ESTIMATION OF GLYCOGEN LEVEL IN OVARY, LIVER AND MUSCLES OF THE ESTUARINE GANGETIC ANCHOVY *SETIPINNA PHASA* (HAMILTON) DURING THE BREEDING SEASON

ABSTRACT

Glycogen level was estimated in ovary, liver and muscle tissues of a commercially important estuarine gangetic anchovy female fish *Setipinna phasa* (Hamilton) during the breeding season. Glycogen level in ovary, liver and muscle tissues can be divided into (i) pre-spawning (November), (ii) spawning (December), (iii) late spawning (January-February) and (iv) post-spawning (March-April) phases. The ovary remains practically inactive during the months of May to October. The level of ovarian glycogen increase in comparison to liver and muscle tissues durirg pre-spawning (November) and the spawning phases (December). But the level of glycogen in the ovarian tissues decreases during post-spawning phase in comparison to liver and muscle tissues. The liver glycogen level increases during late and post-spawning phases. So it is evident that in tune with the gonadal cycle of the fish there is apparent variation in the level of glycogen in different tissues.

INFORMATION on carbohydrate metabolism in fishes is scanty and patchy. Glycogen constitutes a rich source of energy. Seasonal glycogen changes of various tissues are influenced by maturation of gonadal cycle. Gonads have remained comparatively less

studied, despite their vital importance in propagation of fish crop. Similarly glycogen in liver and muscle also plays an important role in maintaining the normal physiological condition of all animals including the fishes besides it greatly supplements the varied needs of the gonad. Earlier workers (Greene, 1921, 1926; Fontaine and Haley, 1953; Idler and Tsuyuki, 1958; Chang and Idler, 1960; Bentley and Foliett, 1965; Viswanathan *et al.*, 1974; Verghese, 1976; Mansuri, 1979; Ottolenghi *et al.*, 1981; Dasgupta and Sircar, 1986 a, b) have worked on different piscine tissues during maturation cycle. The present paper embodies results on the glycogen changes of female *S. phasa* during breeding season only.

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Materials and methods

Female specimens of *S. phasa* were collected from Hooghly River around Barrackpore, a suburb of Calcutta from November to April, the time when these fishes being anadromous, migrate into the Hooghly River from the mouth of estuary. No sexual dimorphism of *S. phasa* could be ascertained. At the time of autopsy the fishes were weighed to the average (120-200 g) and then sacrificed. For the analyses of glycogen, few pieces of weighed samples of ovary (20 mg), liver (20 mg) and muscle (20 mg) tissues were collected. Glycogen content of the tissues were estimated by employing the method of Seifter *et al.* (1950). Percentage of transmission (PT) of the blue colour was recorded spectro-photometrically against a blank at 620 mμ filter Erma Colorimeter (Japan).

Observation

The glycogen level of ovary, liver and muscle tissues of female *S. phasa* has been recorded during the breeding and non-breeding cycle. It is apparent from Fig. 1 that during the breeding season (November-February) the glycogen level in the ovary increases and becomes maximum. During non-breeding season (March-April) the glycogen level in ovary reduces. Significant fall occurred in March-April ($P < 0.05$ compared to November February).

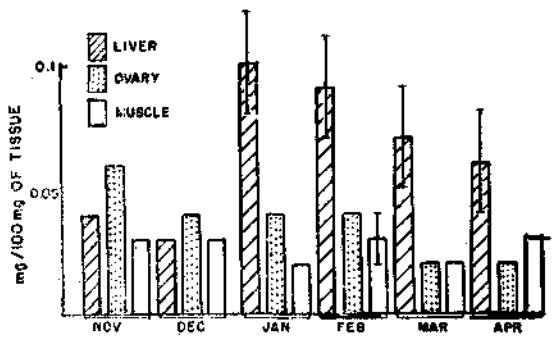

Fig. 1. Glycogen variation in ovary, liver and muscle tissues of a female fish *Setipinna phasa* (Ham.) during breeding cycle.

