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BIOCHEMICAL COMPOSITION OF SOME SEAWEEDS FROM ST. MARTIN'S ISLAND, BANGLADESH

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Abstract: Biochemical composition of three seaweed species, namely, *Asparagopsis taxiformis* (red seaweed), *Hydroclathrus clathratus* (brown seaweed) and *Colpomenia sinuosa* (brown seaweed) from the St. Martin's Island, Bay of Bengal, Bangladesh was studied in order to evaluate their nutritional value during November, 1995 to April, 1996. The mean value of protein, fat and carbohydrate content was found as 10.63±4.36, 0.02±0.01 and 23.92±4.26% in *A. taxiformis*, 4.07±0.91, 1.76±0.50 and 18.56±1.36% in *H. clathratus* and 3.30±0.87, 0.93±0.59 and 22.88±1.12% in *C. sinuosa* respectively. Considering the results of the present study it can be concluded that all the collected seaweeds from St. Martin's island have food value for human consumption.

Keywords: Organic constituents; Seaweed; Food value; Nutrition; St. Martin's island, Bay of Bengal

Introduction

Increasing population is a vital cause for the scarcity of food. Even agricultural production is unable to minimize this problem. However, proper utilization of natural sources can be considered an alternative way to overcome the situation. Seaweed produced in the Bay of Bengal can play an important role in increasing food supply.

Seaweed are used as a kind of human and animal food, fertilizer, source of minerals and agars. Agar may be used as stabilizer, emulsifiers, thickeners, body care products, gelling agents and widely used as microbial culture medium and also therapeutic agents. But seaweed have been used as food for a very long time (Annon, 1992). Nowadays, utilization of seaweed as human food has been increasing in many countries such as China, Japan, Philippines etc. (Trono, 1988). Bangladesh is also rich in both fresh and marine water algae. Islam (1976) reported that there are 76 genera with 157 species of algae available in Bangladesh. However, the mass people of Bangladesh are not aware of the use of seaweed as human food. To understand the importance of seaweed as food sources knowledge on biochemical composition and its nutritive value are essential. Hence, present study was undertaken to investigate into the biochemical composition of some locally available seaweed, namely *Asparagopsis taxiformis* (red seaweed), *Hydroclathrus clathratus* (brown seaweed) and *Colpomenia sinuosa* (brown seaweed).

Materials and Methods

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Collection of sample: The investigation was carried out for six months between November 1995 and April, 1996 at two stations from the St. Martin's Island, Bay of Bengal, Bangladesh. One station was selected in the southern part of the western coast named *Dakshin para* and the other at the northern part of the Western coast named Jingira. The samples were collected monthly. Seaweed were collected in polyethene bags during extreme low tide. Collected samples were then taken in icebox and bought immediately to the Bangladesh Center of Scientific and Industrial Research (BCSIR) laboratory, Chittagong for analysis.

Preparation of sample: To prepare the sample for the determination of proximate composition, the frozen algae were kept under tap water until they attained ambient temperature (28 ^{0}C). The samples were then washed thoroughly and kept in a slanting position to remove water. The samples were cut into small pieces and then macerated separately for investigation. Four replicates were prepared for each species in each sampling.

Analytical Methods: Protein and fat were estimated as outlined in Standard Methods of APHA, (1992). Moisture and Ash content was determined by gravimetric method with the help of Controlled oven and Muffle furnace. Carbohydrate was calculated by subtracting the sum value of protein, fat, moisture and ash percentages from hundred.

Results and Discussion

Protein: The maximum and the minimum amount of protein in *Asparagopsis taxiformis* were recorded as 10.92 and 9.8% respectively where the mean percentage was 10.56 ± 0.18 (Table 1). Silas *et al.* (1987) recorded 16.19% protein in *Asparagopsis taxiformis, which* is higher than the value observed in the present study. In case of *Hydroclahrus clathratus* and *Colpomenia sinuosa*, the percentage of protein ranged 3.02 to 5.1 and 2.9 to 4.8 respectively. The mean percentage of protein in *Hydroclahrus clathratus* and *Colpomenia sinuosa* was 4.24±0.322 and 3.78±0.291 respectively (Table 1).

