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SEASONAL VARIATION OF PROXIMATE COMPOSITIONS AND MINERAL CONTENTS (Ca and P) IN EDIBLE PART OF GIANT FRESHWATER PRAWN, *MACROBRACHIUM ROSENBERGII* (de Man, 1 879)

MOHAMMAD ABDUL SALAM*, MD. KAMRUJJZMAN, M.K. ALAM,[1]
MD. KAWSER AHMED[2] AND M.A. SALAM

Department of Zoology, Jahangirnagar University,
Savar, Dhaka-1342, Bangladesh

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Abstract

The present investigations were conceded on the seasonal variations of proximate compositions and mineral contents (Ca and P) in edible-part of *Macrobrachium rosenbergii* which were collected during May 2003 to April 2004 from Dhaka New Market. It was found that the maximum level of moisture content was in autumn (80.37 ± 0.72 g/100 g) while minimum was in winter (76.99 ± 0.33 g/100 g); the protein content was maximum in winter (21.30 ± 0.70 g/100 g), while minimum was in autumn (18.03 ± 0.26 g/100 g); the fat content was maximum in winter (2.99 ± 0.02 g/100 g), while minimum was in autumn (1.07 ± 0.06 g/100 g) and the ash content was maximum in autumn (2.00 ± 0.20 g/100 g) and minimum in winter (1.21 ± 0.04 g/100 g). In mineral content analysis, it was found that the calcium content was maximum in autumn (210.00 ± 10.00 mg/l00 g) while minimum in winter (144.00 ± 12.17 mg/100 g) and the phosphorus content was maximum in summer (102.00 ± 4.00 mg/100 g) while minimum in autumn (83.33 ± 6.11 mg/100 g). All parameters varied seasonally.

Introduction

Freshwater fishes are important source of essential macro- and micronutrients, which is found to be chronically deficient in Bangladesh.(1) About 63% animal proteins come from fish alone.(2) Besides, the major nutrients such as protein, fat, moisture and ash; fish contain many other important minerals like iron, calcium and phosphorus. These minerals are indispensable for the maintenance of growth and reproduction of animals.(3)

The important constituents of the fish muscle in their order of magnitude are moisture, proteins, fats and minerals.(4) Information on the chemical composition of fish in respect to the nutritive value is important to compare with other source of animal protein, foods such as meat and poultry products.(5) Freshwater prawn is one

*Author for correspondence. [1]Food Technology Division, IFRB, AERE, Savar, P.O. Box No. 3787, Dhaka-1000, Bangladesh. [2]Department of Fisheries, University of Dhaka, Dhaka-1000, Bangladesh.

of the most important culturable species of prawns. There are some information on the biochemical and nutritional studies of some freshwater fish species and the proximate composition of *M. rosenbergii.*[6-10] In spite of huge amount of fish protein consumption, there are a few reports on the nutritive values of fishes. However, biochemical composition of fish shows wide variations of nutrients from one species to another, within the same species, in different portions of the body of same fish, from different geographic regions, from season to season, in relation to age, size and growth.[4]

Therefore, proper information on the biochemical composition of *M. rosenbergii* is necessary for the best utilization of this prawn. The present attempt was made to estimate the nutritional status of the raw *M. rosenbergii* by determining their proximate compositions and mineral contents.

Materials and Methods

Sample collection and preparation: The giant river prawn, *Macrobrachium rosenbergii* was collected from Dhaka New Market in three major seasons, i.e., summer, autumn and winter. The specimens were identified[11] in Limnology and Fisheries Biology Research Laboratory of the Department of Zoology, Jahangirnagar University. Collections were made early in the morning then transported to Food Technology Laboratory in polyethylene bag with ice without much ado.

Proximate composition: In the laboratory, all samples were washed in clean cold water then deveined, peeled degutted and then preserved in refrigerator. In each consecutive day these samples were used to proximate composition analysis.

Estimation of moisture: About 3 - 5 g of fairly minced sample was taken in pre-weighed Petri dishes then the samples were placed in oven at 105°C for 5 - 6 hours. After cooling in a desiccator the Petri dishes were weighed again.[12]

$$\text{Moisture (\%)} = (\text{Initial weight} - \text{Final weight})/\text{Initial weight} \times 100.$$

Estimation of protein: About 1 g macerated sample and 2 g digestion mixture were poured with 25 ml of conc. H_2SO_4 in a digestion tube then the mixture digested by continuous heating till the mixture become clear. The digested products were cooled and made 100 ml volume with water. Then 5 ml digested aliquant and 10 ml of 30% NaOH was transferred in Kjeldahl apparatus. The essence was collected in excess of 2% boric acid solution with mixed indicator and was titrated by 0.01 N HCl.

$$\text{Nitrogen (g/100g)} = (\text{Titrate value} \times \text{normality of HCl} \times \text{vol. of dig. mixture})/(\text{Aliquot of digest taken} \times \text{sample weight} \times 1000) \times 100.$$

Protein (g/100g) samples) = Nitrogen content × 6.25.

