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Seasonal Variations in the Proximate Composition of Gangetic Sillago, *Sillaginopsis panijus* (Perciformes: Sillaginidae)

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Abstract: Seasonal variations in the proximate composition of Gangetic Sillago, collected from local fish market during December 2010 to November 2011, was evaluated with a view to providing nutritional data for dietary planning. The obtained results revealed that crude protein was the main component of the species comprising the highest percentage. The mean crude protein content was found to be 57.79±0.21%, 73.93±0.17%, 64.55±0.12% and the mean carbohydrate was 9.31± 0.08%, 1.31± 0.04%, 6.63±0.04% in December, April and July respectively. The two major constituents, crude protein and carbohydrate showed high seasonal variation ($p<0.05$) in Gangetic Sillago during the study period. Protein content was increasing until April and a sudden decrease was observed in July. The highest protein value (73.93%) was found in April and the lowest value (57.79%) was found in December. The highest carbohydrate value (9.31%) was found in December and the lowest (1.31%) in April. The amount of carbohydrate showed a highly decreased from December to April and then increased from April to July. Lipid percentage decreased in summer and showed slightly increases in the monsoon. Dry matter percentage of the fish remained almost the same in all seasons.

Key words: Proximate Composition · Seasonal Variation · Lipid · Protein · Gangetic Sillago

INTRODUCTION

Fisheries items are the major protein source of Bangladesh which contributing 58% of the nation's animal protein demads [1]. The current fish consumption rate is 17.52 kg/ people/ year whereas the demand is 20.44 kg/ people/year and hence the total demand of fish is 29.74 MT per year [2, 3]. So the country needs to fulfill the increasing demand of fish by either increasing production of fish through aquaculture or capturing fish from the wild. 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 [4]. Recent nutritional studies have established that at least one-third of the total requirement of the protein in the daily diet must come from animal sources, fish and fish products which are the most important sources of animal protein in the human diet [5].

This protein is relatively of high digestibility compared to other protein sources. It comprises of all the ten essential amino acids in desirable quantity for human consumption. Fish have rich source of essential nutrients required for supplementing both infant and adult diets [6]. Fish normally has more poly unsaturated fatty acids than animal fats. An increasing amount of evidences suggest that due to its high content of polyunsaturated fatty acid fish flesh and fish oil are beneficial in reducing the serum cholesterol [7].

Bangladesh has a total of 265 freshwater and 475 marine fish species [8] but only few of them are commercially important. The Gangetic Sillago, locally known as 'Tular Dandi', is commonly found in the fish market of the coastal area of Bangladesh. Most species in the family of Sillaginidae is not considered as an economically important fishery item although nutritionally they are very rich. It is normally distributed in the south

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west coast, Gangetic delta and east coast of India, Bangladesh and Myanmar and rarely in the Indonesian Archipelago.

Proximate composition generally comprises the estimation of moisture, protein, fat and ash contents of the fresh fish body. The percentage composition of these constituents accounts for about 96-98% of the total tissue constituents in fish. The assessment of the proximate composition of the fish is not only important to know its nutritive value, but also for its better processing and preservation [9]. The processor, the nutritionist, the cook and the consumer all have a direct interest in the composition of fish. Proximate composition of fish varied widely from species to species and even within the same species from one individual to another. This individual variation is normally due to some factors such as size, age, season, sex and geographical location [10]. This nutrient composition also differs in different region of the fish body like in fish flesh protein content generally higher in fish skin. While the consumer is interested mainly in the edible part of the fish, that is the flesh or muscle, the fish meal manufacturer is concerned with the composition of the whole fish and the processor of fish oils wants to know what is in the liver. So, to know the composition of nutrients in different parts of the body of fish is very important for different users. But the proximate composition of Gangetic Sillago has not been determined yet. Therefore, this study was undertaken to know the nutritional composition of Gangetic Sillago in different seasons.

MATERIALS AND METHODS

Fish samples were collected from Sonapur fish market of Noakhali District in the period of 2010- 2011. In each season, 5-6 individuals of fresh Gangetic Sillago fish samples with almost same size (30-35 cm TL) were brought from the fish market and then immediately carried to the laboratory of Fisheries and Marine Science Department, Noakhali Science and Technology University. Then the samples were kept in an insulated cool box with ice and immediately transported to the fish nutrition laboratory of Bangladesh Agricultural University in Mymensingh. Then the samples were separated, labeled and stored at -20°C until laboratory analysis.

Determination of Proximate Composition: The samples were analyzed in triplicate determination for each chemical analysis. The conventional method of AOAC (Association of Official Analytical Chemicals) on weight basis [11] was followed for determination of proximate composition.

Estimation of Moisture: Moisture of fish is commonly determined by drying a sample at some elevated temperature and reporting the loss in weight in terms of moisture.

$$\%\ of\ moisture = \frac{Weight\ loss}{Original\ weight\ of\ the\ sample\ taken} \times 100$$

Moisture factor = (100 – moisture) / 100

Estimation of Ash Content: Ash in fish and fish products is readily determined by incineration from either raw or dried sample at about 600-700°C for 5-8 hours, depending on the method used. The residue is weighed and reported as ash.

$$\%\ of\ ash = \frac{Weight\ of\ dry\ sample}{Original\ weight\ of\ the\ sample\ taken} \times 100$$

Estimation of Protein Content: The crude protein of the fish was determined by Micro- Kjeldhal method (Pearson, 1999). The percentage of nitrogen I sample was calculated by the following formula-

% of N_2= (Titration reading-blank reading) X strength of Acid X100/5 X 100/ weight of the sample. For most routine purpose the % of protein in the sample is the calculated by multiplying the % of N_2 with an empirical factor 6.25 for the fish.

