Bangladesh J. Sci. Ind. Res. **41**(3-4), 219-226, 2006

Seasonal Variation in the Chemical Composition of Body Flesh of Koi Fish *Anabas testudineus* (Bloch) (Anabantidae: Perciformes)

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Abstract

Protein, carbohydrate, fat, ash and moisture contents in the body muscle of *Anabas testudineus* (Bloch) were investigated. The compositions varied seasonally in relation to reproductive cycle of the fish. Significant correlation existed between moisture and carbohydrate, moisture and fat, moisture and protein, moisture and ash, protein and ash, fat and carbohydrate, fat and ash, protein and carbohydrate. The protein content found to be higher in medium sized fishes and gradually decreased with the increase of age. Fat content was higher in large-sized male than that of the females. Carbohydrate content was slightly higher in male than the female.

Introduction

Fish protein occupies an important place in human nutrition. It has high digestibility, biological and growth promoting value. The importance of chemical analysis in marine fish and prawns and expressed the food value in terms of energy units.[1] Works on chemical composition of different fishes are well documented in Bangladesh.[2-5] Nutritional problem is one of the biggest threats to the overall development of Bangladesh especially in health sector. More work needs to be necessary on the chemical composition of different fishes. The present study deals with the status of the chemical composition of *Anabas testudineus.*

Materials and Methods

Fresh specimens of different sized *A. testudineus* of both sexes were collected from different areas of Rajshahi. Immediately after collection, the samples were washed and the surface blotted off and their length and weight were recorded. Head, fins, scales, general viscera and bones of each specimen were recorded. The muscles were collected from dorsal, ventral and tail portions and macerated in a minced to act a homogenous mass. Moisture and ash determination of the samples were estimated by the standard method. Crude protein content in the fish muscles were estimated by determining the total nitrogen by Micro-Kjeldhal method.[6]

Fat is estimated as crude ether extractions of the dry material. Carbohydrate determination was followed by acid hydrolysis method.[7]