Determination of fat: About 5 g muscles were taken in a mortar and homogenized. An adequate amount of sands were added and grinded gently in which 10 ml of chloroform-methanol (2 : 1) mixture was added and mixed properly. The aliquant was filtered through a filter paper (11 cm) and was collected into a pre-weighed small beaker. By adding 1 ml 14% $CaCl_2$, the mixture was kept for over night. After drying, the content of beaker was again weighed.[12]

Fat (g/100 g samples) = Weight of extract/weight of samples × 100.

Estimation of ash: About 4 - 5 g of the macerated samples were weighed into a pre-weighed crucible. The crucible with the contents was kept under a low flame till all the material was completely burned. Then burned sample kept in an electric muffle furnace and continuous heating for 5 - 6 hours at 600°C up to white in color.

Ash (g/100 g samples) = (Weight of raw sample – weight of ashes sample)/(Weight of raw sample) × 100.

Mineral contents : The ashes were moistened with 1 m1 of H_2O and 5 ml of HCl. The mixture was then evaporated to dry. Another 5 and 4 ml of HCl was added gradually and the solution was evaporated to dryness then added a few ml of H_2O with solution. The solution was filtered and volume made up to 100 ml, for the estimation of calcium and phosphorus contents.

Estimation of calcium: About 20 - 25 ml of the mineral solution was diluted with 100 - 150 ml dist. H_2O. A few drops of methyl red indicator were added and neutralized with ammonia till the pink color changes to yellow then 10 ml of 6% ammonium oxalate added. Then the solution was heated to boiling point and a few drops of glacial acetic acid added till the color was distinctly pink and the mixture was kept at low temperature for over night for precipitation. About 10 ml of 2N H_2SO_4 was mixed with the precipitate containing beaker after filtration that is titrated against N/100 $KMnO_4$ at 70°C.

Calcium (mg/100 g) = (Titration value × 0.2 × total valume of ash solution)/ (Volume taken for estimation × weight of sample taken for ashes) × 100.

Determination of phosphorus: About 0.1 to 0.2 ml of mineral solution was taken in a test tube and was added with 1 m ammonium-molybdate; 1 ml hydroquinone and 1 ml of Na_2SO_3 solution. The solution was mixed well after each addition. The volume was then made up to 15 ml with water. After 30 minutes, the optical density of the solution was measured by a spectrophotometer. The phosphorus content of the sample was read from a standard curve prepared with standard solution (0.01 - 0.1 mg P).

Phosphorus (mg/100 g) = (mg of P in ash solution × total volume of ash solution)/(Volume taken for estimation × weight of sample taken for ash) × 100.

Statistical analysis: Correlation coefficients between different proximate compositions and mineral contents were done by Pearson correlations using SPSS Program (Version 6.0). Seasonal effects on proximate compositions and mineral contents were analyzed by ANOVA using MS Excel Program (Version - 5.0).

Results and Discussion

Proximate compositions: The study revealed that the body composition of freshwater prawn (*M. rosenbergii*) varied from season to season which has reflected in its seasonal proximate composition (Fig. 1). In edible part, the moisture varied from 76.99 ± 0.33 to 80.37 ± 0.72, the protein varied from 18.03 ± 0.26 to 21.30 ± 0.70, the fat varied from 1.07 ± 0.06 to 2.99 ± 0.02 and ash varied from 1.21 ± 0.04 to 2.00 ± 0.20 g/100g samples. The related approach of proximate composition was observed by 13, 14, 15, 16 and 17. They have also passed comments regarding such variations in proximate composition of fish flesh might vary with the age, class and on the feeding habit of fish.

