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Seasonal Variations in the Chemical Composition of Apple Snail, *Pila globosa* (Swainson) (Mollusca: Gastropoda) in pond habitat.

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Abstract

Protein, carbohydrate, fat, ash and moisture content in the muscle of *Pila globosa* (Swainson) were analyzed. The compositions varied seasonally in relation to reproductive cycle of the snail. Significant correlation existed between moisture and carbohydrate (r = 0.79), moisture and fat (r = 0.74), moisture and protein (r = 0.94), moisture and ash (r = 0.73), protein and ash (r = 0.80), fat and carbohydrate (r = 0.95), protein and carbohydrate (r = 0.89) in females. In male, correlation is highly significant between protein and ash (r= 0.65), protein and carbohydrate (r= 0.49), fat and carbohydrate (r= 89). But negatively correlated with moisture and fat (r = -0.38), moisture and carbohydrate (r = -0.40) ,), moisture and ash (r = - 0.30), moisture and protein (r = - 0.13). Fat and carbohydrate content was higher in large sized female than that of the male.

Key words: Moisture, Fat, Protein, Seasonal changes, Size, Sex

Introduction

Snail is a key stone species of an aquatic ecosystem. In the Southeastern part of Bangladesh.. Snail trading is one of domain business because of shrimp farms (Kabir *et. al*. 2004). The largest freshwater apple snail, *Pila globosa* is an edible snail having an increasing demand throughout the world. Prabhakar and Roy (2009) mentioned that shell fisheries is a solution to the world food problem because it is an available source of low cost animal protein for poor people.

Our present knowledge about the nutritive value of *P. globosa* is inadequate. Acquiring knowledge on biochemical composition of this economically important snail is necessary. So, this work was undertaken to detect the seasonal variations in the chemical compositions of *P. globosa* in relation to some biological factors, such as maturation, spawning, size, sex and aestivation.

Materials and Methods

Fresh specimens of different size of *P. globosa* were collected from the culturing pond of snail, located in BCSIR Campus, Rajshahi. Immediately after collection, the samples were washed and external surface blotted off and their length, breadth and weight were recorded. The shells were carefully removed so that the edible parts could be removed and dried. The powders were subjected to different process ing methods of consumption. Moisture, ash and contents of the snail flesh were determined by the method of the Association of Official Analytical Chemists (AOAC 1990). Crude protein content was estimated by determing the total nitrogen by Micro-Kjeldhal method. (Ahmed *et al.* 1981). Fat is determined as crude ether extractions of the dry material. Carbohydrate determination was followed by acid hydrolysis method (Anonymous, 1960).

Results and Discussion

Moisture content

Average annual values of moisture content was 65.59 ± 0.94% in males and 67.89 ± 1.41 in females. Lowest value was noticed in June in both the sexes, 65.59 ± 9.25% in males and 69.38 ± 0.49% in females. Highest value of this component for male and female were 68.87 ± 0.42 % and 71.86 ± 0.48% respectively (Figs 1 and 2).

Ash

Ash content value varied from 0.95 to 1.09% with an average of 0.95 ± 0.04% for males and 0.97 to 1.07% with an average of 0.96 ± 0.02 for females. Maximum values for males were recorded in August and those of females in July (Fig 1 and 2).

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Protein

Protein content differed between 24.49 to 32.08% with the mean of 23.72 ± 2.07 for males and 24.29 to 35.79% with the mean of 24.29 ± 4.29 for females. In males, the maximum and minimum values were observed in August and February respectively. In female, the lowest value was noticed in February and highest value in July (Figs 1 and 2).

Fat

Fat content fluctuated from 1.18 to 1.98% with the mean of 1.09 ± 0.19% in males and 1.17 to 1.83% with the mean of 1.17 ± 0.22% in females. In both the sexes, the minimum value was obtained in May. The maximum value of male was in October and that of female was in September as shown in Figs. 1 and 2.

