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RESEARCH ARTICLE

CHANGES IN MUSCLE CARBOHYDRATE CONTENT OF *Schizothorax curvifrons* IN RELATION TO SEASON

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ABSTRACT

Fish is one of the main food constituents in our diet as it includes essential fatty acids, amino acids and some of the principal vitamins and minerals in sufficient amounts for healthy living (Borgstrom, 1961). The importance of biochemical composition of fish and their significant role in human nutrition is well recognized. The present study involves the estimation of the total carbohydrate content in the muscle tissues of an endemic fish species of Kashmir valley namely *Schizothorax curvifrons* during the period of January 2012 to December 2012. Fresh samples of the fishes were collected from local fish markets of Kashmir valley and were immediately taken into the zoology department lab and analyzed. Our results showed that the total carbohydrate content was 0.00126, 0.00087, 0.00116, 0.00099, 0.00081, 0.00142, 0.00134, 0.0006, 0.0003, 0.00092, 0.0008 and 0.0011g/g tissue in *Schizothorax curvifrons* for the month of January, February, March, April, May, June, July, August, September, October, November and December respectively. The highest carbohydrate content in the muscle tissue was recorded in summer season (0.112%) followed by winter (0.108%) and spring (0.099%) and lowest in autumn season (0.067%). Thus, we conclude that the carbohydrate content of the fish varies seasonally.

INTRODUCTION

Fish is an important source of food for mankind all over the world from the times immemorial. Fish is a very important source of animal protein in the diets of man. The importance of fish as a source of high quality, balanced and easily digestible proteins, vitamins and polyunsaturated fatty acids is well understood now (Ravichandran *et al*., 2011). Fish meal contains most important nutritional components and serve as a source of energy for human beings (Ojewola and Annah, 2006; Sutharshiny and Sivashanthini, 2011). The biochemical composition of the fish muscle generally indicates the fish quality. Therefore, proximate biochemical composition of a species helps to assess its nutritional and edible value. An increasing amount of evidences suggest that due to the high content of polyunsaturated fatty acid, fish flesh and fish oil are beneficial in reducing the serum cholesterol (Stansby, 1985). In addition to that, the special type of fatty acid, the omega- 3 polyunsaturated fatty acid, recognized as an important nutritive supplement to prevent a number of coronary heart diseases (Edirisinghe, 1998), is also present in fishes. Principal composition of fish is 16-21% protein, 0.2-25% fat, 1.2-1.5% mineral, 0-0.5% carbohydrate and 66-81% water (Love, 1970).

The composition, however, varies greatly from species to species and also from individual to individual depending on age, sex, environment and season (Huss, 1988; 1995). The spawning cycle and food supply are the main factors responsible for this variation (Love *et al.*, 1980). Therefore, it is important to know proximate composition of fish and variations throughout the year. In this study, total carbohydrate composition of selected fish species was examined for one year from January 2012 to December 2012. Fish species selected for this study was *Schizothorax curvifrons*. *Schizothorax curvifrons*, locally called as "Satter Gad" on which the present research work has been carried out is a lotic form and appears to be the morphometrically and meristically most variable species of *Schizothorax* of Kashmir Valley which is recognized by the combination of its average high scale count, high gill racker number (21-28) and thin lips. Although several studies deal with the proximate composition of biochemical components of many commercially important fishes but no work on similar lines has been carried out in *Schizothorax curvifrons* particularly in Kashmir valley. Therefore, the present study was undertaken to elucidate the dynamics of carbohydrate composition of muscle of *Schizothorax curvifrons*.

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MATERIALS AND METHODS

Collection and treatment of fish sample

The fish samples *Schizothorax curvifrons* were purchased from the local markets of Kashmir valley in the period of January 2012 to December 2012. In each month 5-6 individuals of fresh *Schizothorax curvifrons* fish samples with almost same size were brought from the fish market and then immediately carried to the ichthyology lab, Department of Zoology, University of Kashmir where fish samples were thoroughly washed and rinsed with water to remove any adhering contaminants. The morphometric analysis of the fresh fish samples were done. Body muscle samples (free from skin and scales) of each month were collected, homogenized in a homogenizer and centrifuged before the analysis of biochemical components.

Carbohydrate estimation

Carbohydrate content was determined by using Phenol-sulphuric acid method (Dubois *et al*., 1956).

