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Nutritional content of marine macroalgae (Seaweeds) from Kanyakumari coastal district, Tamil Nadu, India

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Abstract
Fast globalization and modern lifestyles have affected our eating habits and replaced them with fast food. Fast food is not the same as traditional food but fast food can be served but it has serious disadvantages especially in terms of human health. Seaweed is said to be a marine macroalgae that thrives in the estuaries' shallow waters, and countercurrents that go down to a depth of 80 metres where there is little photosynthetic light. Seaweed has many benefits. With its multi-functional properties such as food energy life extension detoxification disease prevention health and fairness benefits seaweed can be incorporated into the Indian diet in moderation for nutrition and wellbeing. In this study eight species of marine macroalgae (sea algae) (Figure 1) were selected from the Kanyakumari coast of Tamil Nadu subjected to proximate composition analysis followed by the AOAC standard method and the selected algae were observed to be abundant. in trace elements (Table 1). Therefore it can be concluded that macroalgae Bryopsis Chaetomorpha Dictyota Enteromorpha Gracilaria Padina Sargassum Ulva selected from this study can be used as human food and value added products for commercial use. pharmaceutical paper production food fertilizer and food industry. Industrial use of macroalgae is currently limited mainly to the extraction of hydrocolloids and some fine biochemicals.

Keywords: Sea weeds, marine macro algae nutritional value, proximate analysis

1. Introduction
Increasing consumer awareness of nutrition health promotion has given rise to interest in research on food supplements globally. In addition to supplemented foods, the In some developed countries the consumption of exotic foods with nutritional value has also become important. [1]. Algae use has grown significantly over the past 50 years, leading to an increase in applied research in a variety of related fields [2]. Protein, lipids, carbohydrates, and minerals are just a few of the nutritive components that seaweeds contain. Ash, which is made up of a variety of minerals, vitamins, and other substances related to them, accounts for more than 30% of marine algae's dry weight [3]. Seaweed is a rich and diverse raw material that can be used to make cosmetics, fertilizers, extract industrial gums, and chemicals that are used in many industries, including food, pharmaceuticals, and industry. In addition, a number of macroalgae were examined for a variety of bioactive compounds that have strong anti-inflammatory and pain-relieving effects as well as high antioxidant properties [4, 5]. Since at least 600 BC, seaweeds have been included in human diets. Since ancient times, many Asian civilizations have utilized them for food, animal feed, fertilizer, and traditional medicine. Numerous epidemiological studies demonstrating the health benefits associated with seaweed consumption have resulted from this age-old custom drawing attention to seaweeds [6].
Seaweeds are eaten as food by people all over the world due to their high nutritional value. There are currently reports of the commercial exploitation of seaweeds in 42 nations worldwide. China leads them all, followed by North Korea, South Korea, Japan, the Philippines, Chile, Norway, Indonesia, the United States, and India. Up to 95% of the world's commercial use of seaweed is made by these top ten nations [7]. Seaweeds are the most complete and balanced food source in nature because they are harvested from pure seawater. Seaweeds are a great source of vitamins, proteins, carbohydrates, trace minerals, and other bioactive compounds [8] that can be consumed as part of a healthy diet. Seaweeds supply all

of the necessary vitamins and minerals, as well as a significant amount of dietary fiber and antioxidants. Seaweeds' high mineral content probably contributes to their numerous health benefits [9]. inclusion of whole seaweed as a useful food ingredient in the preparation of delectable desserts such as chocolates, pates, seaweed cookies, bread, crackers, and smoothies. For thousands of poor coastal communities, seaweed can be an important source of foreign currency and the development of new livelihoods [10]. According to numerous reports, seaweeds contain a significant quantity of various micro and macronutrients, including calcium, sodium, magnesium, iron, and others [11]. Seaweeds are referred to as the "medical food of the 21st century" due to their abundance of minerals, vitamins, trace elements, and bioactive potential substances. Additionally, many macroalgal species have traditionally been used as ingredients in both food and medicinal preparations [12]. Estimating the proximate composition of marine macroalgae collected from the Kanyakumari coast in Tamil Nadu, India, was the goal of this study.

2. Materials and Methods

2.1 Collection of marine macroalgae (seaweeds)

Bryopsis, *Chaetomorpha*, *Dictyota*, *Enteromorpha*, *Gracilaria*, *Padina*, *Sargassum*, and *Ulva* are the species (Fig. 1) gathered from the coast of Kanyakumari in Tamil Nadu, India. To get rid of salt, particulate matter and associated organisms, marine macroalgae samples were washed with seawater and freshwater.

Modified from Google images

Fig 1: Photographs of marine macro algae (sea weeds).

