Recent Research in Science and Technology 2012, 4(7): 05-07
ISSN: 2076-5061
Available Online: http://recent-science.com/

Seasonal and monthly variations of protein content in the muscle of fish *Schizothorax esocinus*

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Abstract

Schizothorax esocinus (Chirruh snow barbell) Heckel, 1838 a key and freshwater species in the valley of Kashmir and is now endangered one. This study is to evaluate seasonal and monthly changes in protein content of muscle tissue and was studied over a period of twelve months from January 2011-Febuary 2012. Remarkable variation in protein content of muscle tissues of *S. esocinus* has been analyzed during the study period. The protein content of fish species showed increased level in summer season (28%) and lowest percentage in winter season (10%), attaining peak values in July (35%) and minimum value in December (0.08%). The results indicate that the protein content of the fish depends on season but also to a great extent in reaction to food and reproductive cycle. The present study is the first to describe the seasonal variation in the protein content of muscle of *Schizothorax esocinus* from the Kashmir Valley.

Keywords: *Schizothorax esocinus*, protein variations and muscle tissue.

INTRODUCTION

On a global scale, fish and fish products are the most important source of protein in the human diet. This protein is relatively of high digestibility compared to other protein source. It comprises of all the ten essential amino acids in desirable quantity for human consumption. It is recommended by cardiologists to use generous quantities of fish in food to obtain adequate protein without taking in excessive fatty acids and lipids [1,2]. Fish is one of the most important sources of animal protein available, and has been widely accepted as a good source of protein and other elements for the maintenance of a healthy body [3]. About 79 per cent of the population in Kashmir valley is located in rural areas so having limited sources of protein foods. Fish is an excellent and relatively a cheaper source of animal protein of high biological value.

In general, the biochemical composition of the whole body indicates the fish quality. Therefore, proximate biochemical composition of a species helps to assess its nutritional and edible value in terms of energy units compared to other species. Variation of biochemical composition of fish flesh may also occur within same species depending upon the fishing ground, fishing season, age and sex of the individual and reproductive status. The spawning cycle and food supply are the main factors responsible for this variation [4]. Knowledge of biochemical composition of muscles of *Schizothorax esocinus*, is of great help in evaluating not only its nutritive value but also helps in quality assessment and optimum utilization of this natural recourse. This in turn can help in processing the fish into products and other byproducts without wastage or loss of constituents such as free amino acids, proteins and fats. Biochemical investigations on fish help to evaluate the impact of environment. The composition of several fish species varies from season to season due to its natural cycle, maturity stage, geographic location, etc. [5,6].

Schizothorax esocinus inhabits cold streams, rivers and is distributed in the inland waters of Kashmir [7] besides Afghanistan and Pakistan. Hill-stream fish species constitute about 3.5% of the fish fauna available in India and all of them can be easily put into the threatened category on account of the adverse effect of increasing human activity [8]. *Schizothorax esocinus* is commonly used by the local people around the valley of Kashmir. Fish quality in the study area is important for rural communities since it contributes to their healthy diets and livelihoods. *S. esocinus* was selected because of its prime economic importance to the local inhabitants due to its endemic nature and taste. Till date no work on protein variations of this fish has been carried out. Therefore, the present study was undertaken to elucidate the monthly and seasonal variation of protein content of muscle tissue of *S. esocinus* with reference to season.

MATERIALS AND METHODS

Sample collection

Fresh and live fish were collected from Hazratbal Srinagar city with the assistance of the fishermen cooperative society. Samples were collected monthly from Jan 2011-Feb 2012. The length and body weight was measured to the nearest centimeter and weighed to the nearest gram respectively. Fishes were thawed and the bone and skin were separated from the flesh minced and homogenized in a

Received: May 12, 2012; Revised: June 19, 2012; Accepted: July 25, 2012.

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homogenizer.

Protein Determination

Total protein content of fish was estimated by Lowry's method [9].

