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BIOCHEMICAL INVESTIGATION OF MARINE SEAWEEDS *COLPOMENIA SINUOSA* AND *HALYMENIA PORYPHYROIDES* COLLECTED ALONG THE SOUTH EAST COAST OF TAMILNADU, INDIA

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ABSTRACT
In the current study the biochemical evaluation of the seaweeds were conducted which were collected along the south east coast of India. The marine brown macro alga *Colpomenia sinuosa* (Mertens ex Roth) Derbes and Solier as well as the marine red alga *Halymenia poryphyroides* Boergesen were used in this study. The relationship between the nutritive components and the variation of the biochemical composition like organic and inorganic constituents were mainly analyzed in the current study. The present analysis revealed that both the seaweeds were rich in protein content whereas more carbohydrate content was observed in marine red alga *Halymenia porphyroides* compared to the marine brown alga *Colpomenia sinuosa*. Similarly the analysis of inorganic biochemical constituents revealed that calcium, magnesium, iron and phosphorus were present in higher amount in marine brown alga *Colpomenia sinuosa* whereas sodium and potassium contents were observed in higher amount in marine red alga *Halymenia porphyroides*. The presence of high organic and inorganic biochemical constituents in these seaweeds may be of economic importance and ass potential health food for human diets.

KEYWORDS: Biochemical composition, *Colpomenia Sinuosa*, *Halymenia porphyroides.*

INTRODUCTION
Seaweeds are the raw material for many industrial products like agar, alginates and carrageenan; also, they continue to be widely consumed as food and medicine in Asian countries.[1,2,3] Most edible seaweeds are known to contain significant quantities of protein, lipids, minerals, vitamins[4,5,6,7], and nutrient contents.[8,9] Seaweeds are also considered as a source of bioactive compounds and antioxidants as they are able to produce a great variety of secondary metabolites characterized by a broad spectrum of biological activities.[10,11] The chemical composition of seaweeds varies with species, habitats, maturity and environmental conditions.[12] The chemical composition of seaweeds has been poorly investigated when compared to land plants and most of the chemical composition information was available only with Japanese seaweeds.[13,14] Some algae, especially red and brown algae, are harvested and eaten as a vegetable and in some cases the mucilage are extracted from the thallus for use as gelling and thickening agents.[15,16] At least 221 macro algae species are utilized commercially, of which 145 species are used as human food.[17] Macro algae are not only a useful food source for humans, they are also being used in animal nutrition since the amino acid and carbohydrates present in seaweeds are considered as important groups of cell constituents.[18] In addition seaweeds and their constituents are used medicine and pharmacology for their various properties like antimicrobial, antiviral, antitumor and anticoagulants.[19] In the current study the biochemical composition of two seaweeds namely *Colpomenia sinuosa* (Mertens ex Roth) Derbes and Solier and *Halymenia poryphyroides* Boergesen collected from south east coat of India were studied by analyzing their organic and inorganic constituents.

MATERIALS AND METHODS
Collection and preparation of seaweeds
The marine brown alga *Colpomenia sinuosa* (Mertens ex Roth) Derbes and Solier was collected from the intertidal regions of Leepuram, Kanyakumari District, the South East Coast of Tamilnadu, India and the marine red alga *Halymenia porphyroides* Bøergesen was collected on summer season in the from 2.5 metre rapid intertidal regions of the Gulf of Mannar–Mandapam, Ramanathapuram District, South East Coast of Tamilnadu, South India. Collected seaweed was washed with sea water for eliminating impurities such as sand, rocks, epiphytes and epifauna. The washed samples were transported to the laboratory in a box containing slush

ice. In the laboratory, the samples were washed thoroughly in running tap water to remove salt and were shade dried for 48 hours, pulverized to a fine powder and packed in airtight container and were stored at room temperature.

Estimation of organic and inorganic biochemical constituents

Total carbohydrate content was estimated following anthrone method.[20] Total soluble proteins were estimated from the fresh thalli of seaweeds according to the Lowry method.[21] The total lipid content was determined from air dried algal sample.[22] The mineral content were subjected to acid digestion and analyzed through atomic absorption spectrophotometry following the procedures described by AOAC.[23]

RESULTS AND DISCUSSION

The carbohydrates, proteins and lipids form the basis and building blocks of algal biomass of which carbohydrates is the important constituent in the metabolism supplying the energy needed for respiration and other important processes.[24] The values of organic and inorganic biochemical composition of marine brown alga *Colpomenia sinuosa* and marine red alga *Halymenia porphyroides* are presented and the significant variation in the metabolite content are illustrated in Tables 1 and 2.