Results and Discussions

Moisture content

Average value of moisture content in *A. testudineus* throughout the year was

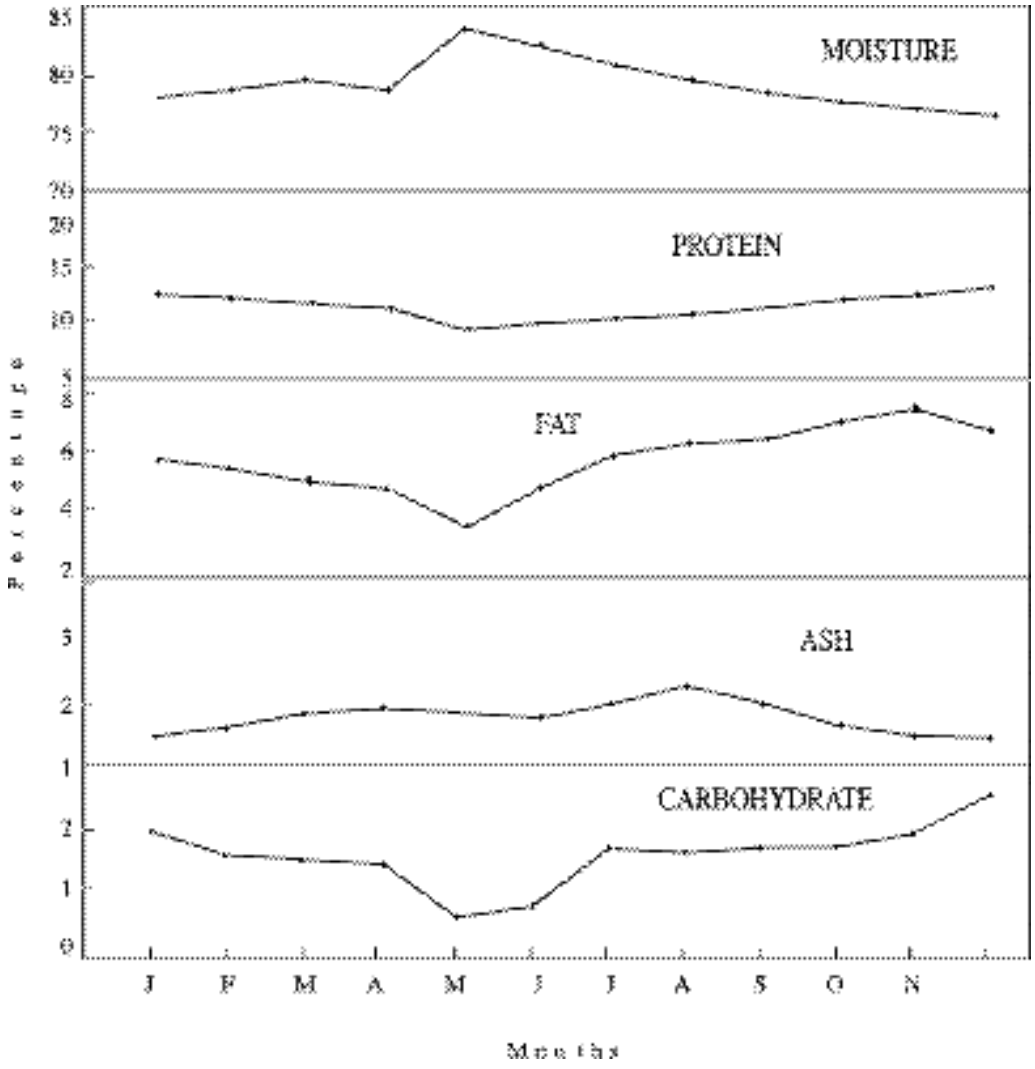

Fig 1. Seasonal variation of *A. testudineus* (male)

79.11 ± 0.65 % in males and 78.99 % females. The lowest value (76.97 %) in males were noticed in December whereas the highest value in May (84.17 %). In females, the lowest value (76.94 %) were noticed in October but the highest value (82.73 %) in May (Fig 1 and 2).

Ash

Ash content was found to vary from 1.32 to 2.15 % with an average of 1.72±0.07 % for males and 1.45 to 2.21 % for females (1.78 ± 0.06%). Maximum ash were recovered in both the sexes in August (Fig 1 and 2).

