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PROXIMATE COMPOSITION OF THREE COMMERCIALLY IMPORTANT SPECIES OF A GENUS *GRACILARIA* FROM RAMESHWARAM COASTAL REGIONS, TAMIL NADU, INDIA

A. Nagaraj[1], Dr. K. Parvathi[1], M. Logeshwari[1], M. Atchaya[1], S. Ashwathaman[2], Dr. G. Subramanian[1]*

[1]Post Graduate and Research Department of Botany, Arignar Anna Government Arts College, Namakkal – 637 002, Tamil Nadu, India.

[2]Department of Biotechnology [B.Tech.], Selvam College of Technology, Salem Road (NH - 7), Pappinaickenpatti (Post), Namakkal – 637 003, Tamil Nadu, India.

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***Corresponding Author**
Dr. G. Subramanian
Post Graduate and Research Department of Botany, Arignar Anna Government Arts College, Namakkal – 637 002, Tamil Nadu, India.

ABSTRACT

The present study investigates the preliminary information of the proximate composition of three red algal seaweeds collected from Rameshwaram coastal regions, Tamil Nadu, India. The proximate composition (moisture, protein, total soluble carbohydrates, lipids, fiber and ash) of the marine red algal samples; *Gracilaria corticata, Gracilaria edulis,* and *Gracilaria salicornia* were analyzed. It was observed that the moisture content was high, ranging from 86.20% to 93.55%. High moisture content was found in *G. corticata* and minimum in *G. salicornia*. Carbohydrate content of seaweeds ranged from 25.95% to 37.55%. The maximum carbohydrate was recorded in *G. edulis* and minimum of carbohydrate was *G. salicornia* recorded. Quantitative analysis of protein content ranged from 7.88% to 14.25%. High protein was found in *G. edulis* and low in *G. salicornia*. The lipid content varied from 1.99% to 3.45%, high in *G. salicornia* and lower in *G.corticata.* Ash content was observed to range from 28.87% to 55.45%. The maximum ash content was recorded in *G. corticata* and *G. salicornia* recorded the minimum content. The fiber content ranged from 5.67% to 21.56%; high in red alga *G. salicornia* and lower in *G. corticata.* The moisture and ash contents were recorded higher in *G. corticata* than *G. edulis and G. salicornia*. The results of the present work indicates that, the seaweeds from Ramehwaram coastal regions an alternative nutritional source. Various environmental factors, as well as climatic changes, affect the seaweed

composition; especially minerals present in Rameshwaram coastal regions are the major parameters for the ash content.

KEYWORDS: Proximate composition, Seaweeds, *Gracilaria*, *G. edulis*, *G. corticata*, and *G. salicornia*, Rameshwaram.

INTRODUCTION

Seaweeds are generally attached to the rock or hard substrata in the coastal areas. Luning[1] reported that there are more than 8,500 species of seaweeds along the world's coast and they may be extending up to 275m deep in the sea. Protein-rich seaweeds are being used as human food in many countries all over the world. Hence, studies on the proximate composition of seaweeds are essential to measuring their nutritive level and value.[2]

Seaweeds are cultivated and harvested for the bio-products of agar, alginate, and carrageenan. They are collectively called as hydrocolloids or phycocolloids. Edward[3] stated that the seaweed hydrocolloids are considered as commercial significance, because; they are being used for the production of food and food additives. Algae are highly valuable or important sources for medicine and bio-fertilizer. They have been used as bio-fertilizer in agriculture.[4,5] Japan, China, Korea, and other coastal populations are using seaweeds as their cultural diets or food products. Fleurence[6] and Nisizawa[7] reported that Japan has a maximum consumption of seaweeds in the world. Seaweed salads, soups, and vegetables are the main consumption products of Japanese. *Laminaria japonica, Undaria Pinnatifida* and *Porphyra* sp (Nori seaweed) are the most popular seaweeds are highly rich in the vitamin B complex, vitamins B6, vitamin B12, vitamin C and Vitamin-A precursors (β-carotene).[8-10]

Though Rameshwaram coastal regions have diversified with different seaweeds, little information is available about the nutritional value of the seaweeds in southeast coast of Tamil Nadu, India. Hence, this research paper is an attempt to state the nutritional importance of the *Gracilaria* species.