The protein content of *Colpomenia sinuosa* was found to be 433.5 ± 0.08 mg/g dry wt. and in *Halymenia porphyroides* it was 503.46 ± 0.12 mg/g dry wt. (Table.1; Fig.1). The rich protein content may be attributed in the activities like enzymatic catalysis, transport and storage, growth and cellular differentiation control.[25] The protein content of seaweeds considerably varied between the specie a well as the seasons.[26] The level of total carbohydrate content in Colpomenia sinuosa was 93.5 ± 0.11 mg/g dry wt. and in *Halymenia porphyroides* it was observed at 133.5 ± 0.11 mg/g dry wt. (Table.1; Fig.1). The decrease in the carbohydrate content in *Colpomenia sinuosa* may be due to the variation in the growth of the thallus.[27] The lipid content of *Colpomenia sinuosa* was 13.4 ± 0.12 mg/g dry wt and in *Halymenia porphyroides* it was 13.5 ± 0.17 mg/g dry wt. (Table.1; Fig.1). Lipids were present in lesser amount as compared to carbohydrates and proteins.

The inorganic biochemical constituents of both seaweeds were illustrated in Table 2 and Figure 2. Shade dried powdered extract of the experimental algae *Colpomenia sinuosa* and *Halymenia porphyroides* were estimated for their mineral content. *Colpomenia sinuosa* contained higher amount of calcium (156.56 ± 0.12 µg/g), phosphorus (103.7 ± 0.11 µg/g), magnesium (47.7 ± 0.34 µg/g) and potassium (0.35 ± 0.01 µg/g) than in *Halymenia porphyroides* [calcium (145.73 ± 0.08 µg/g), phosphorus (98.52 ± 0.08 µg/g), magnesium (34.8 ± 0.11 µg/g) and potassium (20.35 ± 0.01 µg/g)]. Sodium content in *Halymenia porphyroides* (145.67 ± 0.08 µg/g) was noteworthy as compared to that of *Colpomenia sinuosa* (27.7 ± 0.11 µg/g). Among the trace elements, iron content was higher in *Colpomenia si*nuosa (45.6 ± 0.05 µg/g) than in *Halymenia porphyroides* (13.46 ± 0.01 µg/g) whereas zinc (3.47 ± 0.01 µg/g) and copper (1.84 ± 0.01 µg/g) content of *Colpomenia sinuosa* were present in lesser amount as compared to that in *Halymenia porphyroides* [zinc (3.49 ± 0.01 µg/g) and copper (1.87 ± 0.06 µg/g)] (Table.2; Fig.2). The variation the inorganic biochemical composition in seaweeds largely depends upon the type of seaweed processing[28,29] as well as the mineralization methods involve.[30] The present study reveals that the organic and inorganic nutrients present in the seaweeds may be a potent pathway for the nutritive requirement both in animal and human diet.

Table 1: Organic constituents of the experimental seaweeds.

Experimental seaweeds	Total protein (mg/g dry wt)	Total carbohydrates (mg/g dry wt)	Total lipids (mg/g dry wt)
Colpomenia sinuosa	433.5 ± 0.08	93.5 ± 0.11	13.4 ± 0.12
Halymenia porphyroides	503.46 ± 0.12	133.5 ± 0.11	13.5 ± 0.17

Values are expressed as Mean ± SEM, n=3.

Table 2: Inorganic constituents of *the* experimental seaweeds.

S.No	Minerals	*Colpomenia sinuosa (µg/g dry wt)*	*Halymenia porphyroides (µg/g dry wt)*
1	Calcium	156.56 ± 0.12	145.73 ± 0.08
2	Magnesium	47.7 ± 0.34	34.80 ± 0.11
3	Iron	45.6 ± 0.05	13.46 ± 0.01
4	Sodium	27.7 ± 0.11	145.67 ± 0.08
5	Potassium	0.35 ± 0.01	20.35 ± 0.01
6	Phosphorus	103.7 ± 0.11	98.52 ± 0.08
7	Zinc	3.47 ± 0.01	3.49 ± 0.01
8	Copper	1.84 ± 0.01	1.87 ± 0.06
F-Value		7327.0000	1641.00000
P-Value		0.000	0.000

Values are expressed as Mean ± SEM, n=3 as ANOVA test p <0.05% level.
Means in each column with superscripts(s) are significant different (p<0.05).

