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SHORT NOTE

BIOCHEMICAL ALTERATIONS IN FRESHWATER INDIAN CATFISH *HETEROPNEUSTES FOSSILIS* EXPOSED TO 96-h LC_0 OF ALDRIN

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Anil Kishore Srivastava, Narendra N. Singh and Anil K. Srivastava (1992) Biochemical alterations in freshwater Indian catfish *Heteropneustes fossilis* exposed to 96-h LC_0 of aldrin. *Bull. Inst. Zool., Academia Sinica* **31**(2): 137-140. When exposed to 96-h LC_0 concentration (0.06 ppm) of commercial grade aldrin for 96 h, Indian catfish, *Heteropneustes fossilis*, developed hyperglycemia and hyperchloremia. However, the treatment also induced hypocholesteremia and hypoproteinemia after exposure to the pesticide.

Key words: Aldrin, Toxicity, Fish, Blood chemistry.

The organochlorine insecticide aldrin (1, 2, 3, 4, 10, 10-hexachloro-1, 4, 4a, 5, 8, 8a-hexahydro-1,4-endo-exo-5,8-dimethanonaphthalene) is indiscriminately applied in soil pest regulation strategies in many developing and underdeveloped countries. The entry of aldrin into aquatic environments adversely affects spawning, hatching success, and growth in salmonids and threespine stickleback; as well as induces changes in the blood and tissue chemistry of freshwater catfish (Katz, 1961; Srivastava and Singh, 1981). The aim of this investigation was to examine if acute exposure (96 h) LC_0 (0.06 ppm) of aldrin would caused any changes in blood glucose, chloride, cholesterol, and serum protein levels in freshwater Indian catfish, *Heteropneustes fossilis*.

MATERIALS AND METHODS

Healthy male and female adult catfish *Heteropneustes fossilis* (weight 30.65±2.40 g; length 15.8±1.2 cm), obtained locally from a large freshwater pond, were brought to the laboratory and acclimated in tap water for 15 days under natural photoperiod and ambient temperatures (28±1.3°C) in 50-l glass aquaria. They were fed a daily diet of wheat flour pellets and ground dried shrimp; the aquaria were cleaned and the water replenished daily. The physiochemical properties of the water used included: hardness 114.85±4.59

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mg/l as $CaCO_3$; conductivity 455.33±3.33 μmho/cm; pH 7.70±0.01; and dissolved oxygen content 6.07±0.18 mg/l.

Toxicity data on 96-h LC_{50} and LC_0, as determined according to American Public Health Association *et al.* (1975), on catfish for aldrin were 0.175 and 0.06 ppm, respectively. For this study, groups of 30-36 fish (6 fish/20-l glass jar) were exposed to 0.06 ppm of aldrin dissolved in absolute alcohol, added to the tap water for 96 h. There was zero mortality for both treated and control fish. Six fish from each group were selected randomly for analysis. Parallel groups, each consisting of six fish, which had received corresponding concentrations of absolute alcohol only were sampled for comparison.

The fish were anesthetized with 1 g/3 l MS 222 (tricaine methanesulfonate) and blotted dry. Caudal penduncles were removed, and free-flowing blood was collected in citrated tuberculin syringes; the blood was used to determine blood glucose, cholesterol, chloride, and total serum protein content according to methods described by Folin and Wu (1920), Zlatkis *et al.* (1953), Schales and Schales (1941), and Lowry *et al.* (1951), respectively.

RESULTS

The effects of a 96 h exposure to a 96-h LC_0 concentration (0.06 ppm) of aldrin on blood glucose, cholesterol, chloride and total serum protein contents of the examined fish are given in Table 1. Mean blood glucose concentration in the control fish was 72.64 mg/100 ml; blood glucose levels increased significantly 96 h after exposure to aldrin. The fish exhibited hypocholesteremia in comparison with control levels of 701.53 mg/100 ml. Blood chloride levels in aldrin-treated fish increased significantly 96 h after exposure from a mean control value of 136.36 mM/l. In contrast total serum protein content in catfish exposed to 0.06 ppm aldrin was significantly reduced as compared to a control value of 7.22 g/100 ml.

Table 1
Biochemical parameters in Indian catfish, *Heteropneustes fossilis* exposed to 96-h LC_0 (0.06 ppm) of aldrin for 96h. Values are expressed as mean±SE (n=6), *p<0.01 and **p<0.001 (Student t-test)

Parameters	Control (untreated)	Experimental (treated)
Blood glucose (mg/100 ml)	72.64± 1.93	85.53± 3.60*
Blood cholesterol (mg/100 ml)	701.53±25.98	361.40±13.00**
Blood chloride (mM/l)	136.36± 0.41	184.69± 5.15**
Total serum protein (g/100 ml)	7.22± 0.22	6.71± 0.13*

DISCUSSION

The occurrence of hyperglycemia in catfish exposed to 0.06 ppm aldrin may be brought about by separate enzymic, harmonal, and respiratory disturbances, or by a combination of these factors. Yau and Mennear (1977) reported reduced secretory activity in the pancreatic β-cells of rats subjected to DDT intoxication. Insulin deficiency in fishes causes a repeated exchange of glucose from extracellular fluids to muscle tissues, resulting in blood glucose elevation (Lewander

et al., 1976). The inhibition of acetylcholinesterase in fish after exposure to endosulfan increases the secretion of catecholamines (Gopal *et al.*, 1985), which may bring about glycogenolysis and hyperglycemia through raised levels of cyclic AMP (Terrier and Perrier, 1975).

Gluth and Hanke (1985) reported hypocholesteremia in *Cyprinus carpio* exposed to organochlorine (OC) pesticides. Singh and Singh (1980) reported a decreased GTH pituitary potency in the blood serum of *H. fossilis* following OC toxicosis. Thus, in this study it is likely that aldrin affects GTH potency which, in turn, inhibits the conversion of esterified cholesterol to free cholesterol.

Grant and Mehrle (1973) reported hyperchloremia in rainbow trout following endrin intoxication. Thomas and Murthy (1976) reported that endrin toxicosis significantly decreased carbonic anhydrase activity in *H. fossilis*. Thus, increases in blood chloride concentration in our experimental catfish may have occurred due to a decrease in carbonic anhydrase activity due to aldrin (Maetz and Garcia-Remeu, 1964),

In general, OC pesticides are known to depress both tissue and circulating protein in fishes (Grant and Mehrle, 1973). It is possible that OC pesticidal stress influences the conversion of tissue protein into soluble fractions which can enter the blood and be utilized.

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短　　報

淡水中印度鮎魚 (*Heteropneustes fossilis*) 以不致死濃度的阿特靈處理 96 小時後生化特性上的改變

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淡水中印度鮎魚 (*Heteropneustes fossilis*) 以不致死濃度 (百萬分之零點零六) 商品級的阿特靈處理 96 小時後，產生了高血糖，高血氯，低膽脂醇與低血蛋白癥狀、膽酯醇與低血蛋白癥狀。