Seasonal changes in the biochemical composition of freshwater bivalves, *Parreysia spp*. From Tungabhadra river, Karnataka

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Abstract:

In the present study, variations in organic constituents were observed in whole body tissues of *Parreysia spp.* during different seasons. As environmental condition changes, it shows an effect on biochemical constituents in the tissues. Protein was found maximum during summer season (60.8%) and was found minimum during winter season (40.5%) of dry tissue weight. There is great fluctuation in the values of Carbohydrate (glycogen) present in the body tissues during different seasons. During summer season, maximum carbohydrate (40%) was found, whereas during monsoon and winter, minimum carbohydrate (14.12%) was found. Similarly, lipid was found maximum (8.2%) during summer season and was minimum (6.8%) during winter season. This shows the mobilization of biochemical constituents in body tissues during different seasons. The bivalve mollusc shows maximum variation of biochemical constituents as it undergoes different stages like development, maturation and spawning during different seasons.

Keywords: Freshwater bivalves, *Parreysia*, Protein, Carbohydrate, Lipid.

Introduction:

The mussels are ecologically important because of their widespread distribution and biological filtration activity [1-2]and also economically, used as food and in the production of freshwater pearls[3]. Bivalve molluscs are potential sources of valuable proteins, carbohydrates and minerals and are abundantly available in India.The biochemical composition of mollusc is influenced by its size, growth and reproductive status. Bivalves play an important role in the ecosystem equilibrium and constitute an important economic end point.The bivalves have not been the subject of intense studies despite the presence of rich diversity of edible and commercial species in India.

Cyclical changes in biochemical composition of animal tissue are mainly studied to assess the nutritive status of an organism. This information may, however, be used in supplementing other studies like assessment of the course of the reproductive cycle. Marine bivalves indicated that seasonal cycle of energy storage and biochemical cycles are closely related to reproductive activity [4]. According to Gabbott [5], seasonal metabolic activities in molluscs result from complex interactions among food availability, environmental conditions, growth and gametogenic cycle.

Of all the components, changes in carbohydrates play an important role in the seasonal variation of the chemical composition. In general, the water content of the tissue of bivalves usually gives an indication of the time of spawning. Variation in dry tissue weight of mollusc is always associated with biochemical components. Seasonal changes in the biochemical constituent are the characteristics of the seasonal activities of bivalves. In general, energy is stored prior to gametogenesis, when food is abundant, in the form of carbohydrate, lipid and protein. The particular importance of these substrates, where they are stored and the timing of their use varies among species, as well as among populations of the same species [6]. Bivalves generally store carbohydrates in large amounts during their growing season and use them over the rest of the year [7]; although proteins may be an energy reserve in some bivalve species [8-9].Lipids have been reported to function most importantly as energy storage substances and physical properties of biological membranes [10]. Lipid accumulates in the developing gonads and depletes during spawning.

Since limited amount of information is available on the freshwater bivalves, the present investigation has been undertaken to study seasonal variations in the nutritional value of bivalves from Tungabhadra river and to gather information on the uses of these bivalves as medicines in the treatment of diseases.

Materials and methods:

1. Sample collection and preservation:

The study was carried out from river Tungabhadra, near Teerthahalli in Shimoga district of Karnataka, India. The samples were collected every month by random free hand collection and brought to the laboratory alive. The bivalves were identified mainly based on external as well as internal shell characters using standard methods given by Preston [11] and other available literature [12]. The present study was carried out on two Parreysia species *P.favidens* and *P.khadakvaslaensis*. The mussels were further grouped based on their size into less than 30mm, 30-60mm and more than 60mm. The meat was separated from the shell and dried at 60°C for 48hrs after which the sample was powdered and stored until further use.

