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PATHOLOGICAL CHANGES IN THE CARP EXPOSED TO IRON SULPHATE

H. Yuksel[1], M. Ural[2], M. Dorucu[2] and E. Karadas[3]

Department of Pathology, [1]University of Yuzuncu Yil Faculty of Veterinary, 65080, Van, Turkey.

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Iron and its compounds reach water in different ways and can have negative effects on aquatic organisms, depending on their concentrations. Tolerable levels of iron and iron-compounds in water are 0.9 mg/L for carp and 0.1-0.3 mg/L for trout (Celikkale, 1994). Histopathological studies on fish exposed to pollutants have shown that fish organs are efficient indicators of water quality (Cengiz *et al.*, 2001; Cengiz and Unlu, 2002).

Andersen *et al.* (1997; 1998) and Baker *et al.* (1997) studied the effects of different iron sulphate concentrations on the growth and lipid peroxidase levels in catfish tissue. Lesions in the gill, liver and spleen have been observed in the fish exposed to iron-compounds (Peuranen *et al.*, 1994). Vogt and Quinito (1991) investigated histopathological changes in *Penaeus monodon* exposed to 1 mg/L iron for 10 days. This study was performed to determine the effects of iron-compounds on the organs of carp *(Cyprinus carpio)*.

Materials and Methods

This study was conducted in the Cip Fisheries unit of Firat University, Elazig, Turkey. The fish (30±5 g) were acclimatized in glass aquaria (110x25x30 cm) in the laboratory for 15 days. Aquaria were filled with 40 L of water with hardness, temperature and pH at 29 mg/L CaO, 20°C, and 7.9, respectively. Water was continuously aerated. Twenty fish were divided into four groups. Groups I, II, and III were exposed to 0.9, 5 or 10 mg/L iron-sulphate, respectivly for 10 days. The average values for the water quality data were as follows: temperature 20°C, pH 7.9, dissolved oxygen 7.3 mg/L, hardness 29 mg/L CaO. At the end of the experiment, fish were anaesthetized in benzocaine (0.05 mg/L) prior to tissue removal. The fourth group was maintained in iron-sulphate free water to serve as the control.

Samples from the gill, liver, kidney, intestine, heart and brain of the fish were collected for histopathological examination. Tissue samples were fixed in neutral buffered formalin, embedded in paraffin, sectioned at 5 mm and stained with hematoxylin and eosin (HE) and Gomori's method for iron and Turnbull blue method for hemosiderin (Luna, 1968). Histopathological changes were examined under light microscope.

2. University of Firat, Faculty of Fisheries, 23119 Elazig, Turkey.
3. University of Afyon Kocatepe, Faculty of Veterinary Department of Pathology, Afyon, Turkey.

Results and Discussion

No behavioural changes were observed in the fish exposed to 0.9 mg/L iron-sulphate or the control group. It has been reported that existence of high level iron and iron-compounds in the water cause lesions, hypoxia and respiratory failure by accumulating on the gill lamellae (Celikkale, 1994). Aggressive and excitable behaviour initially, was followed by decreased activity in the fish exposed to 5 mg/L iron-sulphate. Increased breathing, high activity and attempts to jump from the aquarium were observed in the fish exposed to 10 mg/L iron sulphate. No mortality occurred during the experiment. No macroscopic lesions were observed on the organs of fish exposed to 0.9 and 5 mg/L iron-sulphate.

Histopathological studies revealed degeneration in the gill lamellae and hypertrophy of the epithelial cells (Barlas, 1999; Peuranen *et al.*, 1994 and Rawson *et al.*, 1993). Histopathologically, after 10 days of exposure to 5 and 10 mg/L iron-sulphate, hydropic degeneration (Fig. 1a), damaged epithelial cell exfoliation, hypertrophy of the gill lamellae, hyperplasia of the secondary gill lamellae, mononuclear cell infiltration on the interlamellar area (Fig. 1b) were observed. Epithelial exfoliation, hydropic degeneration and hyperplasia were more prominent on the gill lamellae of the fish exposed to 10 mg/L than exposed to 5 mg/L.

In addition to these findings, after exposure to 5 and 10 mg/L iron sulphate solution, diffuse lymphocyte infiltration and haemorrhage in the endocardium of the heart muscle (Fig. 2a) and focal glial cell proliferation in the brain (Fig. 2b) were detected. Diffuse lymphocyte infiltration on the endocardium were detected when exposed to 5 mg/L in 2 fish out of 5,