Table 1. Protein content (%) in different seaweed.

Species	November	December	January	February	March	April	Mean ± SE
A. taxiformis	10.92	10.87	10.8	10.76	10.2	9.8	10.56 ± 0.18
H. clathratus	5.1	5.06	4.38	4	3.88	3.02	4.24 ± 0.322
C. sinuosa	4.8	4.18	3.54	4.12	3.15	2.9	3.78 ± 0.291

Silas *et al*. (1987) estimated 6.62% protein in *Colpomenia sinuosa* which was higher than the mean protein value of *Hydroclahrus clathratus* and *Colpomenia sinuosa* of the present investigation. The highest percentage of protein in *Hydroclahrus clathratus* (5.1%) and *Colpomenia sinuosa* (4.8%) observed in the present study shows similarity with the result (6.62%) of Silas *et al*. (1987) by a little difference. Bird and Benson (1987) observed protein value as 3.0 to 8.2% in *S. peteropleuron* which supports the present studied protein value of *Hydroclahrus clathratus* (4.24±0.322%) and *Colpomenia sinuosa* (3.78±0.291%).

Fat: The amount of fat in *Asparagopsis taxiformis*, *Hydroclahrus clathratus* and *Colpomenia sinuosa* ranged 0.013 - 0.027%, 1.4 – 1.9% and 0.76 - 1.35% respectively where the mean value was 0.02 ± 0.002, 1.67 ± 0.073 and 1.1 ± 0.12% respectively (Table 2). Tressler (1923) found 0.05% fat in *Gracilaria coronopifolia* and Hansen *et al*. (1981) found 0.2 to 0.8% in *Porphyra* species. The percentage of fat observed in *Asparagopsis taxiformis* in the present study agrees with

the results of Tressler (1923), and the results of Hansen (1981) shows similarity with the results found in *Colpomenia sinuosa.*

Table 2. Fat content (%) in different seaweed.

Species name	November	December	January	February	March	April	Mean ± SE
A. taxiformis	0.013	0.016	0.018	0.023	0.024	0.027	0.02±0.002
H. clathratus	1.4	1.55	1.64	1.74	1.79	1.9	1.67 ± 0.073
C. sinuosa	0.76	1.2	0.88	0.92	1.35	1.5	1.10 ± 0.12

Bird and Benson (1987) recorded 0.6 to 2.7% fat in *Sargassum pteropleuron* and 1.0 to 3.3% in *Sargassum filipendula*. The results (1.4 to 1.9%) of *Hydroclathratus clathratus* in the present investigation more or less agree with the results of Bird and Benson (1987). On the other hand, the results of *A. taxiformis* and *C. sinuosa* found in the present study were lower than the results estimated by the authors. This difference might be due to difference in species.

Moisture: The percentage of moisture in *Asparagopsis taxiformis, Hydroclathrus clathratus* and *Colpomenia sinuosa* was recorded as 59.4 to 63.15, 69.5 to 70.81 and 67.5 to 69.9 respectively where the mean percentage were 61.64 ± 0.571, 70.40 ± 0.196 and 68.44 ± 0.363 respectively (Table 3). Luning (1990) stated that the fresh weight of seaweed contains 75-90% moisture. The present investigation showed lower amount of moisture than the findings of Luning (1990). This difference in results might be due to the difference in species.

Table 3. Moisture content (%) in different seaweed.