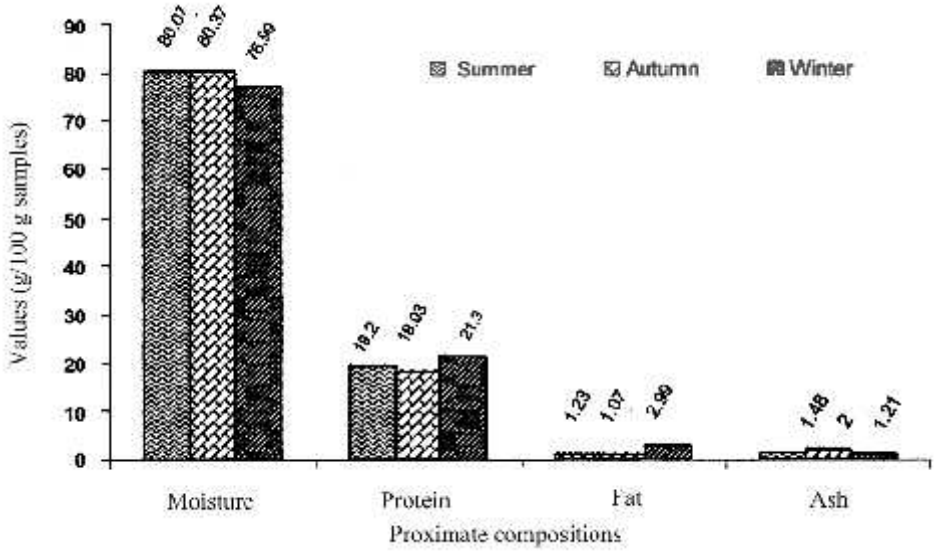

Fig. 1. Seasonal variation of proximate compositions in edible parts of *M. rosenbergii.*

In freshwater prawn, moisture was negatively correlated with protein (– 0.029), fat (0.234) and ash (– 0.175); protein was positively correlated with fat (0.667) and negatively correlated with ash (– 0.608); while ash was positively correlated with fat (0.074). The negative correlation between amount of fat and moisture in fish were

found in *Barbus puntius*[18] and in pink salmon.[13] However, the positive correlation was found between protein and moisture in *Clupisoma atherinoides*.[17]

Moisture : The moisture content varies throughout the year in different body parts. Average moisture content was 79.14 ± 1.87 g/100 g in edible part that agreed with the findings in shrimps,[19] in *M. rosenbergii.*[9,10] In edible part, the highest value of moisture was found in autumn (80.37 ± 0.72 g/100g), whereas the lowest value was in winter (76.99 ± 0.33 g/100 g). This result coincides well with the findings in *Macrognathus aculeatus*,[20] in *M. rosenbergii*,[21] in *Puntius gonionotus*,[22] in *Hetero-pneustes fossilis*[16] and in *C. atherinoides*.[17]

Protein : The protein content of freshwater prawn varies seasonally among the different body parts. Average protein content was 19.51 ± 1.66 g/100 g in edible part. In shrimp, the average protein content was 17.35 g/100 g,[19] 18.40 ± 0.25 g/100g in prawn[9] and 18.46 g/100g edible part in *M. rosenbergii*.[10] The highest value of protein was found in winter (21.30 ± 0.70 g/100g), whereas the lowest value was in autumn (18.03 ± 0.26 g/100 g). Similar result also found by[20,23] in *M. aculeatus*, in *M. rosenbergii*,[21] in *P. gonionotus*,[22] in *H. fossilis*[16] and in *C. atherinoides*.[17]

Fat : Fat content of the feshwater prawns varied in different body parts. Average fat content was 1.76 ± 1.07 g/100 g in edible part that was similar with the findings in shrimp[19] and that was 1.68 g/100 g and in prawn was 1.37 ± 0.07 g/100 g(9) and 1.8 g/100 g in *M. rosenbergii*.[10] The highest value of fat was found in winter (2.99 ± 0.02 g/100 g), whereas the lowest value was in autunm (1.07 ± 0.06 g/100 g). Similar pattern of fluctuation in fat content also observed in *Cyprinus carpio*,[24] *Gasterosteus aculeatus*,[25] *M. aculeatus*,[20] *M. rosenbergii*,[21] *P. gonionotus*,[22] *H. fossilis*[16] and in *C. athermoides*.[17]

Ash : Ash content fluctuated throughout the year. Average ash content was 1.56 ± 0.04 g/100 g in edible part that was similar to the judgment in Prawn.[26] The ash content was 2.60 g/100 g in shrimp,[19] 1.02 ± 0.01 g/100g in prawn[9] and 1.15% ash in *M. rosenbergii*.[10] The highest value of ash was found in autunm (2.00 ± 0.20 g/100 g), whereas the lowest value was in winter (1.21 ± 0.04 g/100 g). Similar results were observed in *H. fossilis*[16] and in *C. atherinoides*.[17] This result deviated from the finding in *P. gonionotus*,[22] they found maximum ash content in November and lowest in June. The ash content in *M. rosenbergii* at autumn was highest which was similar with present findings.