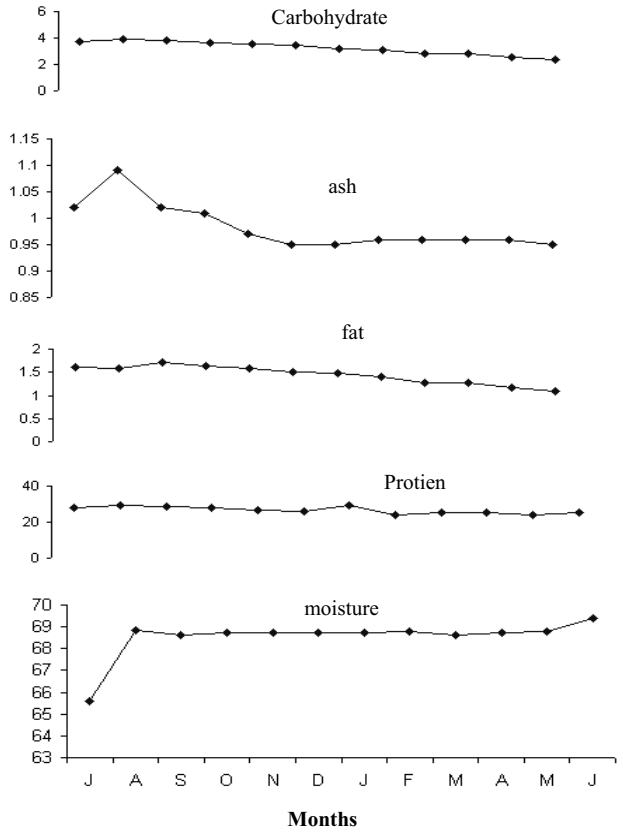

Fig. 1: Seasonal variations in *P. globosa* (male)

Carbohydrate

From Figs. 1 and 2 it was evident that carbohydrate content fluctuated in male from 2.47 to 4.73% with the mean of 2.37 ± 0.50% and in female 3.26 to 4.39% with the mean of 3.27 ± 0.22%. The maximum values were obtained in September and August for females and males respectively. The minimum value was obtained in June in both the sexes.

The correlation co-efficient proved to be positive and highly significant in the parameters like moisture and fat, moisture and carbohydrate, moisture and ash, moisture and protein, protein and ash, protein and carbohydrate, fat and carbohydrate in females and protein and ash, protein and carbohydrate, fat and carbohydrate in males. Negative correlations were observed in moisture and fat, moisture and carbohydrate, moisture and ash, moisture and protein parameters for males. Table I represents regression equations by which fat, carbohydrate, protein and ash contents of snail muscle can be predicted.

Variation in size and sex

The percentage of moisture varied with the variation of size and sexes of *P. globosa.* The moisture content was higher in females than those of the males. The protein content slightly higher in female than the male and lower in small sized *P. globosa.* Fat content was high in large- sized male than the

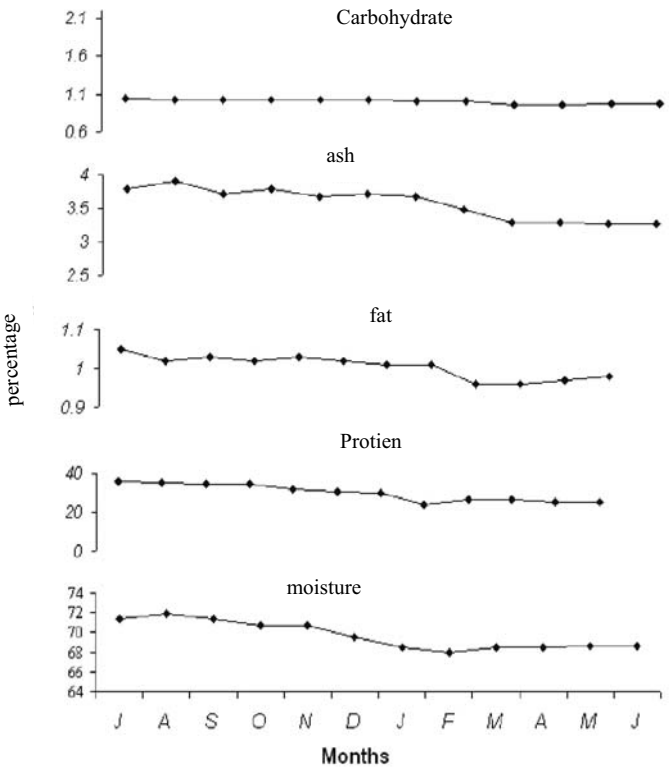

Fig. 2: Seasonal variations in *P. globosa* (female)

females. Carbohydrate was slightly high in female than the male. In case of ash content, no remarkable difference was observed.

