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Nutritional Composition Of Some Selected Seaweeds From Kanayakumari Coast, Tamil Nadu, India

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Abstract

A systematic investigation was carried out to assess the nutritional composition of 10 different seaweeds belonging to Chlorophyta, Rhodophyta and Phaeophyta collected from Coast of Kanniyakumari, India. The results showed that the Carbohydrate content ranged from 19.15 to 42.94, Protein from 8.94 to 24.54, lipid from 1.95 to 6.72. From the recorded group of seaweeds protein content were higher in chlorophyceae (Ulva faciata),Carbohydrate were high in Rhodophyceae (Laurencia pedicularis) ,lipid content lower in brown algae Padina pavonica and higher in green algae Ulva faciata.

Keywords: Seaweed, Marine algae, Kanayakumari

INTRODUCTION

Seaweed, also called as algae, is taxonomically classified under four groups namely: red algae (Rhodophyta), brown algae (Phaeophyta), green algae (Chlorophyta), and blue-green algae (Cyanophyta). Macroalgae, which include above three groups of seaweed other than blue-green algae, have a long history of utilization as direct or processed food across the globe. In Asian countries, seaweed is directly used for several culinary purposes, whereas in the west, it is exclusively used for the extraction of important food hydrocolloids including agar, carrageenan, and alginates. Availability almost throughout the year and relatively easy collection potential make macroalgae an inexpensive food source. With the advancement of biological and marine sciences, identification and largescale culturing of edible micro algae (blue-green algae) have also become a reality, and later they have been introduced into different food applications. The nutrients in our daily diet or those synthesized in the human body using the precursor molecules play a vital role in regulating the bodily functions, essential for normal growth and development. Carbohydrates, proteins, lipids, and vitamins are provided to the human body through different food sources. Like most of the terrestrial plants, marine algae are also a rich source of above nutritional elements. In comparison with many common vegetables, high levels of fiber, minerals, o-3 fatty acids, and moderate concentrations of lipids and proteins available in most of the edible seaweed help it to be considered as an important food source for human nutrition. However, the available amounts of the above nutrients may vary basically depending on the variety, season, and the area of production (Murata and Nakazoe,2001) The nutrients composition of seaweed varies and is affected by species, geographic area, season and temperature of water. These sea-vegetables are of nutritional interest as they are low calorie food, but rich in vitamins, minerals and dietary fibres. Seaweeds, which have traditionally been used by the Western food industry for their polysaccharide extractives 'alginate, carrageenan and agar' also contain compounds with potential nutritional benefits. Seaweeds have recently been approved in France for human consumption (as vegetables and condiments), thus opening new opportunities for the food industry. These seaweed ingredients must meet industrial and technical specifications and consumer safety regulations. It is also an ingredient for the global food and cosmetics industries and is used as fertilizer and as an animal feed additive. Today, approximately 1 million tonnes of wet seaweed are harvested and extracted to produce about 55 000 tonnes of hydrocolloids, valued at almost US $ 600 million (McHug, 2003).

Seaweed contains a large amount of carbohydrate as structural, storage, and functional polysaccharides, and the total carbohydrate content may ranges from 20% to 76% of dry weight (Holdt and Kraan, 2011) depending on the species. Though the carbohydrate content in seaweed is considerably high, its greater portion is available as polysaccharide dietary fiber, In general, seaweed protein is rich in glycine, arginine, alanine, and glutamic acid, and contains all the essential amino acids, the levels of which are comparable to those of the FAO/WHO requirements of dietary proteins (Anonymous, 2006). However, when compared with the other protein-rich food sources, seaweed is appeared to be limiting with lysine and cystine. With respect to the protein level and amino acid composition, the amino acid score and the essential amino acid index were higher in red seaweed than those in brown and green seaweeds (Holdt and Kraan, 2011). Seaweed synthesizes higher amounts of polyunsaturated fatty acids (PUFAs) especially under the cool climates, and the total lipid content is elevated during the hot seasons (Narayan et al., 2006). Hence forth, the present paper aims to analyse the variations of biochemical constituents such as Protein, Carbohydrate, lipids of ten different groups of seaweeds species.

