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ORIGINAL ARTICLE

Gonadal Cycle and Protein Content in Liver and Gonads of Freshwater Fish, *Channa punctatus* (Bloch)

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ABSTRACT

Fish are the most important inhabitants of the aquatic ecosystem both marine & freshwater in nature. They form one of the most important groups of vertebrates, which influence the human beings in various ways. In developing countries like India, millions of people suffer from malnutrition & protein deficiencies.

Key words: *Channa punctatus, dimethoate, protein, gonad, Reproductive cycle*

INTRODUCTION

Biochemical studies on the blood and vital tissues of the fish are of specific interest not only for reaching a better knowledge of different aspects of the reproductive biology & development of fish (Singh, 1990; Gupta, 1996) but also because the fish constitutes a rich source of high nutrients and caloric value (Gill, *et al.*, 1983).

Several reports are available on the biochemical estimation of various parameters in blood & different vital organs due to the seasonal changes, spawning migration and different stages of maturity & impact of various pesticides (Gupta, 2003; Kumari, 2009; Naveed, *et al.*, 2010). Gupta (1996) in female *Clarias batrachus* observed highest levels of glucose, total protein, vitamin "C" & lowest levels of cholesterol & lipids in the blood during spawning and just reverse during resting phages, whereas, lowest levels of glycogen, total protein & cholesterol in liver & highest levels in the ovary during spawning & just reverse during resting phases. Naveed, *et al.*, (2010) in *C. punctatus* exposed to lihocin (OC) observed a decrease in total protein content in liver & kidney with an increase in free amino acids up to 96 hr of exposure to sublethal concentration & opined that the fish shifts to alternate methods of metabolism to overcome the toxic stress and maintain its survival in the polluted environment. Raizada & Singh (1980) in *Cirrhinus mrigala* observed marked seasonal changes in serum protein level & correlated them with the gonadal cycle & also with ecological factors.

METHODS AND MATERIALS

100 mg tissue was homogenized in 2.0 ml of double distilled water and repeated with the residue. 1.0 ml of homogenate was taken and mixed up with 8.75 ml of 3% NaOH soln. Left for 20 minutes. To this, 0.25 ml of 20% Aq. CuSO4 soln. was added and mixed. Violet colour developed due to the formation of Cu-Na-biuret compound. The O.D. of this soln. was read at 530 filter in a colorimeter using 1.0 ml of double distilled water in place of homogenate as blank processed as above like sample.

Total protein=O.D. of 1.0 ml of xK^{-1} protein x4x10_tissue homogenate in tissue (mg/gm)_where K^{-1} protein = 48.61 mg/ml (constant) and 4 is the total amount of homogenate of 100mg tissue. The statistical analysis were carried for standard deviation and test of significance according to standard formulae The "t" value thus obtained, was seen in the table and significant at 5% level ($P<0.05$) was noted (Finney 1981).

RESULT AND OBSERVATIONS

The average total protein content in the blood of normal male & female fish varied in between 2.86±0.11 to 3.65±0.12 & 3.12±0.12 to 3.94±0.16 gm/dl. In male, the lowest value has been

recorded in December and highest in July while in female, lowest & highest values were observed in January & September months. A gradual increase/decrease had been recorded during the different months of the year. The seasonal changes showed that the total protein content in the blood of both male & female was lowest during resting phase, which gradually increased & became highest during spawning phase followed by a decline in post spawning phase. However, no significant difference in blood protein content has been observed in between male & female of the same gonadal cycle but when compared the value of male & female of resting phase with that of the respective sexes of other phase, a significant increase has been observed in males of pre-spawning, spawning & post-spawning phases & in females only during spawning phase (Table 1 and Fig. 1).

Table 1: Total protein in Liver and Gonads of *Channa punctatus*

Breeding Stage	Liver		Gonad	
	Male	Female	Testis	Ovary
Resting (Dec-Jan)	39.80±1.35	40.49±1.36	21.09±1.74	22.96±1.59
Maturing (Feb-Apr)	38.10±1.33	38.44±1.32	22.91±2.25	26.48±1.89
Pre-spawning (May-June)	34.87±1.20	34.51±1.28	27.81±2.82	32.38±2.38
Spawning (Jul-Aug)	29.80±1.12	28.76±1.18	34.12±3.66	41.48±3.22
Post-breeding(Oct- Nov)	35.92±1.28	31.10±1.27	27.34±2.14	27.41±2.20