% of the protein=% of total N_2 X 6.25

Estimation of Lipid Content: The estimation of fat content of experimental raw fish, smoke cured fish samples had been accomplished by Bligh and Dryer method [12].

$$\%\ of\ fat = \frac{Weight\ of\ the\ residue}{weight\ of\ the\ sample\ taken} \times 100$$

Determination of Carbohydrate Content: There is no single method suitable for determining total carbohydrate in all tissues and, apart from the indirect infrared method mentioned earlier under protein, the methods are not straightforward. For these reasons it is common to estimate carbohydrate (c) by difference.

$$C\ (\%) = 100 - P - W - F - A$$

Where P is percentage protein (Nitrogen × 6.25), W is percentage water and F is percentage of fat and A is percentage of ash.

RESULTS AND DISCUSSION

The proximate composition of the fish found in the experiment is furnished in table 1.

It has been found that dry matter percentage in Gangetic Sillago varied slightly remaining within the range of 2 % variation. Lipid percentage decreases in the summer and slightly increases in the monsoon. It has also been found that the main nutrient composition is crude protein. The amount of crude protein is higher than all other nutrient compositions in the fish. Crude protein percentage increases in the summer season and decreases in the monsoon. Ash content also decreases from winter to summer and increases in the monsoon. Carbohydrate content shows a high seasonal variation being the maximum in winter and the minimum in summer.

In winter (December) the composition of nutrient contents (dry matter basis) of the experimented fish such as dry matter, lipid (oil), crude protein, ash, crude fiber and carbohydrate content was 21.28±0.18%, 14.73±0.05%, 57.79±0.21% 15.64±0.03%, 2.53±0.16%, 9.31±0.08% respectively.

The crude protein percentage of the experimented fish in December, April and July was estimated as 57.79±0.21%, 73.93±0.17% and 64.55±0.12% respectively which is more or less coincides with the findings of Chakwa and Shaba [13] in African catfish (*Clarias gariepinus*).

The lipid content of the experimented fish in December, April and July was estimated as 14.73±0.05%, 11.87±0.05% and 13.09±0.16% respectively which is more or less coincides with the findings of Saha and Guha [14]. They found richest amount of fat in Hilsha (*T. ilisha*) 19.4% while *Silonea silonida*, *Pangasius pangasius*, *Barbus sarana* and *Anabas testudineaus* contained 12.1%, 10.8%, 9.9% and 8.8% of fat respectively. Mridha *et al.* [9] analyzed the biochemical composition of *Cirrhinus reba* which is a native species of Bangladesh and reported that the fish had the average values for lipid was 8.03%. Seasonal differences in the availability of food and changes in the reproduction cycle have considerable effect on the tissue biochemistry of the fish, particularly fat [15]. Bumb [15] also analyzed the variation of fat content with feed intake and found that intensive feeding in *Ambassis commersoni* coincides with the occurrence of high fat content in the muscle of fish.

Table 1: Seasonal variation of proximate composition of Gangetic Sillago

Proximate composition	Winter (December) Mean±SD	Summer (April) Mean±SD	Monsoon (July) Mean±SD
Dry matter (%)	21.28±0.18	22.40±0.15	23.74±0.03
Lipid (%)	14.73±0.05	11.87±0.05	13.09±0.16
Crude protein (%)	57.79±0.21	73.93±0.17	64.55±0.12
Ash (%)	15.64±0.03	11.50±0.09	14.13±0.06
Crude fiber (%)	2.53 ±0.16	1.39 ±0.18	1.60 ±0.03
Carbohydrate (%)	9.31± 0.08	1.31± 0.04	6.63±0.04

The value of ash in the fish in December, April and July was estimated as 15.640±.03%, 11.50±0.09% and14.13±0.06% respectively which was nearer to the result of Petenuci *et al*. [16] in fish bone flour of Nile Tilapia (*Oreochromis niloticus*) which contained 18.3% of ash. Chakwa and Shaba [13] found higher amount of ash content in *C. gariepinus* (3.06%) than the studied fish. The present findings state that the ash contents of *Sillaginopsis panijus* might be a good source of minerals such as calcium, potassium, zinc, iron and magnesium.

The crude fiber content of the experimented fish in December, April and July was estimated as 2.53 ±0.16 %, 1.39 ±0.1 % and 1.60 ±0.03% respectively. According to Stansby [10], variation in proximate composition of fish flesh may vary with species variation, season, age and feeding habit of fish. However, the result of the present study states that the proximate composition of this small fish species is nearer to other larger carp species and high in crude fiber content. The price of this fish species is lower than larger species of fish. Therefore, this fish can play a significant role to fulfill the nutrient demand of poor people of the country.

The carbohydrate content of the experimented fish in December, April and July was estimated as 9.31±0.08 %, 1.31±0.04 % and 6.63±0.04% respectively. Carbohydrate content of fish is affected by some environmental and physiological factors like seasons and feed intake. Seasonal differences in the availability of food and changes in the reproduction cycle have considerable effect on the tissue biochemistry of the fish, particularly fat [15]. Bumb [15] 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.

Generally moisture content shows inverse relationship with lipid content. The inverse relationship has also been reported in marine fishes such as *Mugil cephalus* [17]. Jacquot [18] in his experiment found that fatty fish contained 68.6% moisture, semi fatty fish contained 77.2% and lean fish contained 81.8% moisture which showed the inverse relationship between fat and moisture content. Therefore, this fish can play a significant role to fulfill the protein and other essential nutrients demand of the people in Bangladesh.

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