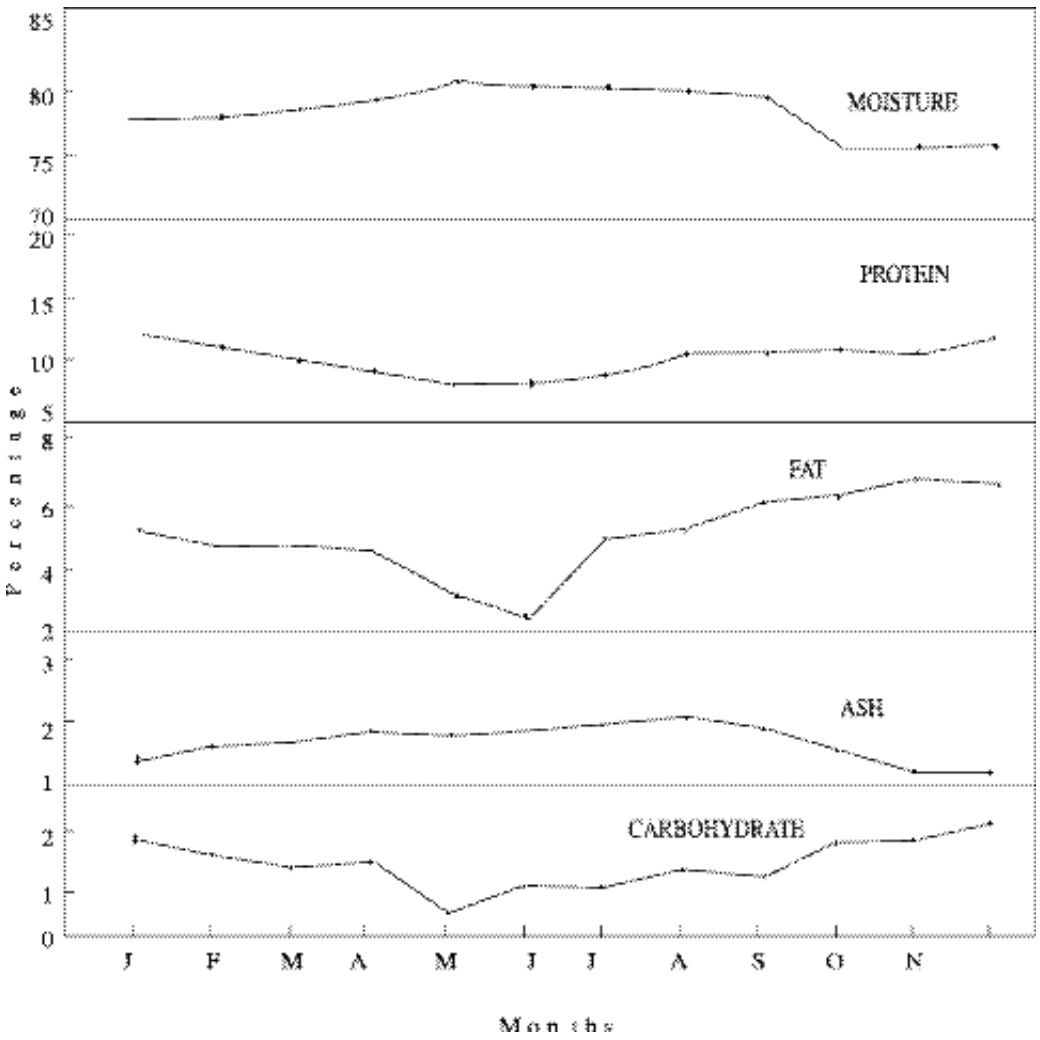

Fig 2. Seasonal variation of *A. testudineus* (female)

Protein

The average protein content was 10.24 ± 0.79% for males and for females (11.07 ± 0.31%). In both sexes the maximum values were obtained in January (Fig 1 and 2).

Fat

Fat content fluctuated from 3.91 to 6.83 % with the mean 5.54 ± 0.25 % in males and 3.82 to 6.68 % with the mean 5.45 ± 0.26 % in females. In both the sexes the maximum value was obtained in May whereas the maximum in November (Fig 1 and 2).

Carbohydrate

Carbohydrate content fluctuated in male from 0.70 to 2.27 % with the mean 1.51 ± 0.12 % and in female 0.73 to 2.25 % with the mean 1.46 ± 0.11%. In both the sexes the maximum value were obtained in December and minimum in May (Fig 1 and 2).

The correlation co-efficient proved to be positive and highly significant, viz., protein and carbohydrate, fat and carbohydrate, fat and ash. The relation between moisture and fat, protein and ash, moisture and protein are negatively correlated. Table I represents regression equations by which fat, carbohydrate, protein and ash content of fish bodies can be evaluated from a knowledge of moisture content only. The high precision of these estimates is indicated by the small standard errors of the regression co-efficient.

Variation in size and sex

The percentage of moisture varied with the variation of size and sexes of *A. testudineus.* The moisture content was higher in males than the females. It was also found that in small fish, the moisture content was high and low in large size fish. The protein content slightly higher in female then male and lower in small sized-fish. The protein content was high in medium sized fish and gradually decreases with the increase of age. Fat content was high in large-sized male than the females. Carbohydrate was slightly high in male then the female. In case of ash content no remarkable difference was observed.