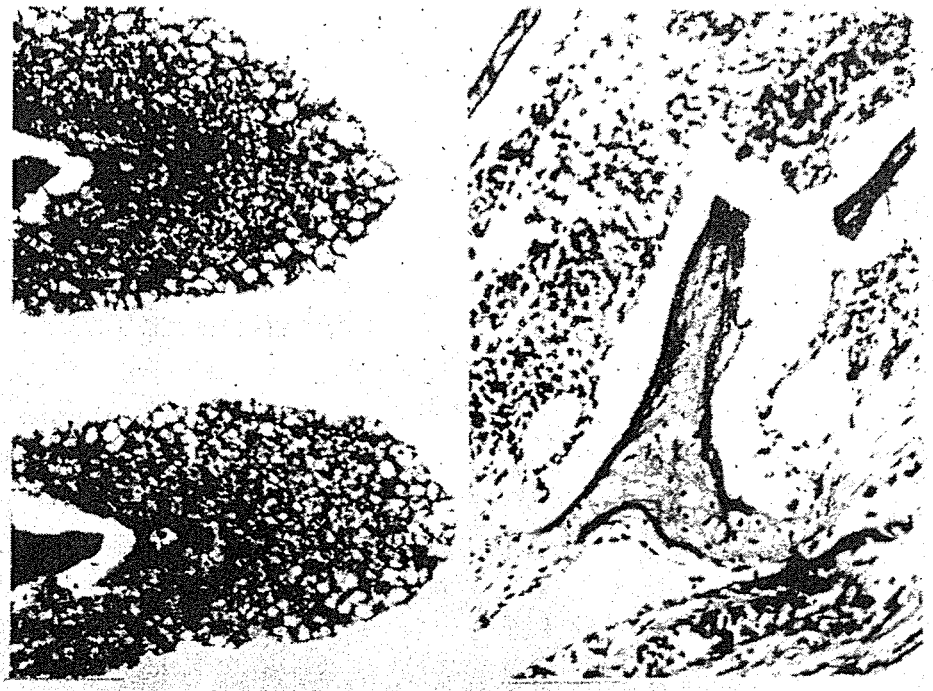


Fig. - a Fig. - b

Fig. 1 (a) Hydropic degeneration in the gill lamella. H & E x 200
(b) Mononuclear cell infiltration in the interlamellar area. H & E x 400

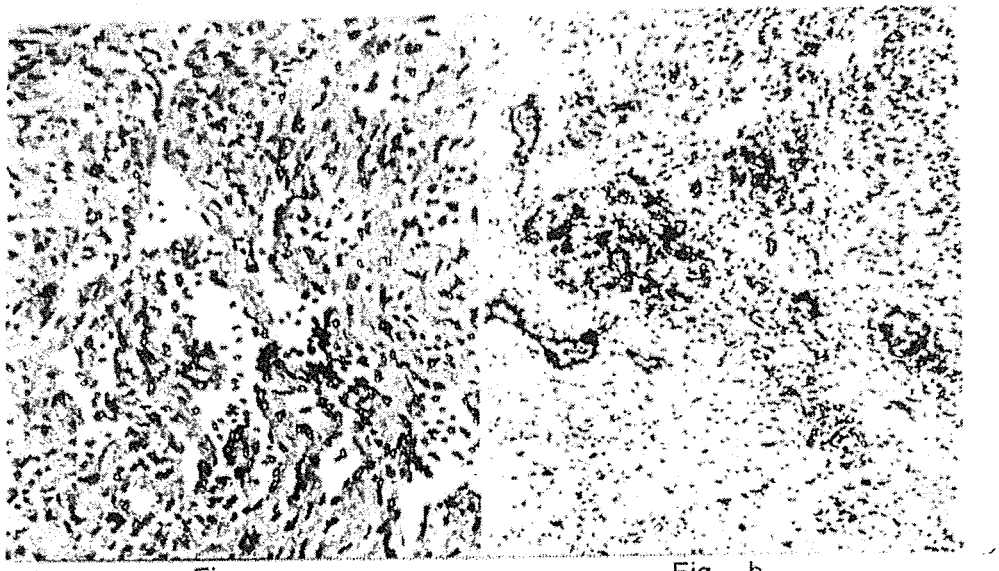


Fig. - a Fig. - b

Fig. 2 (a) Diffuse lymphocyte infiltration and haemorrhage on the endocardium of the heart muscle. H & E x 400 (b) Focal glial cell proliferation in the brain. H & E x 200

and to 10 mg/L in 4 fish out of 5. Focal glia cell proliferation was noticed when exposed to 10 mg/L in 2 fish out of 5 on the brain.

In addition to these observations, hydropic degeneration in the liver cells and epithelial desquamation, subepithelial lymphocyte infiltration in the intestine and haemorrhage or haemosiderosis in the kidney were noticed after exposure to 10 mg/L iron-sulphate. Iron and haemosiderin were stained in the kidney tissues of fish exposed to 10 mg/L iron sulphate. In the fish exposed to 0.9 mg/L iron-sulphate and in the control histopathological changes were not seen.

Summary

Histopathological changes in the carp exposed to iron sulphate were studied. Fish were exposed to iron sulphate solution at the concentrations of 0.9, 5 and 10 mg/L.

Hyperplasia and degeneration of the gill lamellae, diffuse lymphocyte infiltration on the heart muscle, glia cell proliferation in the brain, hydropic degeneration of the liver of the fish were observed in carp exposed to 5 and 10 mg/L iron sulphate.

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