RESULTS AND DISCUSSION

Protein content of fish varies not only in relation to species, but in relation to individuals of a same species [10]. The biochemical composition of *Schizothorax esocinus* collected from Dal lake of Hazratbal Srinagar Kashmir India shown specific pattern in their muscle protein. Results show that in the month of July protein content was highest (0.358 ± 0.039grams/gram tissue) where as in the month of December, we observed low level of protein content (0.089grams/gram tissue) (Table 1). Highest protein content was observed in summer season and lowest in winter season which is in good agreement with previously reported results by Ahmed [11] (Fig. 1). In winter season food availability is less which resulted in poor growth as indicated in December and January. Slight increase in food intake in the month of February and March may be a contrivance for building energy reserve to be used in impending gonadal maturation. During spring season protein content is slightly raised as temperature and food availability changes. During spawning, muscle protein started declining gradually due to its transfer in to ovaries to meet energy requirement of fish. After spawning a period extends from mid-week of May to June in which protein content again decline. Decline of protein has also been reported by Srikar [12]. The protein content during spawning season changes due to change in the endocrine system that monitors supply of nutrients to gonads from all parts of body including liver and muscles [13]. Proteins get accumulated in gonads when fish matures and at the time of spawning the gonadal elements get released either as eggs or milt carrying the protein along with them and protein declines. During the post spawning period, especially with the commencement of the recovery period normal life is resumed and this is marked with an increase in protein content.

In summer season protein content is maximum as temperature is changed and different varieties of food is available to fish and fish takes more food in comparison to other seasons resulting in higher protein percentage. Similar type of results were observed by Geri [14]. Intense feeding shown by the fish is because fish during spawning had lost gonadal elements and recoups to compensate the expenditure through vigorous feeding activity. Stansby [15] made similar observation in the trout. The highest value of muscle protein is observed in summer season as gonads of fish are in the recovery stage and without any gonadal elements; the food that is consumed by the fish is used in the building up of the muscle. These observations

confirm the earlier findings of Bruce [16]. Same is reported by Zafar [17]. During autumn season the protein content declines as protein for germ building is mobilized from muscle as reported by Sivakami [18]. In this period gonadal development starts so the food that fish eats utilizes for making gonads. In this stage fish feeds less as again temperature and food availability changes. Reduced metabolism, low autogenetic production of food and fall in allogenic inflow may account for low winter quantitative feeding in *Schizothorax.* On the contrary, in summer, increased metabolism and rise in autogenetic production of food and overflow of water from connected rice fields may be the contributing factors for rise in feeding intensity during June-August. Earlier publications emphasize that deprivation of fish from adequate amounts of food causes decrease in protein level Mustafa [19]. Fish had to utilize energy also for maintenance of body temperature and for body metabolism.

Table 1. Monthly changes in protein content of *Schizothorax esocinus* (gms/gram of tissue)

Month	Species *S. esocinus*
January	$0.094 \pm 0.025^{\$\#@AC}$
February	$0.149 \pm 0.0085^{\$\#@AC}$
March	$0.189 \pm 0.063^{\$\#@cB}$
April	$0.171 \pm 0.040^{\$\#@Be}$
May	$0.10 \pm 0.053^{\$\#@AdC}$
June	$0.206 \pm 0.038^{\$\#@ABC}$
July	$0.358 \pm 0.039^{\$\#@ABC}$
August	$0.291 \pm 0.072^{\$\#@ABC}$
September	$0.141 \pm 0.017^{\$\#@ABC}$
October	$0.178 \pm 0.021^{\$\#@ce}$
November	$0.1398 \pm 0.011^{\$\#@AC}$
December	$0.089 \pm 0.014^{\$\#@dC}$

Each value represents the mean ± SD of 3 separate experiments. $; p < 0 .001, as compared with July month, #; p < 0.001 as compared with August, @; p < 0.001 as compared with June, a; non significant as compared with August, b; non significant as compared with June, A; p < 0 .001, as compared with April month, c; non significant as compared with April, B; p < 0 .001, as compared with January month, d; non significant as compared with January, C; p < 0 .001, as compared with March month, e; non significant as compared with March. The data were presented as means ± S.D of three parallel measures and evaluated by one way ANOVA followed by the Bonferroni t – test to detect inter group differences. Differences were considered to be statistically significant if p< 0 .05.

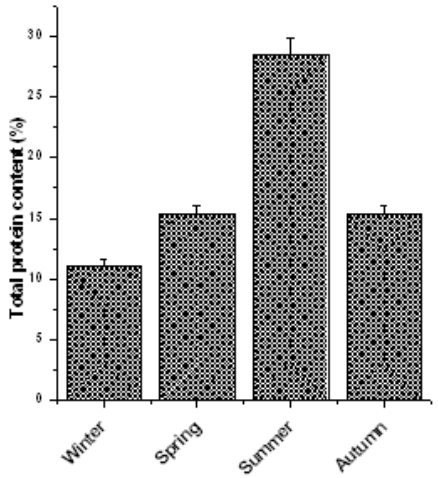

Fig 1. Showing the total protein content of muscle tissue (%) of *S. esocinus*

CONCLUSION

Knowledge of biochemical composition of fish assists in elucidating its environmental, physiological and nutritive status. This information can be helpful for prevention of fish capture in breeding season to conserve the diversity of fish.

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