Mineral contents : In this study, it was observed that the Ca and P contents of freshwater prawn, *M. rosenbergii* varied seasonally (Fig. 2). The calcium content varied from 144.00 ± 12.17 to 210.00 ± 10.00 g/100 g samples and the phosphorus content varied from 83.33 ± 6.11 to 102.00 ± 4.00 g/100 g samples of edible part. The

related approach of mineral contents was observed in freshwater prawn (*M. rosenbergii*)[21] and in *C. atherinoides*.[17]

In giant river prawn, calcium (0.087) was positively correlated with phosphorus (0.154) that means with the increase of calcium phosphorus also increases and vice-versa. The positive correlation was found between protein and moisture in *C. atherinoides.*[17] The calcium and phosphorus content did not show any significant seasonal variation and remain close to constant in Mackerel fish.[27]

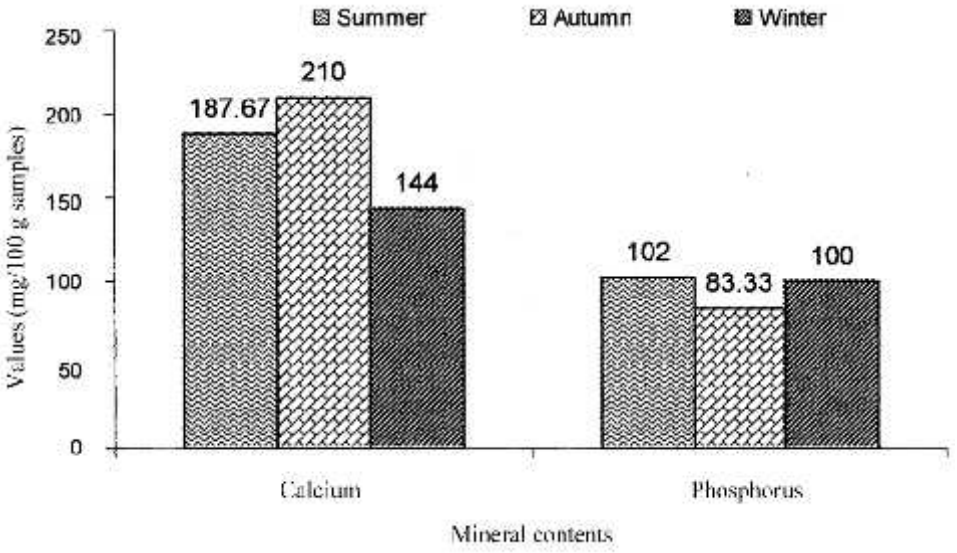

Fig. 2. Seasonal variation of mineral contents in edible parts of *M. rosenbergii.*

Calcium : Calcium content fluctuated seasonally as well as relation to different body parts. The average calcium content was 180.56 ± 33.37 mg/100g in edible part. The calcium content was 114.65 mg/l00 g in shrimp[19] which was lower than the present findings; i.e., 0.43 g/100 g in prawn[28] and 323 mg/100g in prawn[26] which was higher than the present findings. The highest and lowest values of calcium were in autumn (210.00 ± 10.00 mg/100 g) and winter (144.00 ± 12.17 mg/100 g), respectively. The finding in *C. atherinoides*[17] was rather akin with present finding. The maximum and minimum calcium were in summer and autumn in *Anabas testudineus*[29] which was nullify the present findings.

Phosphorus : The phosphorus content also varied seasonally as well as relation to body parts. The average phosphorus content was 99.11 ± 10.25 mg/100 g in edible part. The phosphorus content was 50.25 ± 0.1 in *M. rosenbergii*[9] which was plunge from present findings. The phosphorus content found 0.31 g/100 g in prawn[28] and 278 mg/100g in Prawn[26] which were higher than the present findings. The

maximum value of phosphorus was found in summer (102.00 ± 4.00 mg/100 g), whereas the minimum value was in autumn (83.33 ± 6.11 mg/100 g). The upper and lower limits of phosphorus in *A. testudineus* were in summer and autumn, respectively[29] which validates present findings.

Bangladesh shrimp having original texture and taste has already been recognized in world market. From the proximate composition and mineral contents scrutiny, it is reputed that *M. rosenbergii* is highly nutritious. This information initiates the consumers for best utilization of the species of prawn to meet nutritional need.

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