Materials and Methods

The investigation was carried out at Vattakotai, (8°12′N and 77°56′E) Kanniyakumari coast Tamilnadu the southeren coast of India. The rocky shore of Vattakottai inhabits an biodiversity, Hard rocky bottom of this area greatly supports the algal diversity and provide suitable shelter and feeding ground for grazers. Regular field visits were undertaken from January 2019 to December 2019 once in every 15 days at selected station during the low tide in depth of 0.5 to1.0m, the algal samples were collected during the study period by detaching a portion from the seaweed, The collected sample was washed thoroughly in sea water for three times and finally fresh water in order to remove sand particles, impurities and epiphytes, (Sasikala et al., 2016).These species classified into three categories and chlorophyta (Ulva faciata Caulerpa scalpeliformis), Phaeophyta (Sargassum wightii and Pedina pavonica) and Rhodophyta species (Laurencia pedicularis and Hypnea muciformis) (Fig. 1). The Samples were then shade dried for four days followed by oven drying at 60°C for 5 h. The dried sample was hand crushed and make a course powder using a mixer grinder and it was stored in plastic bags for biochemical analysis. Biochemical Composition (Lowry et al.1951) was employed to evaluate Seaweeds total protein. (Dubois et al. 1956) the Phenol-Sulphuric acid method was used to evaluate seaweeds total carbohydrate. (Folch et al. 1957) chloroform-methanol mixture used to assessed Lipid content, were carried out.

Fig.1- Abundantly available ten selected Seaweeds Species from coastal water of vattakottai,Kanniyakumari region.

Ulva faciata

Chetomorpha antenna

Caulerpa scalpeliformis

Pedina pavonica

Gracilaria corticata

Sargassum whigti

Laurencia pedicularis

Hypnea muciformis

RESULTS

Table 1 - Biochemical composition of seaweeds collected at vattakottai, Kanniyakumari region (mg g $-^{1}$ dry weight)

S.No	Name of the seaweeds	Protein	Carbohydrates	lipid
1	Ulva fasciata	24.54	41.58	6.72
2	Chaetomorpha antennina	17.64	28.97	5.45
3	Caulerpa scalpelliformis	18.28	21.23	4.21
4	Padina pavonica	15.08	26.25	1.95
5	Sargassum wightii	8.93	28.11	2.53
6	Gracilaria corticata	11.18	19.15	2.02
7	Hypnea musciformis	9.16	22.02	3.12
8	Hypnea valentiae	10.45	20.53	3.15
9	Laurencia obtusa	29.28	42.94	1.99.
10	Laurencia pedicularis	23.35	23.63	3.52

Measurable differences in nutritional composition were apparent among the ten species studied. Protein, lipid, carbohydrate, fibre and fat are the most important biochemical components in algae and their results are given in table-1.Proteins have crucial functions in all the biological processes. Their activities can be described by enzymatic catalysis, transport and storage, mechanical sustentation, growth and cellular differentiation control (Stryer, 1988).The total protein content of the samples ranged between 8.93 to 29.28 %, with highest protein content in red seaweeds, Laurencia obusta (29.28 %), S.wightii (8.93 %), and H. miciformis (9.16 %), followed by brown seaweed H. valentia (10.45 %). The protein content sometimes reflects the age of seaweeds, as the maturity of plants increases the Nitrogen content declines. The protein content also varied with collection site, depth and nutrient availability, since the amount of nitrogen levels reflects the protein content of the seaweeds. The protein content of brown algae was low compared to green and red algae. This is in agreement with the findings of higher protein content in species of Rhodophyta, moderate in Chlorophyta and the lowest in Phaeophyta (Rickey, 2004). (Sukran et. al. 2003) also observed maximum protein content in some of the Rhodophyta and Chlorophyta belonging to the genus Ulva. Similarly, (Burtin 2003) also recorded higher protein content in green and red seaweeds.(Fig.2)

