

EFFECT OF SODIUM FLUORIDE ON GROWTH AND DEVELOPMENT OF FINGERLINGS OF *CATLA CATLA*

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ABSTRACT

The fingerlings of *Catla catla* were exposed to different sublethal doses of sodium fluoride (20 mg/L of water, 40 mg/L of water and 60 mg/L water) for 20, 40 and 60 days. Observations revealed that fluoride concentration as well as exposure period had an effect on the growth of fishes. The present study reveals that increase in length and weight was retarded after exposure to fluoride in fingerlings. Retardation was comparatively more in higher concentration as compared to lower concentration and also during longer exposure as compared to less exposure.

Key words: Fluoride, Growth, *Catla catla*.

INTRODUCTION

In both Urban and rural India, ground water is the major source of drinking water and it is the major source of fluoride pollution. It constantly dissolves from the environment and goes into the ground water (Jain *et al.*, 2005). Fluoride, though occurs in minimum quantities in natural water yet evokes considerable interest due to its impact on human health.

Fluoride is increasing in the environment due to various human activities such as processing of phosphate rock and its use as agricultural fertilizer; combustion of coal (containing fluoride impurities), and aluminium, steel, copper, nickel and glass manufacturing industries.

Fluoride in very limited quantities is desirable for healthy growth of teeth and bones in human beings and prevents dental caries. But in excess quantities, not only causes disturbance of enamel structure but it also causes genetic damage, and neurological damage (Saxena *et al.*, 2005).

The permissible limit of fluoride content in drinking water recommended by ISI and WHO is 1.0 mg/L. The maximum permissible limit of fluoride in drinking water according to

the Bureau of Indian standard (BIS, 1983) is 0.6 mg/L to 1.2 mg/L. However, Teotia and Teotia (1984) on the basis of their studies have suggested the maximum permissible limit of fluoride below 0.5 mg/L.

The drinking water has been classified according to its fluoride content as safe (up to 1.0 mg/L) marginally contaminated (1.1 mg/L to 2.5 mg/L) and highly contaminated (2.6 mg/L and above) (Sushella, 1999). Buragohain *et al.*, (2007) reported that fluoride concentration in water less than 0.7 mg/L may cause dental caries.

In spite of the fact that fluoride is considered as a serious pollutant and its concentration is increasing significantly in many aquatic ecosystems, relatively little is known about fluoride toxicity in aquatic animals.

On the basis of above fact in present study it has been planned to observe the effect of fluoride concentration on growth of fingerlings of *Catla catla* which is a freshwater, surface feeder culturable fish and certainly being exposed to natural higher fluoride concentration in fresh water bodies continuously.

MATERIAL AND METHODS

Present study was conducted in fingerlings

of *Catla catla*, collected from local resources. They were treated with 0.1% KMnO₄ solution and kept under standard laboratory condition for seven days before commencement of experiment. They were provided food and kept properly aerated in glass aquarium in water having temperature $24 \pm 10^{\circ}\text{C}$. pH 7.1 ± 0.2 dissolved O₂ 8.2 ± 0.2 mg/L.

For experiment, fingerlings (weighing 7.2 ± 0.32 gm/ 7.4 ± 0.21 cm length) were divided in four groups, each group having 10 fingerlings, Group I served as control while group II, III & IV served as experimental groups, exposed to sodium fluoride. Group II was exposed to lower concentration *i.e.* 20 mg Na F/L of water while group III was exposed to medium concentration *i.e.* 40 mg Na F/L of water and to higher concentration *i.e.* 60 mg Na F/L of water. Experiment was conducted for two months. During this period length and weight was recorded after 20 days, 40 days and 60 days for all four groups. Comparison was made between the control and experimental groups to observe the effect of fluoride on growth.

RESULT

After exposure to fluoride It was found that increase in weight and length of fingerlings was affected.

Length:

In control group there was increase in length of fingerlings at each level of observation *i.e.* continuous increase was found after 20 days (+ 2.70%), 40 days (8.10%) and 60 days (14.86%). In experimental groups there was 7.9% increase at 20 mg Na F/L concentration and 7.8% increase at 40 mg Na F/L concentration after 60 days exposure but fingerlings exposed to higher concentration (60 mg Na F/L) there was no increase at all. (Table-1 & Fig. 1).

Weight:

In control group weight of fingerlings increased after 40 days (8.33%) as well as after 60 days (31.94%) but there was no increase in weight after 20 days. In experimental group there was slight decreased (-1.38%) at 40 days but increased (2.77%) at 60 days exposure at the concentration of 20 mg NaF/L of water. Weight is also decreased (-1.38%) after 40 days exposure and slightly increased (+ 1.38%) at 60 days exposure at the concentration of 40 mg Na F/L of

water. There was no increase after 60 days in fingerlings, exposed at the concentration of 60 mg Na F/L of water. (Table 2 & Figure 2).

DISCUSSION

Results in present investigation reveal that increase in length and weight was retarded after exposure to sodium fluoride in fingerlings. Retardation was comparatively more in higher concentration as compared to lower concentration and also during longer exposure as compared to less exposure. Stokinger (1949) reported that weight gain decreases in rats, rabbits and guinea pigs after exposure to hydrogen fluoride. Similarly Messer *et al.* (1973) reported retardation in growth rate of mice after exposure to 100 ppm or more fluoride in drinking water. Guan *et al.* (1988) and Hanison (1984) reported that growth and weight decreases in rate suffering from chronic fluorosis.