MATERIALS AND METHODS

Collection of sample

A survey was made and three species of a genus *Gracilaria* were identified and collected during the low tide from Rameshwaram coastal regions. The selected samples are *Gracillaria corticata*, *Gracilaria salicornia*, and *Gracilaria edulis*. The algal samples were kept in

polyethylene bags with seawater, tied and transported to the laboratory in Arignar Anna Government Arts College, Namakkal, Tamil Nadu, India. The classification of the selected algae and their taxonomic identifications were done with the help of CMFRI Manual, Mandapam, Tamil Nadu, India. The algae were thoroughly washed with fresh water to remove epiphytes and dirt particles, followed by oven drying at 70°C to obtain a constant weight and pulverized in a 2mm size blender. The samples were kept in an airtight plastic container and stored at room temperature until further analysis.

Methods

The major biochemical constituents namely total protein, total soluble carbohydrates, lipids, and fibers can be identified by following the various standard methods. Moisture content[11], total protein content[12], the lipid content[13], the crude fiber[11], the soluble carbohydrate[12] and the ash content of seaweeds.[12] The results were estimated and measured by using simple excel work sheets.

RESULTS AND DISCUSSION

Moisture content

Moisture contents of marine algae were considered to be high as they live in the water ecosystem, they consist high range of moisture level. The quantitative measurement of moisture content ranged from 86.20% to 93.55%. Higher water content was found in *G. corticata* (93.55%) followed by *G. edulis* (89.76%) and lower in *G. salicornia* (86.66%) (Figures- 1-3).

Carbohydrate content

Carbohydrate content of seaweeds ranged from 25.95% to 37.55%. Higher content of carbohydrate was found in *G. edulis* (37.55%), followed by *G.salicornia* (31.25%) and lower in *G. corticata* (25.95%) (Figures- 1-3). Manivannan *et al.,*[14] have reported the 24.15% of carbohydrates in *Enteromorpha clathrata* had 24.15% carbohydrates, *Ulva lactuca* (35.27%) and *E. intestinalis* (30.58%)[15] had contrast results to this present red algal seaweeds. In the present study, the Rhodophycean *Gracilaria* species showed high carbohydrate content than Chlorophycean species. The external factors and reason may be that, the *Gracilaria* species to synthesize the maximum of carbohydrates by photosynthesis. These results showed the similarities with the Maharashtra coastal Rhodophycean members recorded higher value of carbohydrate content than in Phaeophycean and Chlorophycean members[16], The maximum content of carbohydrate in the red seaweed might be also due to higher phycocolloids content

in their cell walls and green seaweeds might convert the soluble carbohydrates in to insoluble carbohydrates like fiber and other polysaccharides to store in the cells (Figures- 1-3).

Protein content

Quantitative analysis of protein content ranged from 7.88% to 14.25%. Higher protein content was found in the seaweed *G. edulis* (14.25%) followed by *G. corticata* (11.99%) and lower in G. *salicornia* (7.88%) (Figures- 1-3). The protein content of *G. edulis* is similar to reports of Manivannan *et al*,[14] The protein percentage of seaweeds was low, 7% to 14% of dry weight.[17] Protein content was varied among the seaweeds and also in different species of the same genus.[16] This change might be of spatial or temporal. However, this was largely attributed to the surrounding environment factors and water quality.[18] The variations in the protein contents in macroalgal seaweeds could be according to locality, environment, and depth of water level.[18] In the present study, showed that similar to the earlier works in several marine algae estimated by Chidambaram and Unny[19], Pillai[20], and Sitakara Rao and Tipnis.[21,22]