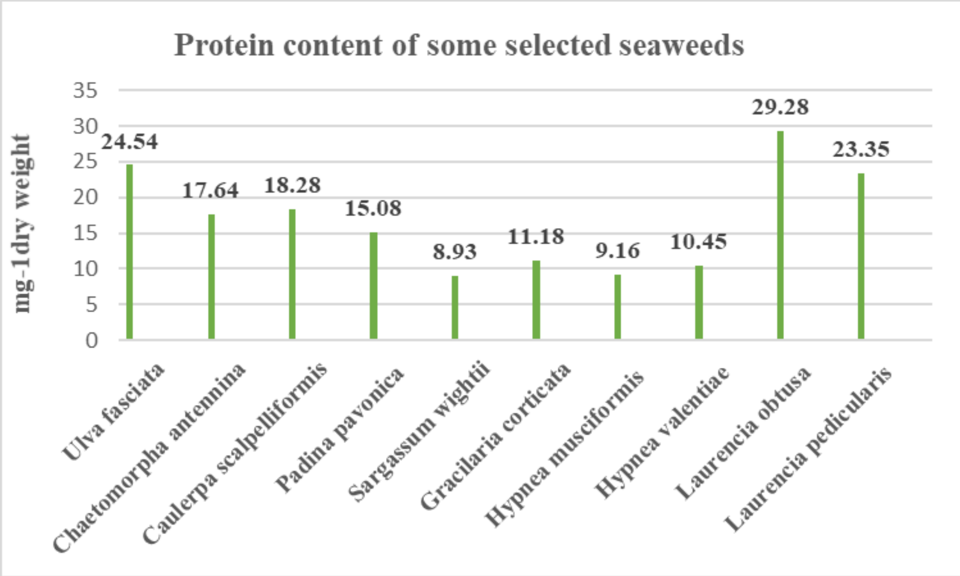


Fig.2- Protein content of some selected seaweeds at vattakottai, Kanniyakumari coast (mg g $-^{1}$ dry weight)

Carbohydrate is one of the important components for metabolism and it supplies the energy needed for respiration and other most important processes. The concentration of carbohydrate was higher in most of the species of Carbohydrate followed by Rhodophyta Phaeophyta and Chlorophyta.The carbohydrate content of the seaweeds ranged between 19.15 and 42.14 %. The highest amount was recorded in L. obusta and the lowest in G. cardicata. The Carbohydrate content was 61.6% in U.lactuca followed by S.wightii (59.2%) and G. corticata (52.6%). (Sasikumar 2000) reported that the studied was species of green algae Enteromorpha intenstinalis and Chaetomorpha linum in which the carbohydrate content ranged from 20.4 to 54.6%. Sukran et . al. 2003) also reported the highest average total carbohydrate content from Ulvar rigida (64.04 = 29.15 $_{g/\ kg}$ dry weight). The high solar radiation makes optimal conditions for photosynthesis and therefore, results in high carbohydrates content in brown seaweeds.