Recently many other workers have reported reduction in weight of rats after exposure to 100 ppm fluoride in drinking water for two months (Chinoy *et al.*, 1991; NTP, 1998; Patel, 1997; Saralakumari *et al.*, 1988 and Stavert *et al.*, 1991) and reported a loss in weight of rats and mice exposed to fluoride which was recovered after withdrawal of fluoride. Camarago (2003) reported that fluoride ion acts as enzymatic poison and inhibits enzymatic activity. Fluoride as pollutants might be disturbing the CNS and endocrine glands responsible for controlling growth of animals as well as nervous system (Atsdr, 2001). Thus fluoride interrupts metabolic processes such as glycolysis, synthesis of DNA and protein, inhibits cell proliferation and cytotoxic at high dose.

Thus retarded growth *i.e.* less increase in weight and length of fingerlings observed in present study might be due to the fact that fluoride interrupts those metabolic activities which are responsible for growth and development in organisms. Thus the observations of present study state that fluoride toxicity to aquatic organisms including fishes increased with the increase in fluoride concentration in aquatic medium and exposure duration.

Thus it can be concluded that fluoride which is a pollutant, interferes with the normal functioning of CNS and endocrine glands responsible for controlling the growth of fish and thus ultimately affect the fish production.

Table 1: Effect of Sodium Fluoride on the length of Fingerlings of *C. catla*.
(Mean values \pm S.D. of 10 fingerlings in each group)

Parameter	Length of fingerlings in cm.			
	0 days	20 days	40 days	60 days
Control (Group I)	7.4 \pm 0.21	7.6 \pm 0.33 (+ 2.70%)	8.0 \pm 0.29 (+ 8.10%)	8.5 \pm 0.32 (+ 14.86%)
20 mg Na F/L (Group II)	7.4 \pm 0.21	7.4 \pm 0.24 (0%)	7.6 \pm 0.33 (+ 2.70%)	7.9 \pm 0.25 (+ 6.75%)
40 mg Na F/L (Group III)	7.4 \pm 0.21	7.4 \pm 0.25 (0%)	7.5 \pm 0.31 (+ 1.35%)	7.8 \pm 0.26 (+ 5.40%)
60 mg Na F/L (Group IV)	7.4 \pm 0.21	7.4 \pm 0.31 (0%)	7.4 \pm 0.32 (0%)	7.4 \pm 0.32 (0%)

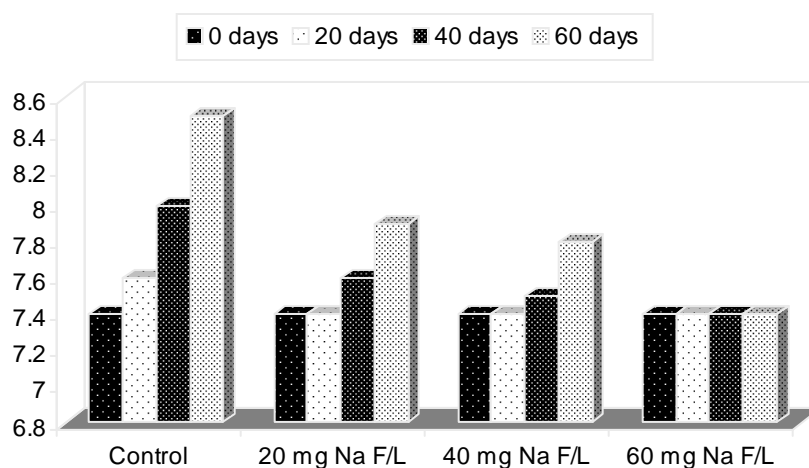


Figure 1: Effect of Sodium Fluoride on the length of Fingerlings of *C. catla*.
(Mean values in cm. of 10 fingerlings in each group)

Table 2: Effect of Sodium Fluoride on the weight of Fingerlings of *C. catla*.
(Mean values \pm S.D. of 10 fingerlings in each group)

Parameter	Length of fingerlings in cm.			
	0 days	20 days	40 days	60 days
(Group I)	7.2 \pm 0.32	7.2 \pm 0.32 (0%)	7.8 \pm 0.24 (+ 8.33%)	9.3 \pm 0.25 (+ 31.94%)
20 mg Na F/L (Group II)	7.2 \pm 0.32	7.2 \pm 0.24 (0%)	7.1 \pm 0.32 (- 1.38%)	7.4 \pm 0.33 (+ 2.77%)
40 mg Na F/L (Group III)	7.2 \pm 0.32	7.1 \pm 0.23 (- 1.38%)	7.1 \pm 0.24 (- 1.38%)	7.3 \pm 0.31 (+ 1.38%)
60 mg Na F/L (Group IV)	7.2 \pm 0.32	7.0 \pm 0.26 (- 2.77%)	7.0 \pm 0.28 (- 2.77%)	7.2 \pm 0.34 (0%)

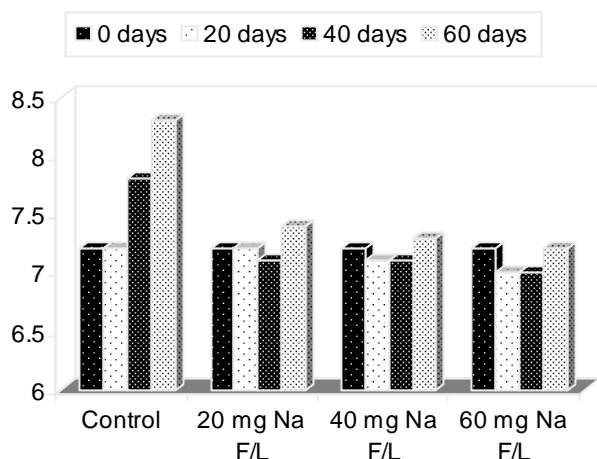


Figure 2: Effect of Sodium Fluoride on the weight of Fingerlings of *C. catla*. (Mean values in gm. of 10 fingerlings in each group)

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