Studies on the Seasonal Variation in Total Lipid and Carbohydrate Content of Muscle Tissue of *Schizothorax labiatus*

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Abstract.
The study was conducted to determine the lipid and carbohydrate content in muscle tissue of fresh water teleost *Schizothorax labiatus* from the Jhelum river of Kashmir valley. *Schizothorax labiatus* was sampled from January 2012 to December 2012. Lipid and carbohydrate content was determined in muscle tissue in four different seasons of the year (Spring, Summer, Autumn and Winter). It was observed that the Lipid and carbohydrate content varied by months and seasons ($P<0.05$). The lipid content in *Schizothorax labiatus* observed was 0.032, 0.026, 0.031, 0.033, 0. 029, 0.037, 0.039, 0.036, 0.033, 0.034, 0.030, 0.027 g/g of tissue in January, February, March, April, May, June, July, August, September, October, November and December. The carbohydrate content ranged from 0.00093 ± 0.00011 - 0.00183 ± 0.00015. The percentage of lipid was maximum in the month of July and lowest in the February. Seasonally the highest carbohydrate content in the muscle tissue was observed in summer season (0.158%) followed by winter (0.123%) and spring (0.119%) and lowest in autumn season (0.114%).
Keywords: Muscle tissue, lipid content, carbohydrate content, *Schizothorax labiatus.*

Introduction

Fish are quite different from the other animal food sources, because they provide low energy and have high-level proteins, which contain all essential amino acids. So they are beneficial nutrition sources (Weatherley and Gill, 1998). The lipids are the important biochemical compounds of fish. Fish store the lipids in various organs; particularly in muscles and liver. The carbohydrate content in fish muscle is very low, usually below 0.5 % and do not show much variation. The carbohydrate occurs in glycogen and as part of the chemical constituents of nucleotides. Carbohydrates are not stored in large quantities by fish as energy-rich compounds unlike mammals. These values also give estimation of food composition of fish, its physiological
condition (Salam and Davies, 1994). Therefore the present study has been undertaken to evaluate the lipid and carbohydrate content in the cold freshwater teleost of Kashmir valley. *Schizothorax labiatus* locally known as *Chhush* is a very valuable fish of Kashmir valley. This fish inhabits the streams, rivers and lakes. It differs in tooth shape, gill-racker counts, morphometry, scale counts, pharyngeal bone and color pattern from the other species of genus Schizothorax.

Materials and Methods

The study was conducted from January 2012 to December 2012 and was carried out in the Department of Zoology University of Kashmir Hazratbal Srinagar. Five to six samples of fishes were collected in each month. Samples of *Schizothorax labiatus* were bought from their natural habitat, i.e, Jehlum River Srinagar Kashmir. Fishing was performed with the help of professional local fishermen.The fish samples were immediately transported to the Ichthyology laboratory and were washed with tap water. After that the fish was weighed and total length, standard length and width of each of these fish were determined. The fish were dissected to collect the muscle tissues. The muscle sample were then weighed and homogenized in a homogenizer, before the analysis of biochemical components.

Lipid and carbohydrate Estimation

Total lipid content of fish was estimated by Folch's method (Folch *et al*., 1957) and carbohydrate content was determined using Phenol Sulphuric acid method (Dubois *et al*., 1956).

Statistical Analysis

Statistical analysis revealed that lipid contents are significantly different in different seasons. The data was evaluated by one-way ANOVA followed by Tukys test to detect inter seasonal differences. Differences were considered to be statistically significant if $P < 0.05$.

Results

The proximate composition of lipid and carbohydrate in the experimental fish for different months is presented in Tables below. Lipid content of *Schizothorax labiatus* showed fluctuating trend and ranged from 0.26g/g in February - 0.39 g/g in the month of July (Table 1). There was increase in lipid content from winter, spring, summer and then gradual decrease was seen in Autumn. Seasonally the higher lipid content was observed in summer i.e 3.733% and lowest in winter i.e. 2.833% (Fig 1). The trend of Carbohydrate content decreases from January to February and then shows slight increase in March and again decreases in April and May (Table. 2). The carbohydrate content again fluctuates and showed increase in summer season where highest was seen in the month of June (0.00183 ± 0.00015). In September the value decreases (0.00093 ± 0.00011) followed by increase in October and November and again values decreases in December (0.00110 ± 0.000200). Seasonal variations showed highest values of carbohydrate percentage in summer followed by winter season in *Schizothorax labiatus* i.e., 0.158% and 0.123% respectively, whereas, the lowest carbohydrate percentage was recorded in autumn season (0.114%).

Table 1. Monthly variation in total lipid content of *S. labiatus* (g/g of tissue).

Month	**Species S. labiatus**
January	0.032 ± 0.010
February	0.026 ± 0.017
March	0.031 ± 0.005
April	0.033 ± 0.001
May	0.029 ± 0.010
June	0.037 ± 0.020
July	0.039 ± 0.010
August	0.036 ±0.001
September	0.033 ±0.013
October	0.034 ±0.014
November	0.030 ±0.010
December	0.027 ±0.002

Data is expressed as mean ± SD of three separated experiments

Table 2. Monthly variation in muscle carbohydrate content of *Schizothorax labiatus.* (g/g of tissue).

