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Research Article

BIOCHEMICAL CHANGES ASSOCIATED WITH THE OVARY MATURATION OF A FRESHWATER TELEOST, *SCHIZOTHORAX NIGER* HECKEL (TELEOST, CYPRINIFORMES, CYPRINIDAE)

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ABSTRACT
The quantitative estimation of the total proteins, lipids and carbohydrates through out the reproductive cycle of *Schizothorax niger* has been carried out by adopting various biochemical techniques with the objective to establish references ranges for the said biochemical indices for comparative studies. The biochemical analysis revealed the fluctuating trend of proteins and carbohydrates during different stages of maturity with maximum value (24.16 ± 0.87) of proteins in stage II and minimum value (4.86 ± 0.40) in stage IV, carbohydrates were also maximum (0.93 ± 0.60) in stage II and minimum (0.43 ± 0.08) in stage IV. However, total lipid percentage of the ovary showed a gradual increase from stage I (5.33 ± 0.58) to stage IV (16.33 ± 1.04).

***Key Words**: Teleost, Schizothorax niger, Proteins, Lipids, Carbohydrates.*

INTRODUCTION
Schizothorax niger commonly known as Ale Gad (Kashmiri name) belonging to the family cyprinidae proves to be one of the most important food fish of paradise dale (Kashmir). The overall population of *Schizothorax* is at decline, the reason being the multiple factors (Mir and Channa, 2009, 2010). The population dynamics and rate of success of any fish species is directly related to the ability of its members to reproduce successfully in a fluctuating environment, thereby to maintain viable population. Reproduction is a highly integrative function, which involves complex physiological changes at intracellular and intercellular level (Chandrasekhara Rao and Krishnan, 2011). The gonads possess a series of developmental alterations with the onset of maturation which are closely accompanied by conspicuous cellular, biochemical, molecular and endocrinological changes (Nagahama, 1983; Guraya, 2000). These complex physiological changes are associated with the control of the spawning activity under natural activity. As the gonads increase in size, somatic growth slows down and eventually stops. At this stage proteins and lipids are mobilized from somatic tissues and transferred to the gonads (Aksnes *et al*., 1986; Chandrasekhara Rao and Krishnan, 2011).
There is no published account on the biochemical studies with respect to the gonads of Kashmiri fishes in general and *Schizothorax* in particular. So the present study has been undertaken for the first time as a primary effort to investigate and establish reference range for biochemical estimation of total proteins, lipids and carbohydrates from ovary during the reproductive cycle of *Schizothorax niger*. These references values are of vital future utility for comparative studies with other *Schizothorax* species, monitoring reproductive potential, disease status and aquatoxicological studies.

MATERIALS AND METHODS

Living specimens of wild, normal and healthy *Schizothorax niger* (28-32 cm in length, body weight, 450-500 g) collected from their natural habitat were transported to the ichthyology and wildlife laboratory, department of Zoology, University of Kashmir for further processing. The sampling period lasted from July 2009 to July 2010. Total proteins, lipids and carbohydrates from the ovary of *Schizothorax niger* were quantified at different maturation stages throughout the reproductive cycle. The estimation of total proteins was carried out by utilizing the method of Lowry *et al*., (1951). Total lipids were estimated as per Folch's method (Folch *et al*., 1957) and the total concentration of carbohydrates was determined by following the phenol sulphuric acid method of Dubois *et al*., (1956). The obtained values were quantified for 100mg per 100ml and were given on wet weight basis. Biochemical assay values of ovary at different stages of maturity were analyzed statistically by analysis of variance using one way ANOVA, SYSTAT software.

Table 1. Biochemical constituents from the ovary of *Schizothorax niger* at different stages of maturation.

Maturation stage	Total Proteins (%)	Total Lipids (%)	Total Carbohydrates (%)
I	14.76 ±0.84(8)	5.33 ± 0.58(10)	0.73 ± 0.49(8)
II	24.16 ± 0.87(10)	9.5 ± 0.80(8)	0.93 ± 0.60(8)
III	9.26 ± 0.79(8)	11.83 ± 1.00(8)	0.76 ± 0.6(9)
IV	4.86 ± 0.40(9)	16.33 ± 1.04(9)	0.43 ± 0.08(10)

Values are presented as Means ± SD. The values included between parentheses indicate the number of samples utilized in each assay.

RESULTS

The reproductive cycle of *Schizothorax niger* comprises of four stages namely, stage I (Resting phase, July-September), stage II (Growth phase, October-December), stage III (Maturation phase, January-March) and stage IV (Spawning phase, April-June). The quantitative estimation of total proteins, lipids and carbohydrates and their statistical analysis of mean differences from the ovary of *Schizothorax niger* are presented in table 1. The total proteins showed a fluctuating trend, the highest concentration of proteins was observed in stage II (24.16 %), declined to 4.86% in stage IV and increased to 9.26% in stage III and 14.76 in stage I. Total lipids were found to depict a positive relation with the maturation from stage I to stage IV as 5.33, 9.5, 11.83 and 16.33% respectively, on the other hand like proteins, carbohydrates also exhibit a similar fluctuating trend with maximum percentage of 0.93 in stage II, declined to 0.43 in stage IV and the increased to 0.73 in stage I and 0.76 in stage III.

DISCUSSION

Proteins are of vital utility for fish growth and other metabolic activity. Protein content of the ovary of *Epinephelus diacanthus* increased with the maturation (Chandrasekhara Rao and Krishnan, 2011). According to Robards *et a*l. (1999) protein percentage of gonads increased in the Pacific sand lance (*Ammodytes hexapterus*) in relation to maturity. However, the present investigation revealed that protein content of the ovary of *Schizothorax niger* possess a fluctuating fashion, being maximum in stage II (growth phase) and minimum in stage IV (spawning phase). The highest concentration of proteins in the growth phase of the investigated fish is suggestive of the fact that during this stage the ova attains the maximum growth and accumulate the highest amount of proteins for subsequent use, however, minimum

concentration of proteins in spawning phase clearly shows that majority of proteins are being consumed to attain the maturation of ova.

The major portion of the yolk material of teleost eggs generally comprises of lipophosphoprotein complex. Lipids are mobilized from the body tissues to the gonads during spawning phase as reserve food material. The drastic increase in the total lipid content of ovary of *Schizothorax niger* from stage I to stage IV confirm previous observations in *Tilapia nilotica* and *Sparus auratus* (El-Sayed *et al*., 1984), *Cyprinus carpio* (Sivakami *et al*., 1986), *Epinephelus diacanthus* (Chandrasekhara Rao and Krishnan, 2011). The stored lipids act as a source of metabolic energy and serve to maintain the structure and integrity of the cellular membranes, besides being precursors of bioactive molecules (Zhu *et al*., 2003; Naesje *et al*., 2006). Medford and Mackay (1978) are of the opinion that endogenous proteins and lipids act as an energy substrate when considerable energy is required for spawning activity.

The observed fluctuation in the carbohydrate percentage during different stages of ovary maturation of *Schizothorax niger* extend support to the findings of Chandrasekhara Rao and Krishnan (2011). Hassan and Jafri (1996) reported that the carbohydrates are most readily utilized and first to be affected by the depletion, this may possibly be the reason for the lowest percentage of carbohydrates observed in the ovary of investigated fish

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