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Seasonal Changes in Biochemical Composition of Freshwater Bivalve Mollusc *Lamellidens marginalis* (Lamark) from Purna River Near Jafrabad (M.S.) India

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Abstract: The aim of the present study was to investigate variations in total protein, lipid and carbohydrate contents in body tissue of freshwater bivalve mollusc *Lamellidens marginalis* (Lamark) from Purna River near Jafrabad during different seasons. As environmental factors changes, it shows an effect on biochemical composition in the body tissues. The bivalve mollusc shows maximum variation of biochemical composition as it undergoes different stages like development, maturation and spawning during different seasons and can be affected by environmental factors, such as fluctuations in the environmental conditions, or by internal factors, such as metabolic and physiological activities.

Keywords: *Lamellidens marginalis*, Seasonal variations, Protein, Lipid, Carbohydrates

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Introduction

The freshwater mussels are an ecologically important fauna because they are used as sensitive biomarkers of aquatic ecosystem pollution. Bivalves are stationary filter-feeding organisms able to bioaccumulate and concentrate most pollutants even if they are present fairly low concentrations (Niyogi *et al*., 2001). The freshwater mollusc perform efficient role in transformation of energy in food chains coupled with their sessile mode of life. Seasonal variation in biochemical composition have been reported by many workers. Gabbott and Bayne (1973) determined seasonal changes in biochemical composition of adductor muscle, mantle, siphon and foot in *Merecenaria merecenaria* and *Mytilus edulis* from India. Dhamne (1975) on *Paphia laterisuca*, and Nagabhushanam and Mane (1975, 1978) on *Mytilus viridis*, have reported changes in the biochemical composition correlating with annual reproductive cycle of bivalves. The bivalves have not been the subject of intense studies despite the presence of rich diversity of edible and commercial species in India (Shetty *et al*., 2013). The overall change in the biochemical composition

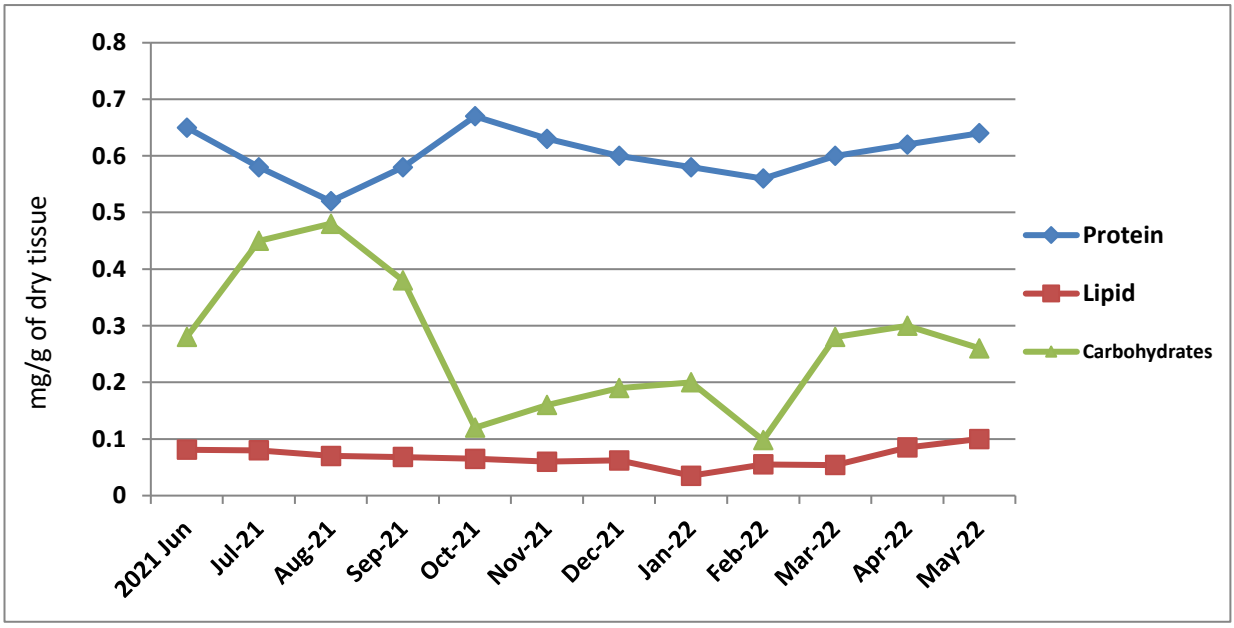

Fig. 1: Biochemical composition of the whole body of *Lamellidens marginalis.*

during an annual cycle has been correlated to the events of the gonadal cycles of organisms. Significantly, proteins, lipids and carbohydrates variations are related to reproductive cycle of bivalves. There is inadequate information regarding biochemical composition of freshwater bivalve *Lamellidens marginalis* from river Purna, hence, present investigation was undertaken to study seasonal fluctuations in protein, lipid and carbohydrates contents of body tissue of *Lamellidens marginalis.*

Materials and Methods

Sample Collection and Preservation:

The freshwater bivalve mollusc, *Lamellidens marginalis* were collected from Purna river near Jafrabad city, Maharashtra, India during monsoon, winter and summer over a period of one year. Immediately after bringing to laboratory, the shells of these bivalves were brushed and washed with fresh and clean water to remove algal biomass, mud and other waste material. The cleaned animals were then kept for depuration for 12 h in laboratory conditions under constant aeration.