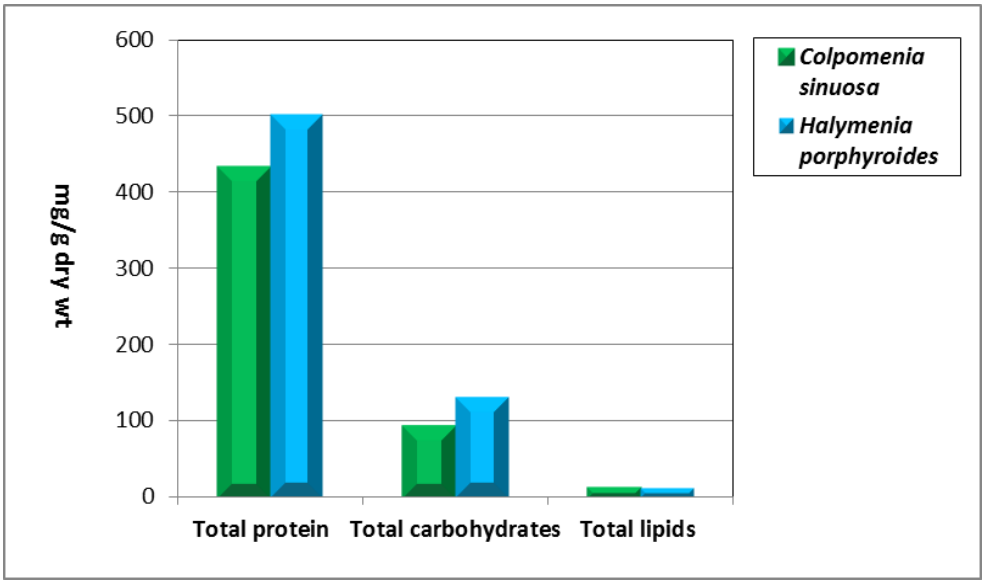

Figure 1: Organic constituents of the experimental seaweeds.

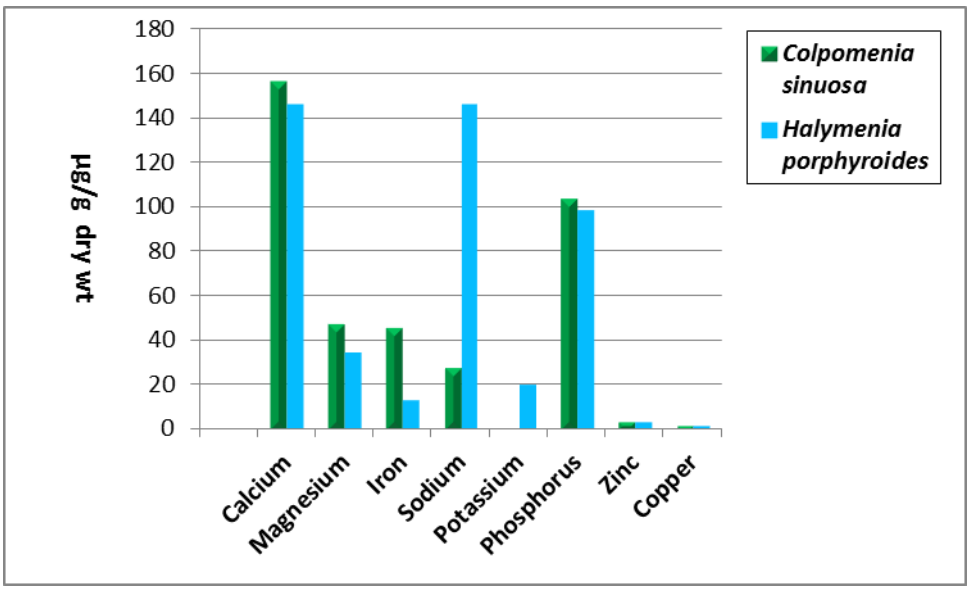

Figure 2: Inorganic constituents of *the* experimental seaweeds.

CONCLUSION

The present investigation on the organic and inorganic biochemical constituents from marine brown and red seaweeds concludes the presence of rich source of protein and carbohydrate contents as well as the sufficient amount of inorganic nutrients may indicate a possible pathway that these seaweeds can be used as the nutritive source for animal and human diet. The seaweeds can thus be used in food processing and pharmaceutical industries to make innovative nutritive supplements. They can also be studied and analyzed for active ingredients for the use in medical industry. More research is indeed required to exploit the full potential of these two seaweeds.

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