2. Biochemical analysis:

a) Protein: Protein was estimated following the method of Lowry *et al*. [13]. To a 10mg of sample 1 ml of 1N NaOH was added for protein extraction in water bath for 30 minutes. Thereafter, it was cooled at room temperature and neutralized with 1 ml of 1N HCL. The extracted sample was centrifuged at 2000 rpm for 10 minutes, and an aliquot of the sample (1 ml) was further diluted with distilled water (1/9 v/v). From the diluted sample, 0.5 ml was taken and made up to 1 ml with 0.1N NaOH. To this, 5 ml of mixed reagent (alkaline copper reagent) and 0.5 ml of FC reagent was added. After 30 minutes, O.D. was read at 660 nm using spectrophotometer.

b) Lipid: Lipid was estimated by the method of Bligh and Dyer [14].50 mg of dried tissue sample was mixed well with 15 ml of chloroform-methanol mixture (1/2 v/v) and 4ml of distilled water. The homogenate was centrifuged at 2000 rpm for 10 minutes. The supernatant was taken in separating funnel and 5ml each of distilled water and chloroform was added and mixed well. After overnight separation the lower layer was collected in pre weighed ceramic bowl, dried in nitrogen stream and weighed.

c) **Carbohydrate:** The carbohydrate content was obtained by calculation.

Result and Discussion:

Biochemicalanalysis observed duringexperimental period has been given in Fig 1-6. Seasonal variation in the nutritional contents of the whole body tissues of *P.favidens* was found to be, proteins (41.2%-60.8%), lipids (3.8%-8.2%) and carbohydrate (14.79%-42.3%) of dry tissue weight. While in *P.khadakvaslaensis* proteins (40.6%-57.2%), lipids (3.2%-7.6%) and carbohydrates (18.3%-40.2%) of total dry weight was observed.In the present study it was observed that the composition of the various constituents did not depend on the size of the bivalves but rather on other factors discussed below.

From the fig 1-6, it was found that the concentrations of proteins and lipids increases during the pre and post monsoon seasons while drastically decreasing during the monsoon season. Accumulation of protein and lipid during the pre-monsoon season corresponds with the proliferation of gonads [15]. Percentage of these constituents also increases with the maturation of gonads[16].

Carbohydrates remain at a high level until the beginning of proliferation of gonads. Carbohydrate is found to be at maximum during summer season, which shows the development of gonads to attain maturation. During the rapid proliferation of these gonads, the reserve supply is used, and by the end of the reproductive cycle the amount of carbohydrate is at a minimum.Spawning occurs during the monsoon season which is represented by a large depletion in the protein and lipid contents. Soon after spawning, after a short period of relative inactivity during which the un-spawned sex cells are reabsorbed, the mussels begin to accumulate and store carbohydrates in their tissues.

Accumulation and depletion of these stored reserves in bivalves also depends on the environmental influences on metabolic activities, and the quantity and quality of available food[17-18]and has been well described by several authors [19-22].Lipids have also been shown to provide energy during winter, when carbohydrate reserves are depleted [23-24].All the body organs show minimum protein values in winter season, which may be due to sedentary life without much activities.

Conclusion:

The present study revealed that, there is significant variation in the biochemical constituents in the bivalves according to seasonal changes.The nutritional composition of the bivalves can be affected by external (exogenous) factors, such as fluctuations in the environmental conditions (temperature and food availability), or by internal (endogenous) factors, such as metabolic and physiological activities [25].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 [26-27].

On the basis of these results, the freshwater mussels are good source for some important nutrients such as proteins, steroids, minerals and vitamins. They have got important roles in food chain since they are consumed by fish, water birds, mammals and reptiles in the river. Certain chemicals found in bivalves are used in the treatment of antithrombotic, extravasation agent, arthritis, ischemic heart disease and hyperlipidemia. Chondroitin is a low molecular compound, a medicine for arthritis, is naturally occurring substance in the body of mussels and is responsible for elasticity of cartilage. Along with glucosamine, Chondroitin sulfate has become a widely used dietary supplement for treatment of osteoarthritis.

