

STUDIES ON BIOCHEMICAL PARAMETERS, GONADOSOMATIC INDEX AND DEGENERATIVE CHANGES OCCURRED IN THE FEMALE GONADS OF THE FRESH WATER FISH *Channa punctatus* EXPOSED TO CUPRIC CHLORIDE

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ABSTRACT

In the present investigation the fresh water fish Channa punctatus was exposed to sublethal concentration of CuCl₂ (1.0 ppm) for 30 days. The gonado-somatic index of female fish declined significantly after 30 days exposure to CuCl₂. The exposure caused various degenerative changes in the ovarian structure. Negatively disturbed vitellogenin synthesis was prominently noted. There was a decrease in glycogen, proteins & cholesterol contents in the CuCl₂ treated ovary of the fish. The decrease in glycogen content was found to be 17.11%, the protein content as 27.88 % & the cholesterol content as 76.21%.

Keywords: Cupric Chloride, Ovary, Histopathology, Biochemical parameters

Introduction

Increasing industrialization leads to continued addition of pollutant in the environment. Amongst pollutants, heavy metals, are the major cause of concern for aquatic environmental because of their toxicity, persistency, tendency to accumulate in organisms and undergoing food chain amplification (Vinikour et.al., 1980). Some heavy metals are essential trace metals required in minute quantities by fresh water fish for their growth and development (Moore & Ramamoorthy, 1984). These heavy metals may proved highly toxic to the fishes even at fairly low concentration affecting the reproductive organs leading to the changed reproductive biology. Data on chemical composition of reproductive organs of exposed to xenobiotics may account for the efficiency of transformation of reproductive products besides indicating the status of their health.

The effects occurred due to exposure to industrial effluents containing heavy metal salts may be biochemical, histopathological or reproductive physiological which may reduce the total yield of fishes. A very little work is carried out in climatic conditions of Vidarbha region where the physicochemical status of the water bodies is too different from the other parts of the country. Hence,

the present investigation to know the biochemical and histopathological status of ovary of the fish *channa punctatus* is undertaken to correlate with that of exposure duration of the heavy metal salt like cupric chloride.

Materials and Methods

The uniformed group, say about 50 of the matured females of *channa punctatus* were collected from Rishi lake at Karanja (lad) Dist. Washim (M.S.), India, with the help of local fisherman. The fishes were brought to the laboratory and specimens of similar weight (80 ± 2 mg) and length (18 ± 1.00 cm) were sorted out. The fishes were kept in aquaria for a period of fortnight in aged normal tap water for acclimatization. The 96h LC₅₀ value of cupric chloride for the experimental fishes were determined by probit analysis (Finney, 19071) and from that five times less concentration was selected as sublethal concentration (1.0mg/L). 10 healthy female fishes were exposed to selected sublethal concentration of CuCl₂ in four separate aquaria to conduct the experiment for 1,10,20 and 30 days. Parallel controls were kept in separate aquarium containing aged tap water. The toxicant solution and tap water (control) were renewed after every second day to maintain uniform test concentration throughout the experimental period.

Treatment was carried out for a period of 30 days. Feeding was done in morning hours with the average feeding rate of 25 mg food/gm fish/ day. After 01, 10, 20 and 30 days. 05 female fish of control as well as experimental groups were weighed and then sacrificed immediately by giving a blow on head and were dissecting to remove complete ovary. They were rinsed in saline to remove the cell debris if any. The ovaries were weighed individually and they were cut into suitable pieces and fixed in aqueous Bouin's fluid. After fixation the tissues were processed for paraffin embedding, sections were cut at 5 m m thickness and were stained with Haematoxylin, eosin.

Monosomatic index (GSI) i.e. ovary weight/100gm body weight, were determined for fish. Total proteins, cholesterol and glycogen contents of ovary were estimated by methods of Lowry et.al. (1951), King and Wolten (1959) respectively. Statistical analysis of all the data was carried out by student's "t" test (Fisher,1950).

Results and Discussion

Treatment of the fish *channa punctatus* with the sublethal concentration of CuCl_2 resulted in significant reduction in GSI ($P < 0.05$) after 10 and 30 days. Ovaries of the fish exposed to sublethal concentration of CuCl_2 at different morphological appearances. The observed degenerative changes due to the exposure of experimental fish to the CuCl_2 salt after 10 days in the young oocytes were extensive vacuolation in oocortex, necrosis of oolemma and hypertrophy of follicular cells. Thereafter the experimental toxicant induced more

lytic changes in oolemma, which resulted in atresia of oocytes after 30 days. Degeneration of vitellogenic and large pre-vitellogenic oocyte was observed after exposed to CuCl_2 salt after 30 days.

The significant decrease in glycogen, protein and cholesterol contents in the ovary of the fish, *Channa punctatus* exposed to sublethal concentration of CuCl_2 on ovary show that the process of oocyte maturation was arrested due to toxicity of experimental toxicant. Bailey and Kadu (1992) also reported, disturbed oocyte maturation in *Clarias batrachus* exposed to sublethal concentration of cadmium chloride for 40 days. Further deposition of yolk protein in ovary is reflected in the increased gonosomatic index (Quinitio et.al.,1989). A similar result of increase in GSI was observed during study among control group of fishes(table 1). While a sharp decrease was noticed in the CuCl_2 treated fishes probably due to histopathological damage done by significant fall in the GSI along with disappearance of mature oocytes and liver damage has also been noticed in cadmium treated fish, *Garra mulley* (Wani and Latey, 1982,1983) which confirms the present findings.

During the present study the cholesterol level were found to be high in the ovary of control fish (table 2). However, in heavy metal treated fish specimen the cholesterol exhibited significant decrease in ovary, suggesting the possibility that the heavy metals either blocked hormone action or the complex enzyme system responsible for vitellogenesis.

Table 1: The Gonosomatic indices of control and CuCl_2 treated female fish, *Channa punctatus*.

	Initial	10 days	30 days
Control	0.535±0.032	0.386*±0.085	0.442**±0.028

Values of mean ± S.D. of five observations.

* $P < 0.05$, ** $P < 0.01$

Table 2 : Changes in some biochemical parameters in the ovary of the fish, *Channa punctatus*, following exposure to sublethal concentration of CuCl₂ for 30 days.

Biochemical parameter		Exposure (Days)			
		1	10	20	30
Glycogen	Control	13.15±0.20	13.42 ±0.11	13.22 ±0.15	13.09 ±0.08
	Exptl.	10.42**±0.08 (-20.76)	12.16**±0.05 (-9.38)	11.92**±0.08 (-9.83)	10.85*±0.12 (-17.11)
Protein	Control	315.20 ± 1.74	318.11 ± 1.99	316.55 ± 2.57	315.35 ± 2.33
	Exptl.	308.46 ^{NS} ± 2.02 (-2.13)	302.87 *± 2.31 (-4.79)	295.96*±2.49 (-6.50)	227.46*±2.65 (-27.88)
Cholesterol	Control	33.05 ±0.38	33.48 ±0.25	35.70 ±0.33	38.25 ±0.2228
	Exptl.	23.78**±0.52 (-28.05)	8.85±0.70 (-73.57)	8.76***±0.49 (-75.47)	9.1***±0.54 (-76.21)

Values of mean ± S.D. of five observations.

Figures in parenthesis denote per cent change over control.

*P<0.05, **P<0.01, ***P<0.001.

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