The influence of age on different constituents of fish and noted a decrease of water and protein contents with the progress of age.[8] A survey was made on the chemical composition of a number of samples of spring herring and although he has not attempt to correlate the change of body weight with the chemical composition, yet on scripting and compilation of his data it appears that immature fish contained more water but less protein, on both wet and dry basis, then the mature ones. This agreement is close to the present findings. The percentage of many constituent of fish increases as the fish grows larger.[10] The present result shows that the larger *Anabas* contained more fat. Such a variation in composition might be due to age and size difference. Decrease in protein and moisture but

Table 1. Correlation coefficient (r), number of observation (N), intercepts (a), regression coefficient (b), standard errors of 'b' (SE) and computed 't' values of different constituent determined separately for male and female of *A. testudineus* (Y=bx+a)

Sex	No.	r	a	b	S.E.	t
		Percent moisture	Fat dry weight (Y)			
Male	20	-0.72	27.575	-0.278	0.251	4.39***
Female	20	-0.79	33.39	-0.35	0.260	5.49***
		Percent protein (X)	and Percent ash (Y)			
Male	20	-0.63	3.36	-0.148	0.069	3.42***
Female	20	-0.41	2.736	-0.09	0.067	$1.91^{N.S.}$
		Percent protein (X)	and Percent carbohydrate (Y)			
Male	20	0.84	7.945	2.068	0.301	6.59***
Female	20	0.84	-1.979	0.31	0.112	6.59***
		Percent fat (X)	and Percent carbohydrate (Y)			
Male	20	0.73	-0.48	0.36	0.124	4.49***
Female	20	0.72	-0.24	0.31	0.112	4.39***
		Percent moisture (X)	and Percent carbohydrate (Y)			
Male	20	-0.38	14.889	-0.169	0.124	$1.74^{N.S.}$
Female	20	-0.38	15.26	-0.17	0.583	$1.74^{N.S}$
		Percent moisture (X)	and Percent protein (Y)			
Male	20	-0.89	43.138	-0.41	0.300	8.22***
Female	20	-0.90	47.885	-0.466	0.309	8.68***
		Percent moisture (X)	and Percent ash (Y)			
Male	20	0.47	-2.29	0.05	0.069	2.26*
Female	20	0.59	-3.367	0.07	0.063	3.09***

*** Significant at 0.01% level, * Significant at 5% level and N.S. = Non-significant.

increase in fat content with the increase of age in the case of carps. In some cases it was also observed that the same sized fish contained different percentage of protein and fat.[2] This is probably due to the difference of food and feed materials available of fish environment.

Seasonal variations

Figure 1 and 2 indicates seasonal variation of protein, fat, carbohydrate, ash and moisture of *A. testudineus*. It was observed that the proportions of the components of muscle tissues varied with the change of season. The seasonal variation found in females greater then the males. In both the male and female cases the highest value of moisture were obtained in May i.e. at spawning time. At spawning time, the fillets contained more moisture than any other time of the year. The findings is more or less similar to other related fishes as well as in other vertebrates due to maturation of gonads.[11-13] The low values of moisture during certain seasons have been observed in several other fishes by various authors and attributed to maturation of gonads.[4] The moisture content was lower in winter (November-January) and higher in summer (May-August). The same result also found on Gobi fish.[3] The fat and protein content decreased from April to June and increased from October and January. From the Table I the moisture content in the case of male fish was higher compared to the female fish both in winter and in summer seasons.

At the breeding season i.e. from May to June the percentage of carbohydrate of *A. testudineus* was lower. It was gradually increased from March to June and then in the winter season. The percentage of fat depends on the reproduction and food. Similar results were obtained on *Macrognathus aculeatus*.[4] The differences in season, depending on the availability of food at different time of the year, have a considerable effect on the tissue components particularly the fat.[14] Changes in the reproductive cycle also have a marked effect on the body composition. He further mentioned that fish like other animals, store fat to supply energy needed during food scarcity and reproductive phases. Reduction of the fat content during the spawning season has been recorded for mirror-carp and three spined stickle back.[16,17] The fluctuation of ash content made difficult to show any relationship with the spawning season. In general, body composition of fishes seems to depend age, sex, season and diet.[18-21]

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