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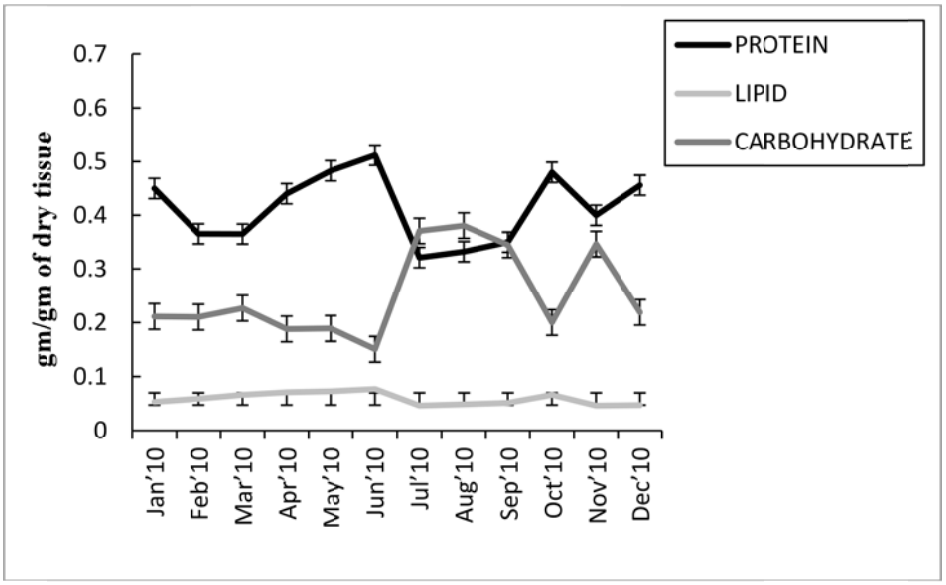

Fig 1: Biochemical composition in whole body tissue of *Parreysia favidens* ranging less than 30mm in size.

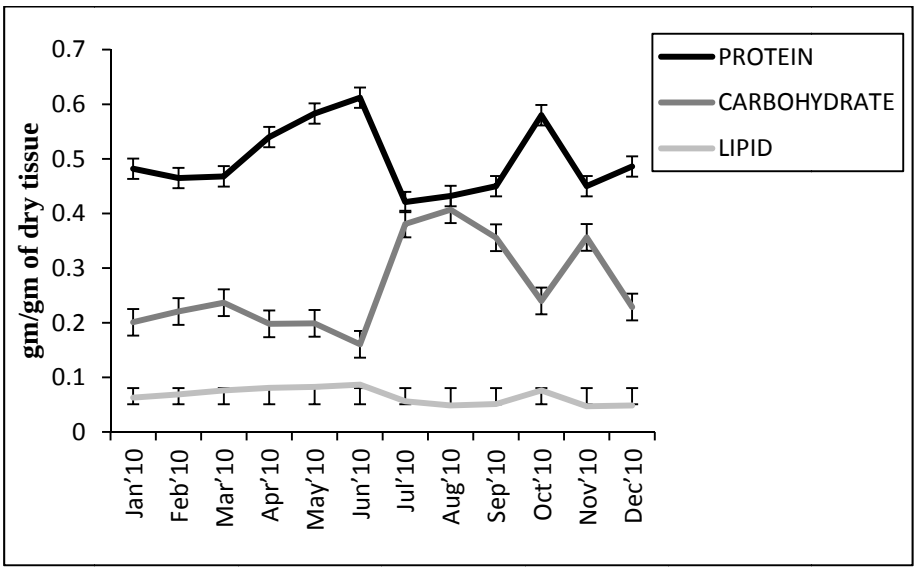

Fig 2: Biochemical composition in whole body tissue of *Parreysia favidens* ranging from 30-60mm in size.