Month	Species S. *labiatus*
January	0.00150 ± 0.00161
February	0.00109 ± 0.00011
March	0.00140 ± 0.00036
April	0.00118 ± 0.00020
May	0.00101 ± 0.00011
June	0.00183 ± 0.00015
July	0.00153 ± 0.00010
August	0.00138 ± 0.00013
September	0.00093 ± 0.00011
October	0.00111 ± 0.00011
November	0.00139 ± 0.0001
December	0.00110 ± 0.00020

Data is expressed as mean ± SD of three separated experiments.

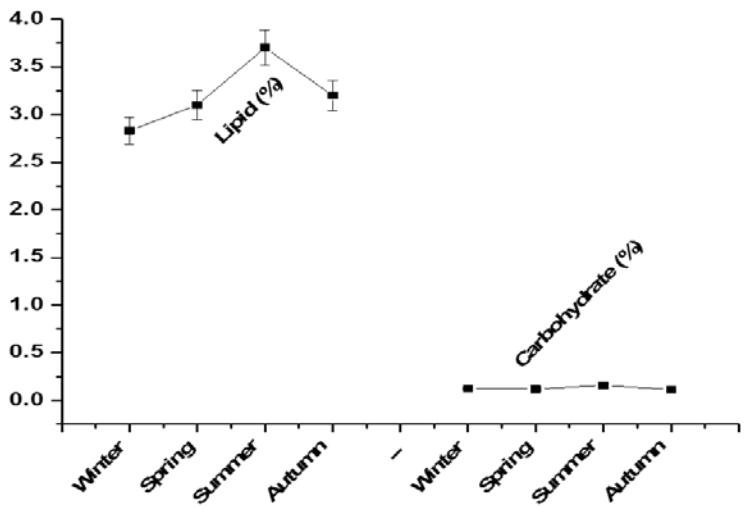

Fig. 1. Graph showing seasonal variation in lipid and carbohydrate % age of muscle content.

Discussion

Fish oil is one of the most important natural sources of polyunsaturated fatty acids which have been proven to have useful effects on human health (Saoud *et al*., 2008). The quantity and composition of fatty acids from lipids are not only associated with the species, but also depend on diet, temperature, seasonality, age and gender (Ackman, 1989). The monthly and seasonal variation in lipid and carbohydrate content in muscle tissues of *Schizothorax labiatus* was monitored from January 2012 to December 2012. The carbohydrate content of the sampled fish in winter, spring, summer and autumn season was estimated as 0.123%, 0.119%, 0.158% and 0.114% respectively. Highest lipid content is observed in summer and lowest in winter season in the species.

The highest lipid content seen in summer season is due to the fact that summer is the nutrition period and intensity of feeding is high therefore maximum amount of lipid is observed in this season and fishes have to store extra lipid for use in winter. According to (Robards *et al*., (1999) and Henderson *et al*., (2000) large amount of the energy that is stored for wintering and spawning is accumulated during periods of intensive feeding. Maximum amount of lipid content in summer season in our results is in agreement with the Bumb (1992) who also analyzed the variation of fat content with feed intake and found that intensive feeding of *Ambassis commersoni* coincides with the occurrence of high fat content in the muscle of fish.

During autumn season the lipid content decreases as in this period the temperature and food availability also changes which leads to decrease in lipid content in the species. Also this period is the period for development of gonads and hence low content of lipid in muscle of fish is observed. In winter season there is scarcity of food and temperature is not feasible for different algae to grow which leads to low availability of food during this season. So low amount of lipid is observed in winter season and fish also can use the stored fat to cope up with the unfavorable conditions occurring during this season. This is in agreement with the work done by Salihoglu and Mutlu (2000) on garfish in which the decline in fat and protein might be because of a potential starvation due to the sharp decrease in the amount of plankton in January. The spring season is the breeding season of the fish. According to Ayas *et al.*, (2005) the variation in fat content is related to feeding and reproduction, so decrease in lipid content is observed in the breeding season of the studied fish. Also during spring season the food that is taken is utilized for the process of spawning.

In the present study the low value of carbohydrates indicates that glycogen in these fishes does not contribute significantly to the total reserves in the body. In some marine fishes same results were observed by (Jayasree, 1994). Carbohydrate content of fish is affected by some environmental and physiological factors like seasons, spawning and feed intake. In present study the low value of carbohydrate could be due to the fact that a carbohydrate does not contribute much to the reserves in the body. This is in agreement with Mathana *et al.*, 2012.We know that winter season is resting phase and in this season energy is reserved so carbohydrate content is more as compared to autumn season. Spring seasons is spawning season of fish hence in this season the carbohydrate is low because the food eaten by fish is utilized for gonadal maturation. Same result was found by Chellappa *et al.*, (1989) in male three-spined stickle backs and stated that energy reserves drops during growth and gonadal maturation. The high content of carbohydrate was found to be in the summer season due to the fact that summer season is the Post spawning season which results in high feeding activity and hence increase in carbohydrate content. Bumb (1992) also analyzed the variation of carbohydrate content with feed intake and found that intensive feeding in *Ambassis commersoni* coincides with the occurrence of high carbohydrate content in the muscle of fish and is in agreement with our observed result.

Conclusions

The results reveals that the carbohydrate and lipid composition of the experimental fish varies with the change in season i.e winter, spring, summer and autumn seasons and with the availability of food during these seasons. Thus

the present study provides valuable information about the biochemical composition of fish studied in order to make best use of the fish species as food.

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