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The Effect of *In vivo* Exposure of Endrin on the Activities of Acid, Alkaline and Glucose-6-Phosphatases in Liver and Kidney of *Ophiocephalus (Channa) punctatus*

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Introduction

Endrin, one of the chlorinated hydrocarbon pesticides, is extensively used in the destruction of agricultural pests. MOUNT (1962) observed that endrin affected central nervous system and reproductive system of Pimephales notatus and Lebistes reticulatus. ELLER (1971) studied pathological changes produced by endrin in the brain, gill, liver and gonads of Salmo clarki. Toxicity of endrin to fishes has also been reported by FERGUSON et al. (1965), SAANIN (1960) and TARZWELL (1965). EISLER and EDMUNDS (1966) reported that sub-lethal concentration of endrin changed liver function in Sphaeroides maculatus. GRANT and MEHRLE (1970) observed altered physiological parameters of growth, reproduction, thyroid activity, intermediary metabolism and osmoregulation in Carassius auratus chronically exposed to endrin by diet. JOHNSON (1968) and KATZ et al. (1969) reviewed the literature on the effects of various pesticides on fishes. In the present communication, the effect of endrin on the activities of three phosphatases in the liver and kidney of Ophiocephalus punctatus has been examined.

Materials and Methods

Animals :

Alive fishes (between 50 - 60 gms. in weight and 10-15 cms. in length) were collected from local fresh water sources. They were maintained with tap water in all glass aquaria. A fish density of two fishes per three liters of water was used with twelve indiviuals in each aquarium. Endrin was dissolved in tap water to form a solution of 0.01 mg/l and the experimental fishes were treated for twenty days with this solution by bath. In each case, twentyfour fishes were examined. Prior to endrin exposure, fishes were preadapted for three days in separate aquaria.

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Enzyme assay :

Ten percent (W/V) homogenates of liver and kidney of control and experimental fishes were prepared in 0.25M sucrose solution. The homogenates were centrifuged for 20 minutes at 1000 g. The clear supernatant fluids were used as the source of enzymes. 0.016M sodium B-glycerophosphate was used as a substrate in a pH medium of 5.0 and 9.3 for acid and alkaline phosphatases respectively. The enzyme activity was estimated according to the method of BODANSKY (1933). SWANSON'S (1965) method was adopted for the estimation of glucose-6-phosphatase activity. 0.01M glucose 6-phosphate solution was incubated for 15 minutes at pH 6.5. Results are expressed in milligram of inorganic phosphate released per milligram of tissue protein per hour incubation at 37°C. Protein was estimated by the method of LOWRY et al. (1951).

Results

The effect of exposure to endrin for twenty days on the activities of acid, alkaline and glucose-6-phosphatases are shown in table 1.

The data shows that in the liver, the activities of alkaline phosphatase and glucose-6-phosphatase were decreased. The most significant decrease was noted in glucose-6-phosphatase activity. Acid phosphatase activity is stimulated. The kidney shows stimulation in activities of all the enzymes. The changes noted in the activities of acid phosphatase and glucose-6-phosphatase were statistically significant.

Discussion

A large number of references are available on the toxicity and accumulation of endrin in fishes (FERGUSON et al. 1965 and HENDERSON et al. 1969). Very little work has been done on the effects of this pesticide on enzyme activities. An attempt has been made to examine the effect of endrin on the activities of the acid, alkaline and glucose-6-phosphatases. Our data indicates that this pesticide inhibited the activities of alkaline and glucose-6-phosphatases in the liver but there is a slight stimulation in acid phosphatase activity. Kidney showed slight stimulation in activities of all enzymes. Acid phosphatase, a lysosomal enzyme, helps in the autolysis of the cell after its death. The increase in lysosomal activity in the injured cells occurs as a part of the prenecrotic

TABLE 1

The activities[a] of acid, alkaline and glucose-6-phosphatases in control and experimental fishes

Enzyme	Tissue	Number of experiments conducted	Controls	Experimentals	Level of significance
Acid phosphatase	Liver	3	0.039 ± 0.003	0.043 ± 0.005	1.14 (-)
	kidney	3	0.080 ± 0.003	0.108 ± 0.011	4.08 (+)b
Alkaline phosphatase	Liver	3	0.046 ± 0.010	0.040 ± 0.005	066 (-)
	kidney	3	0.080 ± 0.007	0.128 ± 0.016	1.50 (-)
Glucose-6-phosphatase	Liver	3	0.151 ± 0.009	0.122 ± 0.022	0.69 (-)
	Kidney	3	0.168 ± 0.005	0.266 ± 0.012	3.88 (+)

a. Activity is expressed in mg. of inorganic phosphate liberated per mg. of tissue protein per hour at 37 C (Mean ± S.E.).

b. (+) indicates statistically significant difference from control values at 95 percent confidence interval.

changes (NOVIKOFF 1961 and DE DUVE 1968). The inhibition in the acid phosphatase activity may be due to the disintegration of the cells affected by endrin treatment. GOEL and SASTRY (1973) and SASTRY (1975) showed the presence of alkaline phosphatase in Ophiocephalus. It is a brush border enzyme. There is no significant variation in enzyme activity in the liver. In the kidney, the stimulation in enzyme activity may be due to the increase in the transphosphorylation activity in this organ. Glucose-6-phosphatase is localized in the endoplasmic reticulum of the cell. The hydrolysis of glucose-6-phosphate is a key step in gluconeogensis and glycogenolysis in liver (HOCHACHAKA 1969). GRANT and MEHRLE (1973) have reported inhibition of mobilization of liver glycogen by low doses of endrin and blockage by high doses. The decrease in glucose-6-phosphatase activity in Ophiocephalus punctatus indicates similar condition.

Summary

The effect of in vivo exposure of a sublethal concentration (0.01 mg/l) of endrin on the activities of acid, alkaline and glucose-6-phosphatases in the liver and kidney of Ophiocephalus punctatus was studied. The period of exposure was twenty days. In the liver, alkaline phosphatase and glucose-6-phosphatase activities were decreased but acid phosphatase was stimulated. Kidney showed stimulation in the activity of all the three phosphatases.

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