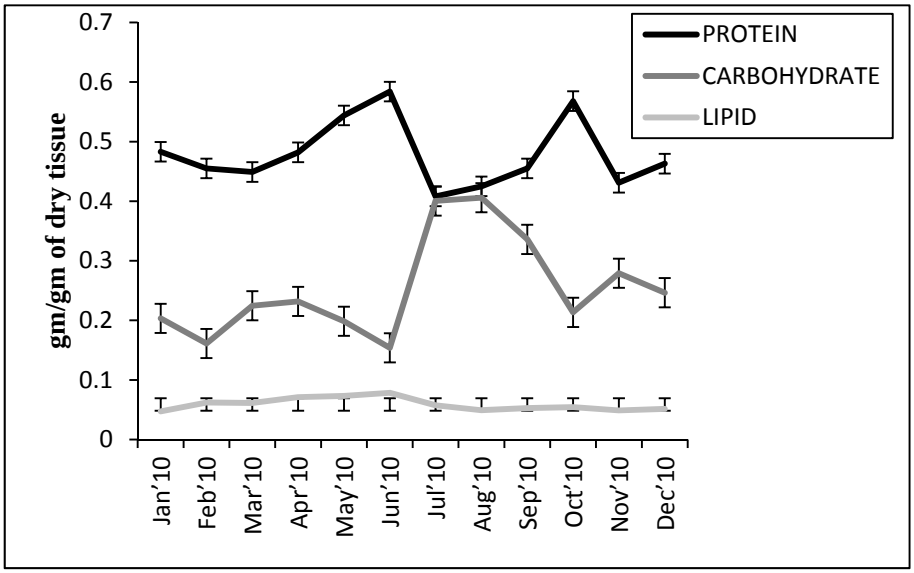

Fig 3: Biochemical composition in whole body tissue of *Parreysia favidens* ranging above 60mm in size.

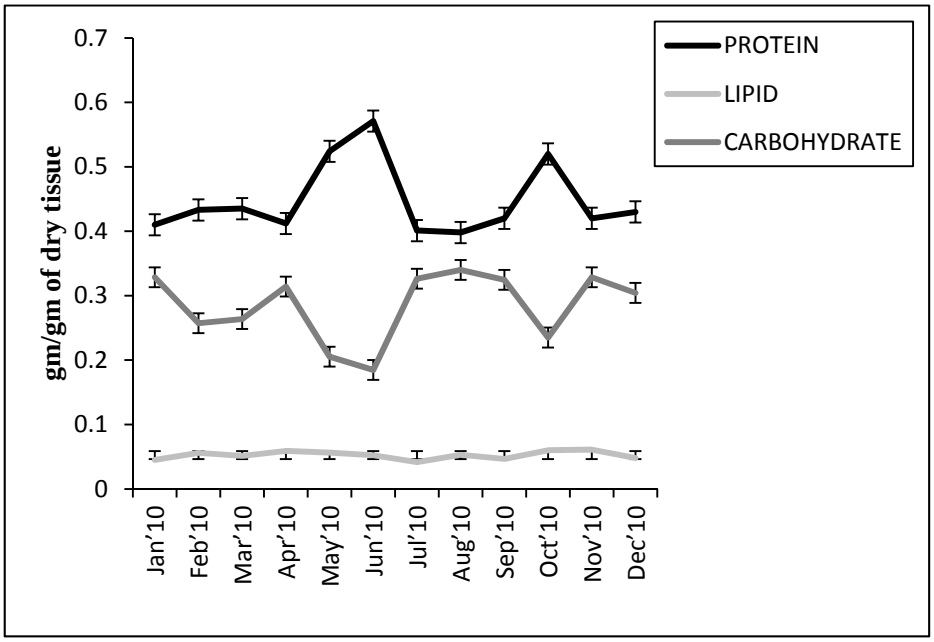

Fig 4: Biochemical composition in whole body tissue of *Parreysia khadakvaslaensis* ranging less than 30mm in size.

