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NOTE

Studies on Aluminium Toxicity to *Saccobranchus fossilis*

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Aluminium toxicity to an edible fresh water fish, *Saccobranchus fossilis* has been studied in aquarium model. Ten fishes were exposed to 50 ppm concentration of Al^{3+} in the form of aluminium sulphate for 50 days in the experimental set. Similar number of fishes were also studied in the control set. Mortality of the fishes was recorded. At the end the experiment, fishes were sacrificed and aluminium uptake by the tissues in different parts was studied. Results suggested that the exposure of fishes to aluminium (50 ppm) is definitely toxic. The upper part of the fish (brain and gills) were found to be the major sites of aluminium accumulation. The lower part (tail) showed the least aluminium accumulation. The total aluminium absorbed by the fish tissue was found to be 0.74 mg/g. The mortality of the fish was found to be 70 % in the aluminium intoxicated water as compared to that of the control.

Key Words: Aluminium toxicology, Aluminium ecotoxicology, Aluminium toxicity to fishes.

Aluminium toxicity to fauna and flora has recently been finding much interest. This is because aluminium exposure has been reported to be neurotoxic[1-14]. Bioavailability of aluminium is limited despite its heavy content in the soil. This is because aluminium in the soil is present as complex alumino silicates, which are quite stable. However, in the event of acid rain and other pH lowering factors, there may be leaching of aluminium to the ground water in the soluble form resulting in toxicity to the living kingdom. Aluminium toxicity to the fishes has been reported earlier[15-20]. Studies on chronic aluminium toxicity in the fishes would serve as effective models for studying aluminium neurotoxicity in humans.

With the above view in mind, we have presently studied on the aluminium toxicity to an edible fresh water fish, *Saccobranchus fossilis*.

Fish of *singhi* species (*Saccobranchus fossilis*) were procured from the local fish market and were reared in a aquarium in fresh water under laboratory condition. The fishes were allowed to acclimatize to the aquarium condition for one week. After one week, 10 fishes each were placed in two aquarium of similar dimension and capacity. 40 L water was taken in each of the aquarium. Calculated quantity of aluminium sulphate [$Al_2(SO_4)_3$. $18H_2O$] was weighed out and added to one of the aquarium so that the Al^{3+} concentration in the aquarium becomes 50 ppm. This aquarium was labeled as experimental set. The other aquarium with ten fishes and 40 L water left as such and was labeled as control set. The fish in both the aquarium were fed with fish food (procured from the market) at a stipulated time during the day. Almost equivalent quantity of food was given to both the sets. Water in both the aquarium were well aerated throughout. The health as well as mortality (if any) of the fish was noted at a stipulated time, every 24 h. till 50 days. Dead fish were immediately removed out from the aquarium. pH of the aquarium water was also noted from time to time. At the end, five fishes of the control set and all the three surviving fishes of the experimental set were sacrificed, weighed out separately and were chopped into three parts *viz.*, head part, middle part and the tail part. Each part of each of the fish was weighed out and treated separately with 100 mL of 1 M HNO_3 solution in a conical flask and boiled for 0.5 h, where upon the entire tissue got dissolved. The solution was then cooled down to room temperature and quantitatively filtered into 100 mL volumetric flask. The solution was made upto the mark (100 mL) with the help of distilled water. Aluminium content of this solution was estimated colourimetrically using Erichrome cyanine R reagent[21]. The average content of aluminium in mg/g of the fish tissue in the different parts of the fish of the experimental and control sets were calculated out separately.

Norms of the institutional committee for ethics in animal experimentation were strictly followed during the experimentation.

Aluminium uptake by the fish is recorded in Table-1. Aluminium has been found to be toxic to the fishes at an exposure

concentration of 50 ppm. The pH of aluminium exposed water (experimental set) was found to vary in the range of 5.0 to 6.5 during experimentation. Out of ten experimental fishes, three died within 96 h. The mortality at 15 days was five. At 30 days, total mortality was seven. At the end of 50 days, the total mortality remained at seven. In the corresponding control set none of the fishes died. This clearly indicates a slow onset of toxicity upon chronic exposure to aluminium. An exposure to higher Al^{3+} concentration would definitely be more toxic. Table-1 shows that the head part including brain and upto gills, absorbs relatively higher quantity (0.42 mg/g) of aluminium as compared to the middle (0.25 mg/g) and tail (0.07 mg/g) parts. The tail part uptaking the lowest quantity. It seems the brain and gill cells have some special affinity for Al^{3+} ions. Accumulation of Al^{3+} in the gills must be intoxicating the respiratory tract, which results in the death of the fish. The total accumulation of Al by the fish tissue in our experiments was found to be 0.74 mg/g. The fishes in the control set showed negligible presence of aluminium in their tissue. Any little amount of aluminium found in the control set fishes must have been coming from the water used in the aquarium. The ability of aluminium to associate with the cell membrane and thus destroy the properties of membrane might be the factor behind the toxicity of aluminium.

TABLE-1
ALUMINIUM UPTAKE BY THE FISH (n = 10) EXPOSED TO 50 ppm Al^{3+} ION CONCENTRATION FOR 50 DAYS

Part of the fish	Aluminium uptake (mg/g)	
	Experimental set (50 ppm Al^{3+})	Control set
Head	0.42	0.02
Middle	0.25	0.00
Tail	0.07	0.00
Total	0.74	0.02

n = number of fishes

Conclusion

Our present studies suggest that exposure of fishes to aluminium is definitely toxic. The upper part of the fish *i.e.*, brain and gills are the major sites of aluminium accumulation and hence are the main target organs for toxicity in fishes. Since fish are the part of food chain, the toxicity might be transmitted onward to other animals and humans through the fish. In view of this, there should be strict monitoring of the aluminium content of water bodies in which the fishes are cultured. Factors responsible for aluminium leaching from the soil such as low pH, as well as, other pathways leading aluminium to the natural waters, should be monitored and checked. The fishes cultured in the vicinity of mines and industries of aluminium should be tested for their aluminium content before consumption by the people. Generally consumption of local fishes in such areas should be discouraged.

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