American-Eurasian Journal of Scientific Research 7 (1): 01-04, 2012
ISSN 1818-6785

DOI: 10.5829/idosi.aejsr.2012.7.1.64126

Variations of Protein Content in the Muscle of Fish *Schizothorax niger*

[1]Ulfat Jan, [1]Mustafa Shah, [1]Tahila Manzoor and [2]Showkat Ahmad Ganie

[1]Department of Zoology, University of Kashmir Srinagar-190006, India
[2]Department of Clinical Biochemistry, University of Kashmir Srinagar-190006, India

Abstract: The seasonal variations in protein content of economically important fish, *Schizothorax niger* (Ale gaad) Heckel 1838, from Dal Lake of Kashmir Valley were monitored from January 2011 to Feb 2012 for their nutritional value. The obtained results revealed that protein content was high in the month of July (0.220 ± 0.046), the lowest was in the month of January (0.0947±0.039) and December (0.091 ± 0.018), then there was a slight increase in the protein content in the months of February, March, April, May and June which ranges from 0.1083±0.027 to 0.1604±0.023g/g tissue respectively. Variation of protein content during different seasons of the year helps nutritionists and researchers who are striving to improve the nutritive value, processing and marketing of endangered fish species and in fishing industry.

Key words: Protein · Monthly Variations · Seasonal variations and *Schizothorax niger*

INTRODUCTION

Knowledge of the proximate composition of fishes can be used to estimate the food value of fishes and to plan the most appropriate industrial and commercial processing.

Early, though long outdated, data on the chemical composition of fishes were given by Weigelt [1] and many others. Fish are known to be a very healthy food item. They are an excellent protein source that also delivers various minerals and vitamins necessary for good health. Scientists reported that societies with high fish intake have considerably lower rates of acute myocardial infarctions, other ischemic heart diseases and atherosclerosis [2, 3]. The present availability of protein is much below the minimum daily requirements and the livestock sector alone will not be able to meet the protein requirements of ever increasing human population [4]. Fish is an excellent and relatively a cheaper protein source of high biological value. Therefore its use may help bridge the protein gap because of its multifarious economic advantages and nutritional significance [5]. Fish proteins contain all the essential amino acids (not synthesized and need to be provided in the diet) in the required proportion and hence have a high nutritional value, which contribute to their high biological value. Cereal proteins are usually low in lysine and/or the sulphur-containing amino acids like methionine and cysteine, whereas fish protein is an excellent source of these amino acids. In diets based mainly on cereals, a supplement of fish can, therefore, raise the biological value significantly. The chemical score or amino acid score of fish protein compares well with that of whole egg protein, which is considered a standard protein source and slightly more than that of cow's milk. Similarly the protein efficiency ratio of fish proteins is 3.5 against that of egg protein (3.9), beef (2.3) and milk protein (2.5). Fish is also rich in the non-protein amino acid taurine, which has a unique role in neurotransmission.

Fishes belonging to the subfamily Schizothoracinae are widely distributed in mountain streams and lakes around Himalayan Karakorum and Hindukush Ranges, the Tibet Plateau and Central Asia [6]. The genus *Schizothorax* Heckel comprises many species that inhabit the reservoirs of Central Asia from Turkmenistan and Eastern Persia in the West to the far reaches of Mekong and Yangtzekiang in the East. *Schizothorax niger* inhabiting cold streams and rivers 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]. Although several studies deal with the proximate composition of biochemical components of many commercially important

Corresponding Author: Showkat Ahmad Ganie, Department of Clinical Biochemistry, University of Kashmir, Srinagar (J&K) 190006, India. Mob:+91-9419972678.

fishes, but no work has been carried out on *Schizothorax niger* particularly from Dal Lake waters of Kashmir Valley. Therefore, the present study was undertaken to elucidate both the seasonal and monthly variations in the amount of total protein content in muscle of *Schizothorax niger*, to determine their nutritional value and variations during the fishing season which is very important in recent years.

MATERIALS AND METHODS

Samples of *Schizothorax niger* were collected from Dal Lake in Hazratbal Srinagar at monthly intervals during the period of January 2011 to February 2012. Upon arrival of fish to market place, they were immediately transported to the laboratory of Biochemistry University of Kashmir, washed with cold tap water and the total length, total weight and sex were determined. Body muscle samples (free from skin and scales) of each month were collected and homogenized in a homogenizer, before the analysis of biochemical components.

Weight of *S. niger* varied from 49.06-400g and length varied from 19.5-30cm.

Protein Estimation

Lowry's Method: This assay was introduced by Lowry *et al.* [9]. It is highly sensitive and can detect protein levels as low as 5µg/ml. This is the most widely used method for protein estimations. Under alkaline conditions Cu^{2}? forms a complex with the peptide bonds of protein and becomes reduced to Cu. The Cu as well as the groups of tyrosine, tryptophan and cysteine residues then reacts with the Folin's reagent. The reagent reacts by first producing an unstable product which is slowly reduced to become molybdenum/tungsten blue and the blue colored complex shows maximum absorption at 620 nm.