Species name	November	December	January	February	March	April	Mean ± SE
A. taxiformis	63.15	62.84	62.23	61.35	60.85	59.4	61.64 ± 0.571
H. clathratus	70.81	70.79	70.55	70.39	70.35	69.5	70.40 ± 0.196
C. sinuosa	69.9	68.7	68.66	68.31	67.54	67.5	68.44 ± 0.363

Ash: The percentage of ash in *A. taxiformis* ranged 3.77 to 4.55 where the mean was 4.1±0.132 (Table 4). The highest percentage of ash found in *A. taxiformis* coincides with the results (6-9% in *Eucheuma isiforme*) estimated by Dawes *et al.* (1977). But the values (7-11% in *Eucheuma nudum*) of ash estimated by Dawes *et al*. (1974) seen to be a bit higher than the results of present investigation.

Table 4. Ash content (%) in different seaweed.

Species name	November	December	January	February	March	April	Mean ± SE
A. taxiformis	3.77	3.8	3.9	4.23	4.35	4.55	4.1 ± 0.132
H. clathratus	4.81	4.885	4.94	5.3	5.6	5.8	5.22 ± 0.168
C. sinuosa	3.61	3.91	3.84	4.13	4.45	4.51	4.08 ± 0.145

In the present study, the percentage of ash in *Hydroclathrus clatratus* and *Colpomenia sinuosa* ranged 4.81 to 5.8 and 3.61 to 4.51 respectively where the mean value was 5.22±0.168 and 4.08±0.145 respectively (Table 4). Bird and Benson (1987) estimated ash contents ranged from 25.8 to 28.0% in Sarga*ssum filipendula* and 26.0 to 35.5% in *Sargassum plerophleuron*. The values of ash observed in *H. clathratus* and *C. sinuosa* in the present investigation were much lower than the values estimated by Bird and Benson (1987). The causes of this variation may be due to the difference in species and also due to differences in habitats.

Carbohydrate: The percentage of carbohydrate in *Asparagopsis taxiformis* ranged 22.147 to 26.223 where the mean was 23.68 ± 0.618 (Table 5). The results of the present investigation agree with the results (12-34% carbohydrate in *Eucheuma nudum*) recorded by Dawes *et al*. (1974). But the value (24-54% in *Eucheuma isiforme*) estimated by Dawes *et al*. (1977) was much higher than that of present values. The percentage of carbohydrate in *Hydroclathrus clatratus* and *Colpomenia sinuosa* ranged 17.715 to 19.78 and 20.93 to 23.59 respectively where the mean percentage were 18.47 ± 0.297 and 22.61 ± 0.416 respectively (Table 5).

Table 5. Carbohydrate content (%) in different seaweed.

Species name	November	December	January	February	March	April	Mean ± SE
A. taxiformis	22.147	22.474	23.052	23.637	24.576	26.223	23.68 ± 0.618
H. clathratus	17.88	17.715	18.49	18.57	18.38	19.78	18.47 ± 0.297
C. sinuosa	20.93	22.01	23.08	22.52	23.51	23.59	22.61 ± 0.416

Bird and Benson (1987) reported that carbohydrate level ranged 10.0 to 23.0% and 14.0 to 23.0% in *Sargassum filipendula* and *Sargassum pteropleuron* respectively where the mean level in those species was 18.30 and 19.90% respectively. The results of the present work coincide with the results estimated by Bird and Benson (1987).

In the present study, protein and carbohydrate values in the seaweed, *A. taxiformis* were observed higher than the values of brown seaweed, *H. clathratus* and *C. sinuosa*. Similar observation was also denoted by Dhargalkar *et al*. (1980) and at the same time he viewed the higher contents of protein and carbohydrate in the green and red algae in relation to brown algae.

Conclusion

From the above discussion, it is clear that the seaweed which were studied in the present investigation, are suitable for human consumption. All the analyzed seaweed showed considerable amount of protein and carbohydrate, which are the preliminary measuring factor of edible species in a sense. Trono (1988) advocated that *A. taxiformis*, *H. clathratus* and *C. sinuosa* are being used as human food in different countries of the world. It is also apprehended that the digestion of the above seaweed by human being is no longer critical. But due to lack of proper knowledge the Bangladeshis are not accustomed to take these available seaweed as human food. The results of the present study will be valuable to encourage people to use seaweed as human food.

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