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Histoarchritectural changes in gill structure of freshwater fish, Rita rita on sodium fluoride exposure.

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Abstract:In the present investigation an attempt has been made to study effect of sodium fluoride on histoarchitecture of gills in freshwater fish, *Rita rita*. To study toxicity of fluoride to gills of the freshwater fish, *Rita rita* one group of 30 fishes served as control group and the second group of 30 fishes exposed to 75 mg/l sodium fluoride which was the lethal dose. Fishes from both the groups were scarified to study histopathological changes in the gills after 24, 48, 72, and 96 hours of exposure. In the experimental group the severity increases with increase in time of exposure. Exposure of fishes for 48, 72 and 96 hours for 75 mg/l sodium fluoride showed epithelial lifting, lamellar fusion, swelling and curling of gill tips and degenerative and tissue necrosis.

Keywords:histopathology, gills , *Rita rita*, sodium fluoride.

INTRODUCTION

Aquatic organisms including fishes die in mass level because of sewage, industrial and pesticide pollution due to cellular and sub cellular damage in vital organs (Adlung, 1957). The pesticide/metal ions absorbed in to the body of fishes through skin and gills from aquatic media (Rackey, 1993). Heavy metals like mercury, lead, copper and several trace metals were found and they are most toxic for aquatic inhabitants. Major sources of water contamination by heavy metals are effluents from caustic and chloride industries, utensils making industries, aluminium smelters, fabrication industries, tile manufacturing industries etc. (Forstoner and Prosi,1979, Kumarguru et al., 1979, Panda and Misra ,1981). Camargo (2003) mentioned that fluoride ions acts as enzymatic poison , inhabiting enzyme activity by interrupting metabolic processes. In the present investigations histopathological effect of fluoride on gills of freshwater fish, Rita rita were studied.

MATERIALS AND METHODS

To study the effect of sodium fluoride freshwater fish, *Rita rita* (total length 10-12 cm, weight 20-30 g) were obtained from Bhima river, Solapur district, Maharashtra. Fish were acclimated to the laboratory in large size glass aquarium for 10 days. The fishes were divided into two groups (each group contain 30 fishes), one group served as control and second group served as experimental group containing 75mg/l sodium fluoride. Water for both groups was changed after 24 hours and maintain constant water temperature (27.00 ± 27.5°C).

Six fishes from both control and experimental groups were scarified by decapitation after 24, 48, 72 and 96 hours. The sacrificed fishes were dissected to collect the gills and immediately fixed in Bouin's solution. Paraffin embedding was carried out after dehydration in ascending series of alcohol grades. Sections of 4-5µ thickness were stained with eosin and hematoxylene then mounted with DPX. Sections were examined by light microscope and microphotographs with 40 x magnifications. Microphotographs was used for histopathological study of gills.

RESULTS-

Figure 1 – Gills of fish Rita rita from control group.

Figure 2to 5 – Gills of fish Rita rita from experimental group after 24, 48, 72 and 96 hours of sodium fluoride exposure.

CONTROL –

The primary gill lamellae (PGL) were flat leaf like structures with a central rod like supporting axis and a row of secondary gill lamellae (SGL) on each side of it. The secondary lamellae with intact cellular layer attached at their bases with the primary lamellae and free at their distal ends. The normal secondary lamellar epithelium was simple, consisting of a thin single or double sheet of epithelial cells, blood vessels and a row of pilar cells (PC). The blood vessel extends to the secondary lamellae. The region between the two adjacent secondary lamellae was inter lamellar region. Between the secondary lamellae, the primary lamellae are lined by a thick stratified epithelium. This region contains

numerous mucus cells (MC) and chloride cells (CLC) (Figure 1).