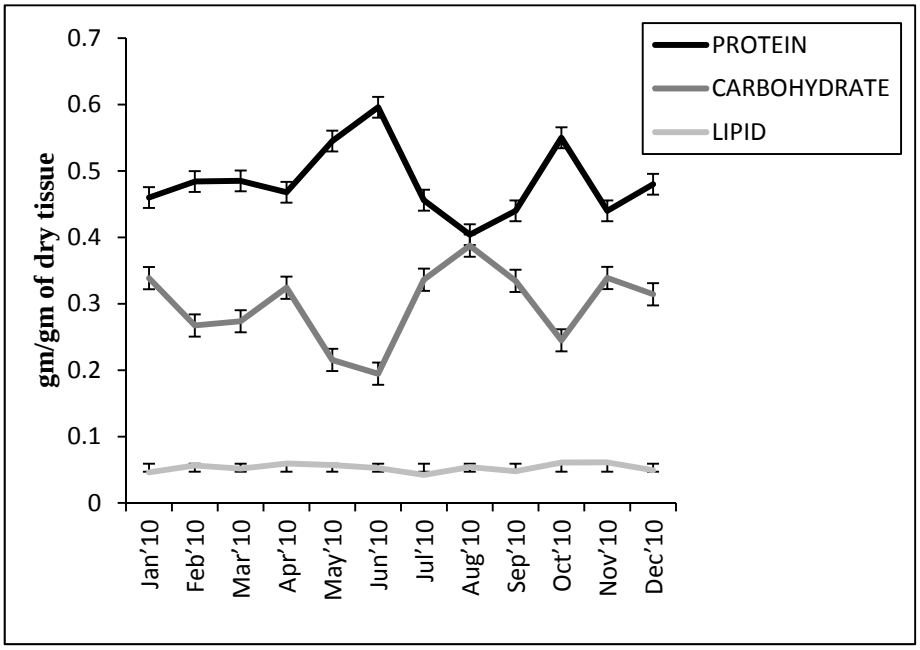

Fig 5: Biochemical composition in whole body tissue of *Parreysia khadakvaslaensis* ranging from 30-60mm in size.

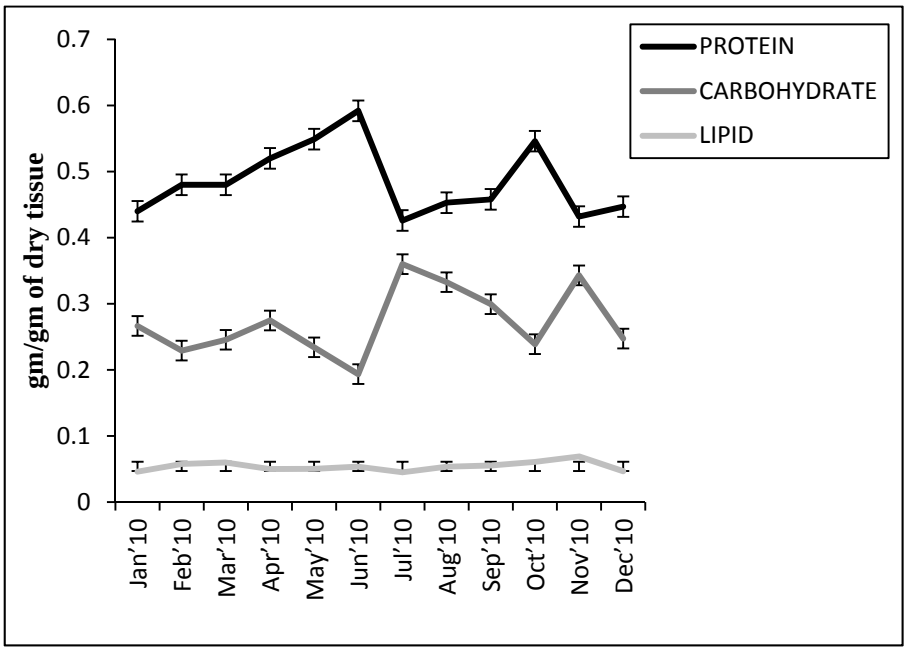

Fig 6: Biochemical composition in whole body tissue of *Parreysia khadakvaslaensis* ranging above 60mm in size.