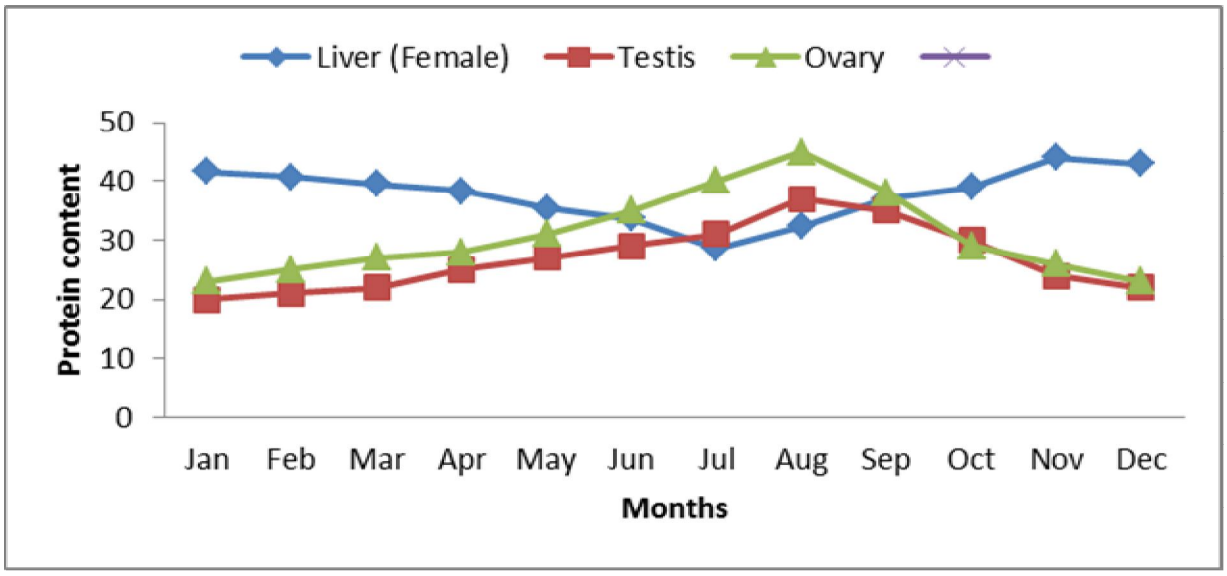

Fig. 1: Protein variation in Liver and Gonad of Channa punctatus

The total protein content in the liver of male & female varied in between 27.46 **±**1.08 to 39.84**±**1.38 and 26.88**±**1.15 to 40.92**±**1.35 mg/gm respectively. The lowest value has been recorded in August in both male & female, while highest value in January in male & December in female. The seasonal variation showed that spawning phase has lowest protein content in the liver of males & females, while highest in resting phase. When compared with the value of males & females during resting phase with that of the respective sexes of other phases, a significant decline has been observed in both sexes during spawning phase and in females only during pre-spawning& post spawning phases.

The total protein content in the gonads of male & female fish varied in between 20.25**±**2.00 to 36.25**±**3.18 mg/gm and 22.32**±**1.50 to 43.82**±**3.44 mg/gm respectively. The females have comparatively more gonadal protein content than males in most of the months of the year. The lowest & highest values in males & females have been recorded in January & August and December

& August respectively, thus showing an inverse relationship with liver protein content and almost positive relationship with blood protein contents. The seasonal variations showed lowest value in both sexes during resting phase & highest during spawning phase. Though no significant difference has been recorded in between male & female values in any gonadal cycle, but when compared with the value of male & female of resting phase with the respective sexes of other phases, a significant increase in gonad's protein content has been recorded in spawning phase & only in female during pre-spawning phase (Table 1 and Fig 1).

DISCUSSIONS

In the present study, the total protein content in the blood & gonads has been recorded higher in females than the males. The total protein content in the serum & gonads of both male & female were recorded minimum during December-January (resting phase) and maximum during July & August in male & August-September in females (spawning phase), whereas, the protein content in liver has been recorded lowest in August (spawning phase) & maximum in December-January (resting phase). Thus, an inverse relationship has been noted in between liver with that of serum & gonads protein contents. However, no significant difference in between the values of males & females were observed in any gonadal cycle, but a significant increase has been observed in spawning phase than that of resting phase in total protein content in serum & gonads and a significant decrease in liver protein content.

Thus, the increase/decrease in total protein content in gonads might be related to the maturation of gonads as it is known that the gonads receive protein contents from liver and/or muscle via blood during their development i.e. during pre-spawning & spawning phases as the gonads require high amount of protein for the formation of spermatogonia, spermatids & sperms in males & fully yolked eggs in females. The hypoproteinemia observed during dimethoate exposure might be due to the damage of vital tissues/organs and/or due to rapid deamination of protein due to intoxication of the pesticide.

Several workers have studied the seasonal fluctuations in total protein content in various tissues of different fish species with contradictory results (Kumari & Sinha, 1995; Kumar, 1999). Total tissue protein as energy sources for fish during thermal stress and muscular exercises has also been observed and several reports are also available on tissue protein contents in various fish and their changes due to certain environmental factors, but most of them are related to various pollutants (Singh, *et al.*, 1996; Sharma & Jain, 2008; Naveed, *et al.,* 2010). According to Sathyanarayana (2005), the physiological status of animal is usually indicated by the metabolic status of proteins. Sharma and Jain (2008) in *L. rohita* exposed to long term pollutants observed synthesis of stress proteins in the body tissues to combat anxiety. Naveed, *et al.*, (2010) in fish, *C. punctatus* exposed to lihocin observed significantly decreased total protein contents affecting tissue protein metabolism and as a consequence of lihocin toxicity, the fish shifts to alternate methods of metabolism to overcome the toxic stress & maintain its survival in the pollutant environment. Somaraj, *et al.*, (1995) and Suraj (1998) have reported a decrease in total protein contents in blood, liver & muscle of the fish exposed to different heavy metals.

CONCLUSION

Thus, it may be concluded that dimethoate is highly toxic to fishes, but the type of changes produced by the physiological, haematological & biochemical parameters may not be specific to a particular species of the fish, but a general toxic response. The chronic exposure resulted in the deterioration of the health of the fish & such situation may result mass mortality in due course of time. Hence, it may be suggested that its (dimethoate) entry into the aquatic bodies may be regulated time to time for better & healthy yield of fish. Further, there is a definite effect of both extrinsic & intrinsic factors on the physiology & biochemical composition of the fish.

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