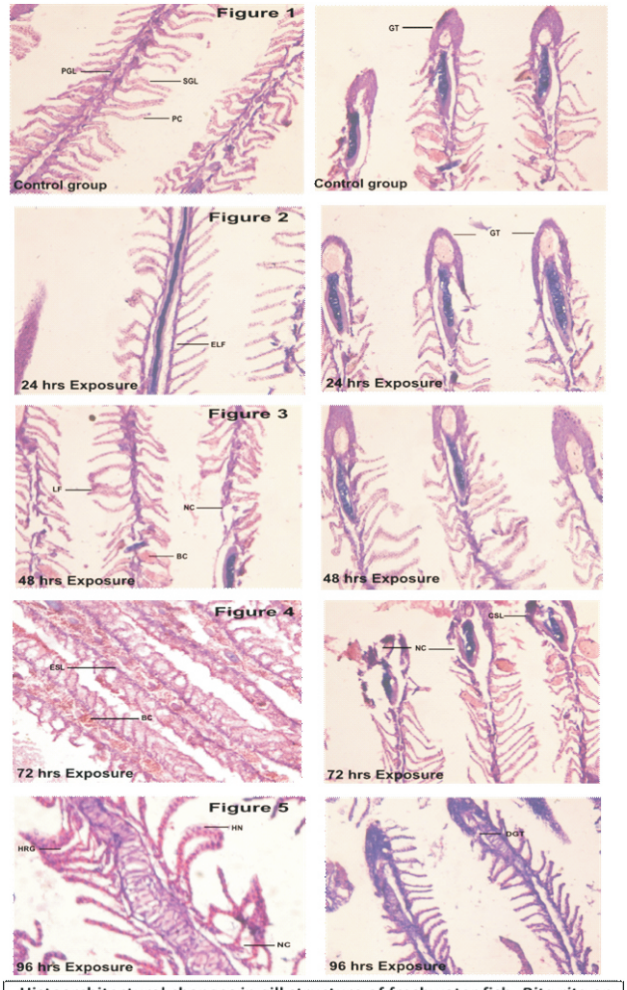
EXPERIMENTAL GROUPS -

In 24 hours of sodium fluoride treatment gills showed some epithelial lesions (EL) . Gills of fish showed the arrangement of primary and secondary lamellar processes was become thicker than as in control group fishes (Figure 2)

In 48 hours of sodium fluoride treatment epithelial lifting (ELF), lamellar fusion (LF) and filament cell proliferation (CP). Blood congestion (BC) was observed in secondary gill lamellae. (Figure 3)

In 72 hours of sodium fluoride treatment fusion of primary and secondary gill lamellae, degenerative and necrotic changes (NC) in the epithelium observed. Edema in secondary lamellae (ESL) accompanied with separation of their epithelium from the lamellar supporting cells. Swelling and curling in gill tips (CSL) (Figure 4).

In 96 hours of sodium fluoride treatment hemorrhages (HRG), blood congestion (BC) was observed in secondary gill lamellae. Hyperchromatic nuclei (HN), splitting of connecting tissues and necrosis (NC) was found. Gills also showed vacuolar degeneration, curling of secondary gill lamellae (CSL) (Figure 5)



Histoarchitectural changes in gill structure of freshwater fish, *Rita rita* on sodium fluoride exposure.

DISCUSSION

In present study revealed that acute exposure of sodium fluoride to fishes resulted damaged in gill structure. The structural changes in the organs at microscopic cellular and organ level leads to alterations of the function systems. Gills are first organs which exposed to sodium fluoride toxicity. In our study histopathological changes observed in gills are vacuolar degeneration, curling of secondary gill lamellae, swelling in gill tips. This variations are dose and time dependent.

Wannee *et al.*, (2002) studied the histopathological changes in the gills of fish, *Oreochromis niloticus* due to glyphosate herbicide observed lamellar cell hyperplasia, epithelial lifting, lamellar fusion and filament cell proliferation after exposing them to 96 hours. Supap et al., (2009) observed deterioration and telangictesia of gill filaments and hemorrhages, blood congestion and necrotic cells in the liver tissue from *Anabus testudineus* from unused lignite mines.

Puntius parrah exposed to copper showed several alterations, such as lamellar epithelium lifting, epithelium proliferation, lamellar axis vasodilation, edema in the filament, swollen tip of secondary gill lamellae. Earlier studies revealed that epithelial edema was one of the more frequent lesions observed in gill of fish exposed to heavy metals (Van *et al*., 2004). The histological alternations noticed in are in accordance to the exposure to the zinc sulphate toxicant as in earlier works (Metwally *et al*.,2010; Hajrudin *et al*.,2010). Gills showed edema of the primary lamellae; severe edema, hyperplasia, fusion and desquamation of the epithelial lining of the secondary lamellae were observed. According to Mallatt (1985), the edema of the gill epithelium is one of the main structural changes caused by the exposure to heavy metals. The histopathological changes were studied in the gill, liver, intestine and kidney of the nickel treated freshwater fish *H. molitrix.* The nickel caused tissue specific alteration in the tissues such as mucus proliferation, fusion of the gill lamellae and hypertrophy of gill tissues in the fish. Lack of normal palisade arrangement was followed by necrosis in hepatocytes (Athikesavan *et al*., 2006).

In the present study after 72 and 96 hours of exposure, sodium fluoride treated fish exhibited fusion of primary and secondary gill lamellae, degenerative and necrotic changes (in the epithelium observed. Swelling and curling in gill tips. Hemorrhages was observed in secondary gill lamellae. Hyperchromatic nuclei , splitting of connecting tissues and necrosis. In the present study sodium fluoride toxicity from freshwater fish *Rita rita* showed similar changes in gill structure. It can be concluded that sodium fluoride induced an early response in the fish as evidenced by alterations both at structural and functional levels in gills.

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