Lipid content

The lipid content of the *Gracilaria* species was commonly low, in this study the range differ from 1.99% to 3.45% The maximum content of lipid was recorded in *G. salicornia* (3.45%), followed by the seaweed *G. edulis* (2.47%) and minimum content in *G. corticata* (1.99%) (Figures- 1-3). In contrast to these results Manivannan *et al*.,[14] reported that the high lipid content in *G. edulis* (4.6%) followed by *Gracilaria folifera* (3.23%), then brown seaweeds *Codium tomentosum* (2.53%), *Colpomenia sinuosa* (2.33%) and S*argassum wightii* (2.33%). The minimum lipid concentration was recorded from *Enteromorpha intestinalis* (1.33%) followed by *Padina gymnospora* (1.40%), *Sargassum tenerrium* (1.46%) and *Uvla lactuca* (1.60%).[14]

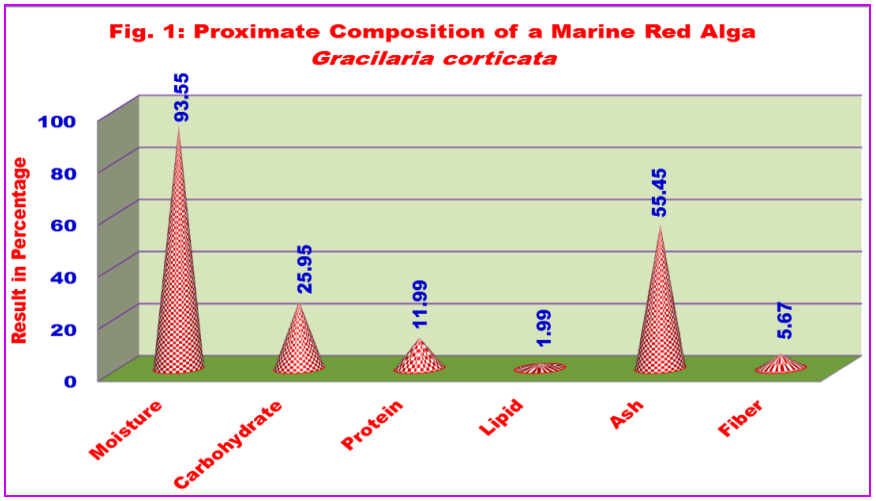
Ash content

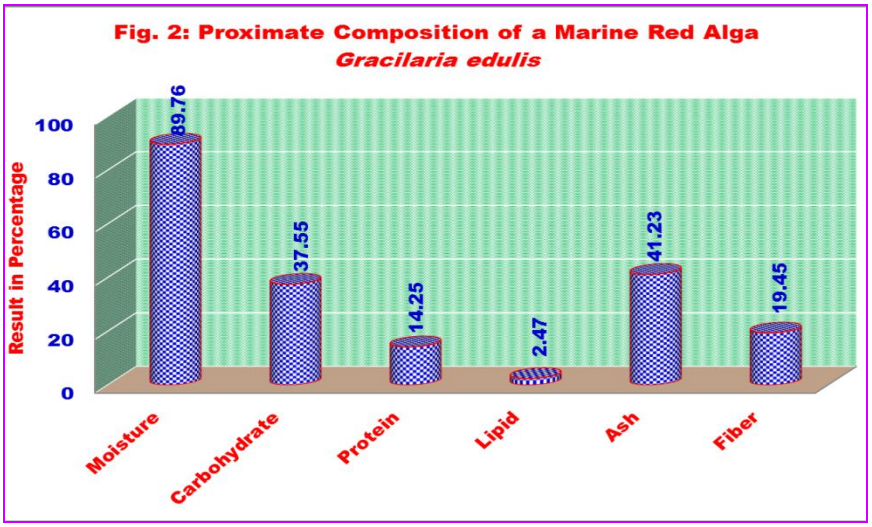
In this study, the ash content range started from 26.86% to 51.16%. The maximum content of ash was quantified in *G. corticata (*55.45%) followed by *G. edulis* (41.23%) and minimum content in *G. salicornia (*28.87%) (Figures- 1-3). Similarly, 49% in *Gracilaria crossa* was quantified by Rajeswary and Sivasurbramaniam.[23] Some other seaweed such as *Hypnea musciformis* 31%, *Enteromorpha intestinalis* 25.6% and *Sargassum filipendula* 21.5% were observed Robert[24], Nisizawa[7] and Sanderson and Di benedetto[25] stated that marine seaweeds naturally absorb minerals in their ionic form from seawater, while they shall