Biochemical analysis:

For biochemical analysis, animals were dissected and soft body tissues like mantle, hepatopancreas, gonad and foot were removed. 100 mg of body tissues were taken for biochemical analysis. Protein was determined by the method of Lowry *et al.* (1951) using Bovine Serum Albumin (BSA) as standard. Lipid was estimated by the method of Bligh and Dyer (1959) and the carbohydrate was estimated by method of Dubois *et al*. (1956). Triplicate values of each biochemical constituents were subjected to statistical analysis using Student t test (Downdeswell, 1957). Standard deviations were calculated during different seasons.

Results and Discussion

Protein:

Protein was the most dominant biochemical constituent in the present study. It was found that the concentration of proteins increases during the pre- and post-monsoon seasons while drastically decreasing during the monsoon season. Accumulation of protein during the pre-monsoon season corresponds with the proliferation of gonads. Percentage of this constituent also

increases with the maturation of gonads, which ranged between 36.4% to 60.5%. The highest values of protein content in *Lamellidens marginalis* was recorded during October (64.60%) and the lowest during August (33.70%) in the study period (Fig. 1).

Lipid:

Voogt (1983) stated that lipids in bivalves are multifunctional and in different species one or some of the functions during the maturation of gametes, drastic environmental conditions, starvation, population stress etc. can be more noticeable. In the present study lipids were found to be 5.00% to 9.10% Total lipid content of various tissues of bivalve was found to be increased during summer (Fig. 1) which might be due to high water temperature and decreased in winter. On the other hand specific differences in lipid composition in mussels are also affected by its diet, vegetation, environmental temperature, salinity and dirtiness of water. Most importantly diet plays a major role in it.

Carbohydrates:

Carbohydrates remain at a high level until the beginning of proliferation of gonads. Carbohydrate is found to be at maximum during summer season (Fig. 1), which shows the development of gonads to attain maturation. Here the carbohydrates were ranging between 11.80%- 41.60% in *Lamellidens marginalis*. During the rapid proliferation of the gonads, the reserve supply is used, and by the end of the reproductive cycle the amount of carbohydrate is at a minimum.

The results obtained in the present study are supported by several investigators. Wafer *et al.* (1976) observed increase in protein content may be a mechanism of maturation of gonad and storage of reserves to meet spawning requirements. Hongwei Yan et al.(2009) observed increased protein content in association with the gametogenesis in the female gonads of razor clam, *Sinonovacula constricta*. George John (1980) also observed accumulation of protein and lipid during the pre-monsoon season which corresponds with the proliferation of gonads. Ansell (1974) stated that percentage of these constituents also increases with the maturation of gonads. Gabbot and Bayne (1973) observed low protein values in monsoon which could be mainly due to increased rate of ammonia excretion and also spawning season which are in conformity with the present study. Kulkarni (1993) observed increased content in the different body parts of freshwater bivalve molluscs *L. marginalis* after exposure of sub lethal concentration of cadmium. Patil (1993) also observed increased protein in different body parts of freshwater mussel *L. marginalis* after exposure to mercury. Glycogen, the primary energy reserve in bivalves, drives many important physiological processes and could be used to ensure short-term exposure to anoxia, emersion and reduced food supplies. The gradual increased content of glycogen from summer onwards could be due to the development of the gonads (Shettigar and Seetharamaiah, 2013). In present study the results showed that during summer season different trend was observed, revealing different type of substrate utilization to meet the energy demand. Depletion of glycogen level might be due to the anoxia and hypoxia caused due to stress condition which is known to increased carbohydrate consumption (DeZawan and Zandee, 1972). Kabeer (1979) stated that decreases in glycogen content in metal exposed tissue could also be due to decreased glycogen synthesis. Decrease in glycogen content indicates disrupted carbohydrate metabolism. In bivalve molluscs the conversion of glycogen into fatty via trios – phosphate entry in glycogen sequence and to the production of pentose sugar for nucleic acid synthesis is well documented by Gabbott (1976). In the present study total lipid content of body tissues of bivalve was found to be increased during summer which might be due to high water temperature.

Conclusion

The present study revealed that there is significant variation in the protein, lipid and carbohydrate content in different body tissues during seasonal

changes and metabolic activities. Protein is the main organic nutrient used to build up different body tissues. Thus, in the present study on *Lamellidens marginalis*, it is observed that organic constituents present in different body tissues shows seasonal changes and are correlated with the change in environmental conditions along with development of reproductive cycle. The spawning cycle and food supply are the main factors responsible for this variation. It is well known that seasonal variations in nutritional contents of adult bivalves are closely linked to the reproductive cycle and climate changes and are affected by the availability and composition of the natural diet.

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