lethal concentrations of 0.002 mg/l mercuric chloride.

The prawn's behaviour and their activity were observed and recorded accordingly. Control groups were maintained for the experiment. In acute and chronic studies, feeding was stopped one day before the experiment started and under chronic studies. Refeeding was done after one day of exposure, Water being changed after every third day in all aquaria.

2.5 Histopathological Analysis

To study the histopathological changes induced by mercuric chloride, the prawns were exposed to 0.002 mg/l $HgCl_2$ for 60 days. Prawns were sacrificed by decapitation after 0, 20, 40 and 60 days. Hepatopancreas was removed for histological studies.

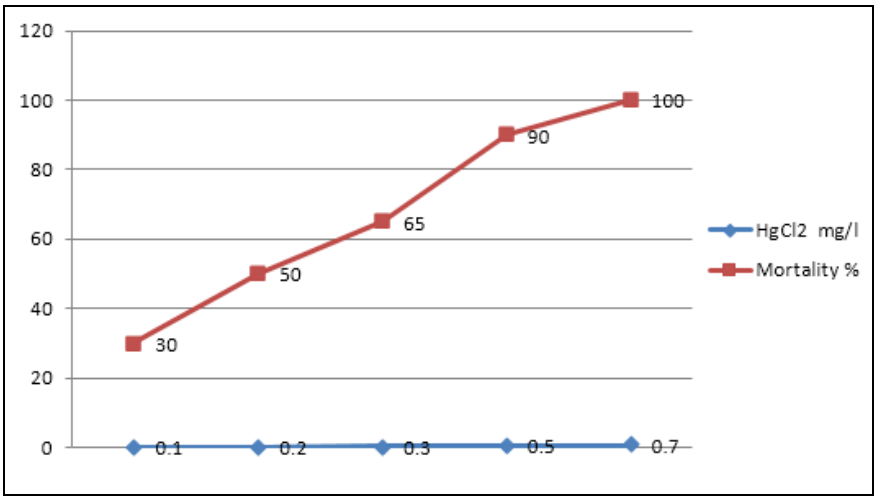

Fig 2: Showing % mortality with relation to $HgCl_2$ for 96 hrs**.**

3. Results

3.1 Determination of LC_{50}

The LC_{50} found out for the heavy metal, when exposed to prawn, *M. Lamarrei lamarrei* to different concentrations of Mercuric chloride for 96 hours, was 0.2 mg/l.

3.2 Histology of Hepatopancreas

3.2.1 Group I (control)

The transverse section of hepatopancreas of *M. Lamarrei lamarrei* showed normal histopathology and did not show any pathological lesions in the hepatopancreas of prawn. Each hepatopancreatic tubule is lined by a simple epithelium which consists of four cell types: E (embryonic), F (fibrillar), R (absorptive) and B cells (blister-like).

3.2.2 Group II (0.002 mg/l $HgCl_2$ treated)

On 20th day, the T.S. of Hepatopancreas of *M. Lamarrei lamarrei* showed disintegration in cell lining, development of small granular inclusions and little decrease in mitochondria in case of R-cells, glycogen content of B-cells start to disintegrate. In case of F-cells, dilation of rough endoplasmic reticulum and cisternae of Golgi bodies took place after 40 days, the exposed hepatopancreas of Prawn showed unembellished loosening of epithelial wall, R-cell showed granular inclusions in lipid vacuoles and cytoplasm; and few mitochondria remained. In case of B-cells glycogen content decreased to great extent and loss of clear cell junction was also seen. F-cells contained few rough endoplasmic reticulums which were dilated.

After 60 days the exposed hepatopancreas of Prawn showed intense loosening of epithelial tissue, haemocytic infiltration and cellular necrosis were evident. B-cells dysplasia, absence of glycogen content, loss of clear cell junction was seen. In case of R-cells development of numerous granular inclusions in lipid vacuoles and cell cytoplasm was observed. In case of F-cells dilated rough endoplasmic reticulum and dilated cisternae of Golgi bodies developed.