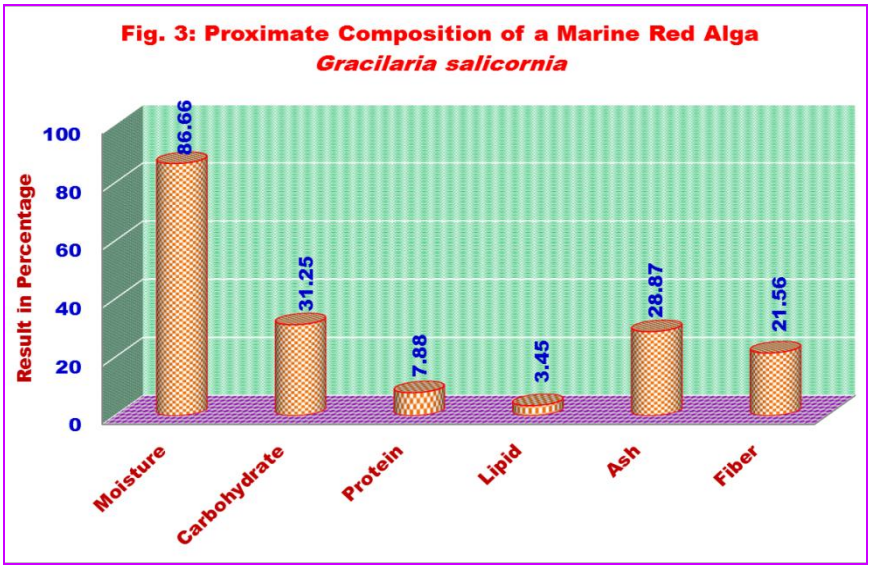
depend upon various factors such as concentration in the waters, growth stage of the algae and competition between the ions for uptake by the algae. The seaweeds from southeast coast of Tamil Nadu has observed and recorded comparatively high amount of minerals. The reason might be due to the variation of salinity concentration of sea, and in addition to the results in the accumulation of the number of minerals.

Fiber content

In this study, about 21.56% to 5.67% of crude fiber was quantified. The maximum fiber content was in *G. salicornia (*21.56%) followed by *G. edulis* (19.45%) and minimum content was observed in *G.corticata* (5.67%) (Figures- 1-3). These results showed less quantity as compared with the previous works of literature. At the same time, there was a similarity with Phaeophycean which has a high amount of fiber, followed by Chlorophycean. The differentiation of biochemical composition among the different seaweeds was due to the season variation and their mass of growth and their production.[26-28]







CONCLUSION

The marine algal seaweeds are really a potentially healthy food supplement for human health diets and they have high nutritionally value ingredient sources which are being used in the food industry and are being made a range of seaweed-based commercial bio-products. The seaweeds biochemical composition may change with varying environmental conditions and their fluctuations such as physical, chemical, climatological factors, and their species composition. Therefore, the effects of understanding may be depending on the different environmental factors. The seaweeds taken for this study have a high amount of ash due to the salinity of the sea.

The *Gracilaria* species has shown the high amount of fiber content due to the environmental conditions with an increase in the possibilities for photosynthesis. The differentiation in the biochemical composition of these selected seaweeds compared with other countries might be due to the environmental conditions. Moreover, the chemical composition and its contents showed that seaweeds in Rameshwaram coastal regions are nutritionally valuable and beneficial for human welfare and the balancing of ecological cycles.

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