The percentage of many constituent of animal increases as it grows larger (Shewan 1951). The present result complies with this view. Such a variation in composition might be due to age and size difference. Decrease in protein and moisture but increase in fat content with the increase of age has been observed. In some cases it was also observed that the same-sized *P. globosa* contained different percentage of protein and fat. This is probably due to the difference of food and feed materials available in snail environment.

Seasonal variations

The seasonal variation found in females was greater than the males. In female the highest value of moisture were obtained in August, i.e. at spawning time. At spawning time, the fillets contained more moisture than any other time of the year. This findings is more or less similar to Annette (1998). At spawning time, the changes were correlated with the reproductive cycle and feeding of the animal (Devi *et al* 1985). In both the sexes, the fat, protein and carbohydrate contents decreased from March to June and gradually increased up to maturity.

Su *et al*. (2004) reported that protein content in Australian abalone as (15%), fat (2.4%) and water 80%. This high protein and low fat content make snail healthy alternative food for people with high protein and low fat diet requirements. Awah (1982) and Bright (1990) found that snail meat contained18-19% crude protein and its calcium content was also high. Snail meat is high quality food that is rich in protein, low in fats and a source of iron (Orisawuyi 1989). Imevbore Ademosun (1988) has assessed the nutritive value of snail meat in relation to some popular conventional animal protein sources and discovered that snail meat had protein content of 88.37 % . Mitra and Mitra (1945) worked on chemical composition of snail and found that moisture 74.1%, protein

Table I: Showing correlation coefficient (r), numbers of observation (N), intercepts (a), regression coefficient (b), standard errors of 'b' (SE) and computed 't' values of different constituents determined separately for male and female of *P. globosa* (Y=bx+a)

Sex	No	r	a	b	S.E	t
		Percent moisture(X)	Fat dry weight (Y)			
Male	5	-0.38	6.87	-0.07	1.73	3.45**
Female	5	0.74	6.61	0.11	0.98	1.22 N.S.
		Percent protein(X)	and percent ash (Y)			
Male	5	0.65	0.25	0.35	1.64	1.12 N.S.
Female	5	0.80	0.004	0.85	2.73	1.15 N.S.
		Percent protein(X)	and percent carbohydrate(Y)			
Male	5	0.49	0.26	0.11	1.87	1.30 C
Female	5	0.89	0.04	2.21	2.04	2.005**
		Percent fat (X)	and percent carbohydrate(Y)			
Male	5	0.89	2.22	0.13	0.09	4.36**
Female	5	0.95	2.09	0.95	0.06	6.95***
		Percent moisture(X)	and percent carbohydrate(Y)			
Male	5	-0.40	18.05	-0.21	0.90	1.69 N.S.
Female	5	0.79	-5.11	0.12	0.90	1.53 N.S.
		Percent moisture(X)	and Percent protein(Y)			
Male	5	-0.13	44.87	-0.26	1.06	3.47**
Female	5	0.94	-172.93	2.91	0.49	9.69***
		Percent moisture(X)	and percent ash (Y)			
Male	5	-0.30	1.27	-0.004	3.09	2.50**
Female	5	0.73	0.03	0.01	1.00	3.51**

*** Significant at 0.01% level.

** Significant at 0.05% level., and N.S. = Non Significant.

10.5%, Fat 0.6%, carbohydrates 12.4% and Ash 2.4%. Devi *et al.* (1985) worked on *Morula granulate* from January to December 1982. He reported that all biochemical constituents showed a progressive increase during May-October and a decrease during November-April.

The changes of the snail mussel were correlated with the reproductive cycle and feeding of the animal. Utilization of lipids was greater during the reproductive season indicating a "Lipid-oriented" metabolism. In *Helix aspersa,* the protein (16%), water (79g), and fat 1 g (Murphy 2001) were observed. The fluctuation of ash content made difficult to show any relationship with the spawning season.

Conclusion

Snail meat is a high protein and low fat content, which is a healthy alternative food for people. Temperature and humidity are prime needs for survival of terrestrial gastropods. The physiological status of the individuals of a molluscan species is dependent on seasonal factors such as, food, physio-chemical factors of water and the space.

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