Statistical Analysis: The values are expressed as mean ± standard deviation (SD). The results were evaluated by using the SPSS (version 12.0) and Origin 6 softwares.

RESULTS

The protein composition of *Schizothorax niger* was determined over the period of one year and the obtained results are present in Table 1. Protein content varied from 0.0947 to 0.220 g/g tissue, the highest protein content was in July and the lowest was in January and April. The protein content was 0.971, 0.170, 0.1769 and 0.1531g/g tissue of protein content in the months of August, September, October and November respectively.

Table 1: Monthly changes in protein content of *Schizothorax niger* (g/g tissue)

Month	Protein content of *S. niger* muscles
January	0.0947 ± 0.039
February	0.1339 ± 0.0265
March	0.188 ± 0.025
April	0.1083 ± 0.027
May	0.1291 ± 0.002
June	0.1604 ± 0.023
July	0.220 ± 0.046
August	0.1971 ± 0.028
September	0.170 ± 0.018
October	0.1769 ± 0.018
November	0.1531 ± 0.015
December	0.091 ± 0.018

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

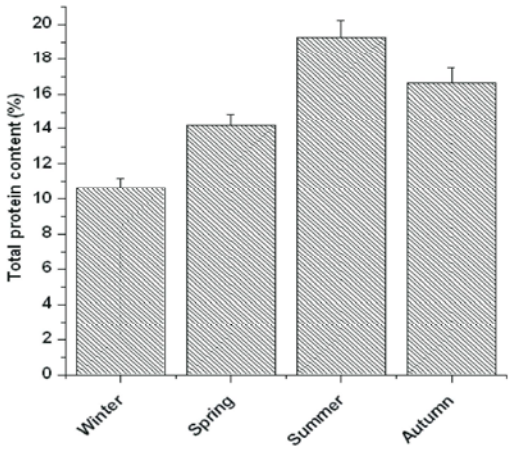

Fig. 1: Showing the total protein content of muscle tissue (%) of *Schizothorax niger*

A decrease in the protein content in the month of December was recorded (Table 1). Seasonal variations showed highest values of protein percentage in summer season of *Schizothorax niger* (19.25%), Whereas, the lowest protein percentage was recorded in winter season (Fig. 1). The decreases in the protein content in some months probably may be due spawning.

DISCUSSION

Figure 1 indicates seasonal variations of protein, of *S. niger*. It was observed that the proportions of the components of muscle tissues varied with the change of season. Fish constitute a very important component of the diet for many people and often provides the much needed nutrient that is not provided in cereal based diets [10]. Fish is rich in protein with amino acid composition very well suited to human dietary requirements comparing favorably with egg, milk and meat in the nutritional value

of its protein [11]. The variation of the protein fraction may be due to the planktonic feed and to climatic changes in the year which influence the general biochemical composition of the fish. The protein content of fish changes with season [12, 13]. The seasonal variations in protein content of *Schizothorax niger* was assessed from Jan 2011- Feb 2012. The highest protein content was in summer season and the lowest was in winter season that was in agreement with previously reported results by Chandra Shekhar [14]. In winter season food availability is less and fish consume less feed which resulted in poor growth. During winter season, gonad of fish are at rest and amino acid related to depletion and select materials for building up of the gonads [15]. Slight increase in food intake (February-March), after winter may be a stimulant 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. In spring season two stages of spawning come i.e. Pre-spawning and spawning. As these stages are from month of March to first week of May in this period protein content increase as reported by Van Bohemen [16] that the highest protein content in pre-spawning stage might be due to its ready supply by the liver. Further this increased protein content may be a mechanism of maturation of gonad and storage of reserves to meet and spawning requirements. Low quantitative feeding observed presently in *Schizothorax* during April-May could be due to spawning activity [17, 18]. Incidentally, the fish during spawning months has been found to be active and agile and this results in the utilization of some of the muscle reserves of energy results in decline of muscle protein. In summer season protein content reach to the maximum. Fish takes more food in comparison to other seasons resulting in higher protein percentage as no gonadal elements are present so the food that is consumed by the fish is used in the building up of the muscle. Similar results were observed by Geri *et al.* [19]. During autumn season the protein content declines as protein for germ building is mobilized from muscle as reported by Sivakami *et al*. [20]. 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.

CONCLUSIONS

The results suggest that the protein content of fish greatly varies during the different seasons. This might be due to physiological reasons and changes in environmental conditions, i.e. spawning, migration and starvation or heavy feeding. This study provides valuable information on variations in protein content of fish species studied in order to take necessary precautions in processing from a manufacturer point of view. Biochemical studies of fish tissue are of considerable interest for their specificity in relation to the food values of the fish and for the evaluation of their physiological needs at different periods of life. It is also necessary to have data about the composition of fish in order to make the best use of it as food and also to develop the technology of processing fish and fish products.

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