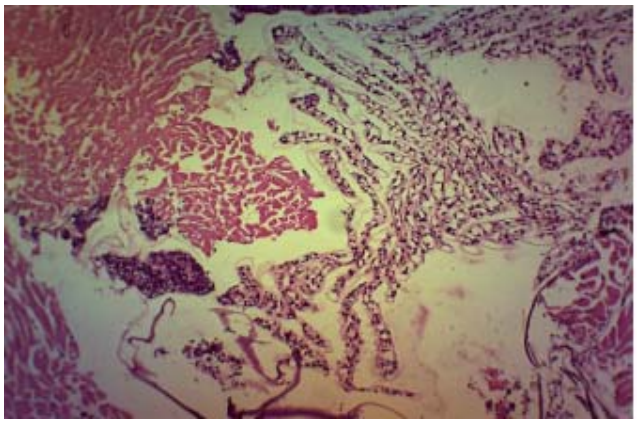

Fig 3: T.S. of hepatopancreas of *M. lamarrei lamarrei* of Group 1 (Control) mg/l $HgCl_2$

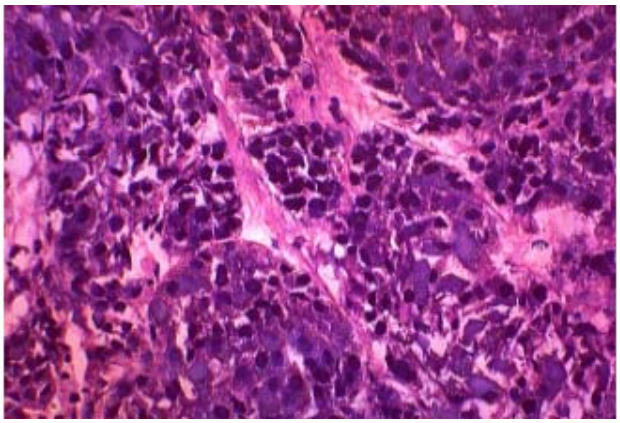

Fig 4: T. S. of hepatopancreas of *M. lamarrei* of Group II (0.002 treated) after 20 days.

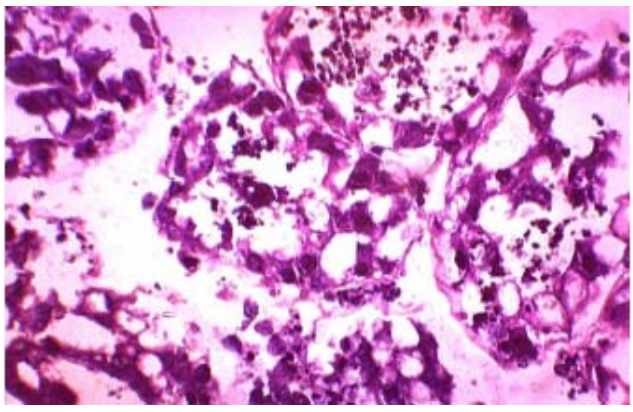

Fig 5: T.S. of hepatopancreas of *M. lamarrei lamarrei* of Group II (0.002 mg/l $HgCl_2$ treated) after 40 days.

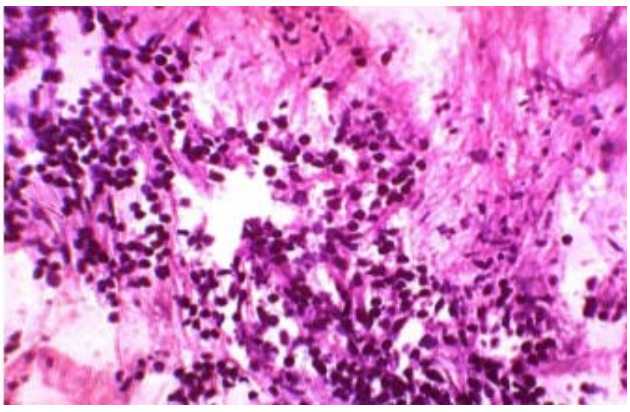

Fig 6: T.S. of hepatopancreas of *M. lamarrei lamarrei* of Group II (0.002 Mg/l $HgCl_2$ treated) after 60 days.