RESULTS

Monthly variation in the carbohydrate content from January to May showed a fluctuating trend followed by an abrupt increase in June (0.00142) and July (0.00134). A sudden fall was observed in August (0.0006) and September (0.0003). Thereafter, there was a gradual increase in carbohydrate values until December (0.0011). Seasonal variations showed highest values of carbohydrate percentage in summer followed by winter season in *Schizothorax curvifrons* i.e., 0.112% and 0.108% respectively, whereas, the lowest carbohydrate percentage was recorded in autumn season (0.067%) in the species (Fig. 1).

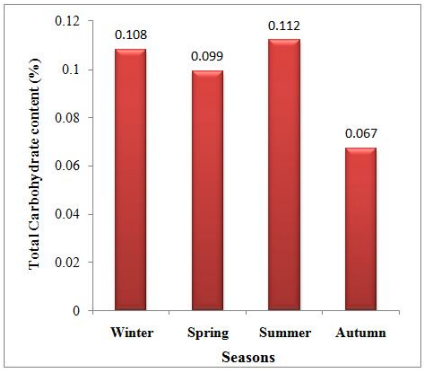

Fig. 1. Figure represents the total carbohydrate content of muscle tissue of *Schizothorax curvifrons* in different seasons. Highest carbohydrate content was observed in the summer season followed by winter and spring. All the values were presented as mean ± SD of three independent experiments.

Table 1. Monthly changes in carbohydrate content of *Schizothorax curvifrons* (gm/gm of tissue)

Month	Species *S. curvifrons*
January	0.00126 ± 0.00011
February	0.00087 ± 0.00011
March	0.00116 ± 0.00010
April	0.00099 ± 0.00010
May	0.00081 ± 0.00011
June	0.00142 ± 0.00011
July	0.00134 ± 0.00014
August	0.0006 ± 0.00012
September	0.0003 ± 0.00014
October	0.00092 ± 0.00025
November	0.0008 ± 0.00012
December	0.0011 ± 0.0001

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

DISCUSSION

Carbohydrate formed a minor percentage of the total composition and the lowest component in fishes. The Carbohydrate content of fish is affected by some environmental and physiological factors like seasons and feed intake. The Carbohydrate content of the fish samples ranged between 0.0003 and 0.00142g/g tissue with an average value of 0.00096 ± 0.0003. The carbohydrate content of the experimented fish in Winter, Spring, Summer and Autumn season was estimated as 0.108%, 0.099%, 0.112% and 0.067% respectively. Seasonal variation showed highest values of carbohydrates were obtained in summer i.e., 0.112% and lowest in autumn i.e., 0.067%. During summer which is a post-spawning season the fishes feed vigorously resulting in increase in the carbohydrate content of the fish muscle. In winter season which is resting period energy is reserved so carbohydrate content is more as compared to autumn season. The low values of carbohydrates recorded in the present study could be due to the fact that a carbohydrate does not contribute much to the reserves in the body. The study is supported by Vijay Kumaran (1979) who stated that carbohydrate plays a minor role in energy reserves of *Ambassis gymnoccephalus*. The change in the values can probably be accounted for by several factors such as food and feeding habit, habitat and geographical location, age, methods of handling/processing, seasons and some other environmental factors (Ryder *et al*., 1993; Omotosho and Olu, 1995; Nadcisa *et al*., 2001; Suhenden *et al*., 2008). Seasonal differences in the availability of food and changes in the reproduction cycle have considerable effect on the tissue biochemistry of the fish Bumb (1992). Bumb 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. Immediate source of energy is carbohydrate as Phillips *et al*, (1966) reported that carbohydrates are utilized for energy in trout, thus sparing protein for building of the body. As in autumn season fish utilizes energy for gonad development. The low values of carbohydrates recorded in the different months of fishes could be because glycogen does not contribute much to the reserves in the body (Jayasree *et al*., 1994).

Conclusion

The results suggest that the carbohydrate composition of the fish species greatly varies in winter, spring, summer and autumn seasons. These seasonal changes in carbohydrate composition of the muscle may be associated with feeding, reproductive cycle, storage and utilization of reserves. Thus the present study provides valuable information regarding the variations in the carbohydrate content of the fish species studied in order to take necessary precautions in processing from a manufacturer point of view and to distinguish their nutritional value and make a choice based on that information from a consumer point of view.

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