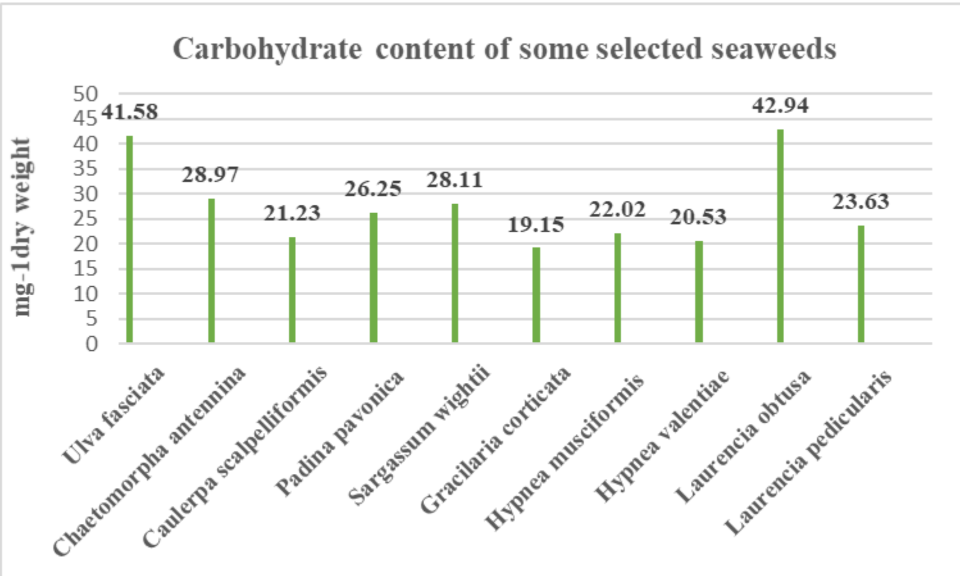
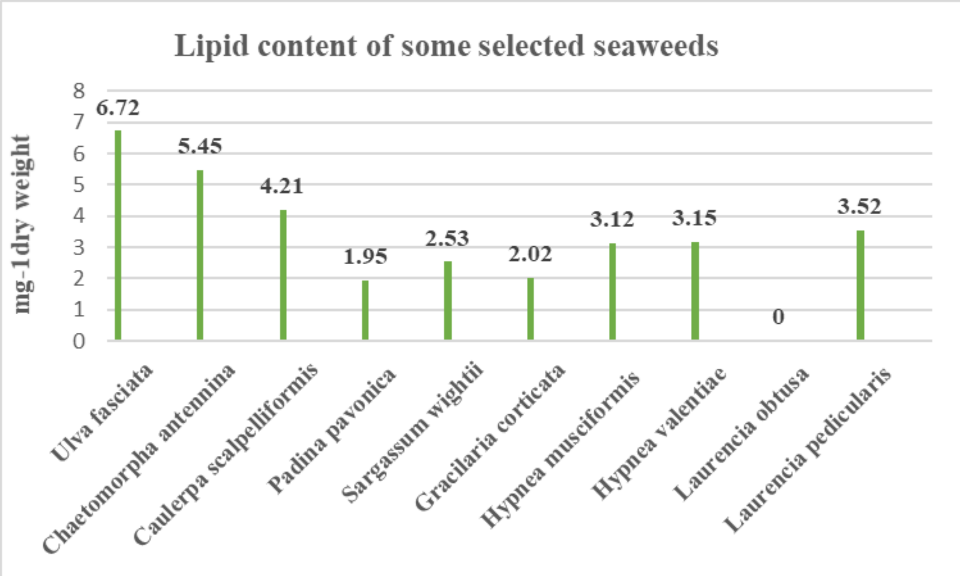


Fig.3-Carbohydrate content of some selected seaweeds at vattakottai, Kanniyakumari coast (mg g $^{-1}$ dry weight)

Lipids are rich –c = o- bonds, providing much more energy in oxidation processes than other biological compounds. They constitute a convenient storage material for living organisms.In macroalgae, the lipids are widely distributed, especially in several resistance stages. (Miller, 1962). In the present study1.95 ,1.9 and 6.72% of lipid was recorded in P. pavonica, L. pedicularis, and U. faciata respectively. Similar results were also reported by Chu et . al. 2003.



Conclusion

The results of the present study have shown that seaweeds contain almost all the nutritional components, which vary from one species to another.They can be used as potential healthy diet for human consumption. Ulva faciata and Caulerpa scalpelformis have recorded with high protein contents. All other seaweeds investigated in this study have reported high quantity of carbohydrate and protein,; hence they can be utilized as additives in common traditional foods. The Kanyakumari coast is conducive for the better growth, along with elevated physicochemical and nutritional composition of seaweed species. Therefore, these seaweeds can be promoted as a dietary alternative and its commercial value can be enhanced by promoting the seaweed-based products.

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