4. Discussion

In the present study, the changes occurred in the histological structure of hepatopancreas of fresh water prawn *M. lamarrei lamarrei* at different duration of exposure of mercuric chloride observed such as, absence of glycogen content, loss of clear cell junction and dysplasia in B-cells. In case of R-cells development of numerous granular inclusions in lipid vacuoles and cell cytoplasm and F-cells show dilated rough endoplasmic reticulum and dilated cisternae of Golgi bodies. Verma RS [5] reveals almost similar results when the hepatopancreas of prawn (*Macrobrachium sp*.) exposed to mercuric chloride.

Heavy metals induced biochemical and physiological changes in tissues of *Macrobrachium* have also been reported [11, 12, 13, 5]. Kaoud HA [7] found the effect of exposure of mercury (Hg) on mortality, resistance and bioconcentration in the tropical freshwater *Macrobrachium.*

5. Conclusion

The present work proposes to investigate the effect of mercuric chloride on the survival, growth, and healthy life of prawns. Herethe effort is being made on the changes occurring in the hepatopancreas of prawn by the addition of mercuric chloride which is highly toxic for prawns as well as the animal eating on them. The various tropic levels of food chain are affected by the consumption of mercury directly or indirectly.

6. Reference

1. Khayatzadeh J, Abbasi E. The Effects of Heavy Metals on Aquatic Animals. The 1st International Applied Geological Congress, Department of Geology, Islamic Azad University –Mashad Branch, Iran, 2010, 1:26-28.
2. Barbosa AC, Jardim W, Dorea JG, Fosberg B, Souza J. Hair mercury speciation as a function of gender, age and body mass index in inhabitants of the Negro River basin, Amazon, Brazil. Arch Environ Contam Toxicol 2001; 40:439–44.
3. Chen CL, Qu J, Zhao S, Liu G, Deng B, Li P *et al*. Accumulation of mercury, selenium and their binding proteins in porcine kidney and liver from mercury-exposed areas with the investigation of their redox responses. Sci Total Environ 2006; 366:627-637.
4. Masud S, Singh IJ, Ram RN. Histophysiological responses in ovary and liver of *Cyprinus carpio* after short term exposure to safe concentration of mercuric chloride and recovery patter. Journal of Environmental Biology 2009; 30(3):399-403.
5. Yamuna A, Saravana P, Bhavan P. Geraldine: Glutathione S-transferase and metallothionein levels in the freshwater prawn *Macrobrachium malcolmsonii* exposed to mercury. J Environ Biol 2012; 33:133-137.
6. Verma RS. Acute toxicity of nickel to fresh water prawns.Department of Zoology, University of Luckhnow. Turk J Zool 2012; 36(4):534-542.
7. Kaoud HA, Manal MZ, Mona MI. Effect of Exposure to Mercury on Health in Tropical *Macrobrachium rosenbergii*. Life Science Journal 2011; 8(1):25-29.
8. Mahajan PR, Zambare SP. Biochemical alterations in protein content of hepatopancreas and gonad of *Bellamya bengalensis* due to heavy metal toxicity. World Journal of Science and Technology 2012; 2(11):13-15.
9. Soegianto A, Dwi W, Usreg SH. Bioaccumulation, Elimination, and Toxic Effect of Cadmium on Structure of Gills and Hepatopancreas of Freshwater Prawn *Macrobrachium sintangese* (De Man, 1898).W. J Sci Tech 2013; 224:1575-1580.
10. APHA. Bioassay methods for aquatic organism in: standard methods for the examination of water and waste water. Ed 14, American Public Health Association Washington DC. 1976, 685-743.
11. Kabila V, Bhavan PS, Geraldine P. Induction of metal-binding protein in the freshwater prawn *Macrobrachium malcolmsonii* following exposure to nickel. J Natcon 2000; 12:95-102.
12. Yamuna A. Effect of Hg and Cu on hemocytes-mediated function in prawn *Macrobrachium malcolmsonii*. J Environ Bio 2002; 23(1):7-13.
13. Bhavan PS, Yamuna A, Geraldine P. Mercury induced metabolic changes in the juveniles of the economically important freshwater prawn *Macrobrachium malcolmsonii*. Asian J Animal Sci 2008; 3:60-65.