The glycogen content of liver tissues markedly decline during the month of November and December. The level of glycogen in the liver tissues increases in each month from January-April and ultimately its level becomes maximum. Statistically no significant differences occurred during this period.

Significant differences of the glycogen level in the muscle tissues are also marked during breeding and non-breeding period. Statistically no significant differences occurred during this period.

Discussion

Carbohydrate is one of the primary constituents of food which furnishes energy. Much of the energy expended by fish in swimming therefore comes from oxidation of

lipid or from glucose. Glycogen content in various tissues of fish body varies with the seasons of the year, irrespective of the degree of maturation. The information concerning the biochemical changes particularly the glycogen level in ovary, liver and muscle tissues of a common edible female estuarine fish *Setipinna phasa* (Hamilton) during breeding cycle is recorded for the first time.

Observation documented in the present study, shows that the glycogen level in the ovary increases during breeding season and reduces in liver and muscle tissues and enhances during non-breeding seasons.

The present work on glycogen level supports the observations of quite a large number of workers who have contributed on the glycogen level in the piscine tissues. Specially Greene (1921) in King Salmon; Fontaine and Hatey (1952) in *Salmo salar* (L); Verghese (1976) in *Pampus argenteus* (Euphrasen) and *Parastromateus niger* (Bloch); Bhavsar (1978) in *Periophthalmus dipus* and *Boleophthalmus dentalus*; Ottolenghi *et al.* (1981) in *Ictalurus melas*; and Das Gupta and Sircar (1986 a, b) in *Anabas testudineus* (Bloch) and *Clarias batrachus* (Bloch). These workers have all investigated the glycogen level of gonad, liver and muscle tissues. Besides these, few others *viz.* Chang and Idler (1960) in Sockey Salmon; Valtonen (1974) in white fish; Emmerson and Peterson in *Platichtys telesus* (L) have worked with respect to glycogen level in liver only. Viswanathan and Bangalore (1974) in *Heteropneustes fossilis* (Bloch) have worked with respect to glycogen level in ovary while Mansuri (1979) in *Johnius vogleri* (BKr); *Megalaspis cordyla* (L); *Arius maculatus* (Thunberg); *Ilisha megaloptera* (Swainson) worked only with relation to glycogen content in the muscle tissue.

The works of these authors as well as the present findings point to the fact that the glycogen changes in the ovary, liver and muscle tissues appear to be influenced by maturation cycle and depletion (spent stage) of gonad. In confirmity with these findings in the present paper, the glycogen level is higher during breeding season in the ovarian tissues. The higher level is due to higher physiological needs of the developing ovaries. Glycogen is drained off along with reserve lipid and fat bodies from liver and muscle. Ultimately leading to a greater increase in the weight of the ovaries and the accumulation of carbohydrate in the ovaries.

During breeding season due to paucity of abdominal space and high pressure of ripe gonads on the alimentary canal, the appetite of the fish is lost. This is evident from lesser food consumption by the fish. However, the increase in glycogen content of the ovaries in *S. phasa* is likely to be the result of its increased synthesis and its reduction in liver and muscle may be due to decreased synthesis and/or increased breakdown. Both phosphorylase and glycogen synthetase activities in the liver have been reported to be very low at the time of vitellogenesis (Emmerson and Peterson, 1976). This has also been seen in *S. phasa*. The liver glycogen level is the net result of the relative activity of these two enzymes. The reduction of liver and muscle glycogen with the concomitant enhancement of ovarian glycogen during vitellogenesis in other fishes have also been reported (Veltonen, 1974). The oocytes in *S. phasa* also show continuous glycogen formation and high activity of key enzymes of gluconeogenesis.

Owing to the spent stage of gonad during the non-breeding season, the glycogen level decreases in the ovarian tissues. Depletion in muscle glycogen in the present study may be due to extensive locomotion by the fish during breeding seasons.

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