Then the collected macro algae cleaned with blotting paper to remove excess water, then air-dried in room temperature and powdered. The powdered samples were then stored in the refrigerator and used for the estimation of nutritional parameters namely protein, lipid, carbohydrates, fiber, and ash content.

2.2 Proximate analysis

Total proteins, lipids, carbohydrates, fiber, and ash are the parameters that are determined for proximate analysis, followed by AOAC standard methods [14].

2.3 Statistical analysis

The data were analyzed statistically and presented as the mean (n=3) minus the standard deviation (SD) for each analysis.

3. Results and Discussion

Results have shown that the nutritional composition of marine macroalgae varies with species, In the present investigation, an attempt was made for the proximate composition of *Bryopsis, Chaetomorpha, Dictyota, Enteromorpha, Gracillaria, Padina, Sargassum, Ulva* to provide a good estimation in order to evaluate their potential use as food ingredients.

3.1 Proximate composition

The proximate composition including proteins, lipids, carbohydrates, fiber and ash content was determined (Table 1).

Table 1: Proximate composition of marine macro algae (% of dry weight basis).

S. No	Name of the marine macro algae sps.	Protein	Lipid	Carbohydrate	Fiber	Ash
1	*Bryopsis*	24.52	1.7	54.7	4.9	8.9
2	*Chaetomorpha*	19.89	1.0	49.6	15.3	6.3
3	*Dictyota*	19.42	0.9	35.3	9.4	7.5
4	*Enteromorpha*	18.98	0.2	65.2	11.2	6.4
5	*Gracilaria*	25.34	0.1	59.8	5.9	9.7
6	*Padina*	18.96	1.8	30.9	10.2	3.5
7	*Sargassum*	19.34	3.0	32.7	15.9	6.8
8	*Ulva*	27.21	2.1	41.9	7.6	7.2

Proteins play an important role in every biological process. Enzymatic catalysis, transport and storage, and mechanical sustentation control are some of their activities. In this study, we found the protein content as Ulva> Gracilaria> Bryopsis> Chaetomorpha> Dicotyota> Sargassum> Enteromorpha> Padina. Bryopsis had a mean protein content of 24.52 percent, Chaetomorpha had 19.89 percent, Dictyota had 19.42 percent, Enteromorpha had 18.98 percent, Gracilaria had 25.34 percent, Padina had 18.96 percent, Sargassum had 19.34 percent, and Ulva had 27.21 percent [15].

In general, the lipid provides energy than other biological compounds during the oxidation process. They are a material for storing living things. In this study, we found that the amount of lipids in the macroalgae *Sargassum>Ulva>Padina>Bryopsis>Chaetomorpha>Dictyota> Enteromorpha>Gracilaria.* The mean lipid content was found to be in *Bryopsis* 1.7%, *Chaetomorpha* 1.0%, *Dictyota* 0.9%, *Enteromorpha* 0.2%, *Gracilaria* 0.1%, *Padina* 1.8%, *Sargassum* 3.0%, *Ulva* 2.1%. Similar to previous studies [16, 17], most seaweed species had a crude fat content of less than 3.0%.

One of the important parts of metabolism is carbohydrates, which provide the energy for respiration and other important processes [18]. In the current research, we observed that the carbohydrates content in the macro algae *Enteromorpha* > *Gracillaria* > *Bryopsis* > *Chaetomorpha* > *Ulva* > *Dictyota* > *Sargassum* >*Padina*. The concentration of carbohydrates was observed in *Bryopsis* 54.7%, *Chaetomorpha* 49.6%,

Dictyota 35.3%, *Enteromorpha* 65.2%, *Gracilaria* 59.8%, *Padina* 30.9%, *Sargassum* 32.7%, and observed in *Ulva* 41.9%. Carbohydrates accounted for up to 90.83% of the dry matter in seaweeds, according to proximate composition analysis of macro algae [19].

Beneficial physiological effects like laxation and regulation of blood cholesterol are aided by dietary fiber. Fibers in food can bind toxic substances and prevent them from moving around in a person's body. In the current research, we observed that the fiber content in the macro algae*Sargassum>Chaetomorpha>Enteromorpha>Padina>Dictyota>Ulva>Gracilaria>Bryopsis.* The concentration of fiber was observed in *Bryopsis* 4.9%, *Chaetomorpha* 15.3%, *Dictyota* 9.4%, *Enteromorpha* 11.2%, *Gracilaria* 5.9%, *Padina* 10.2%, *Sargassum* 15.9%, *Ulva* 7.6%.

Seaweeds contain the essential minerals and trace elements required for human nutrition, and macroalgal ash content is typically high. The concentration of fiber was observed in Bryopsis 8.9%, *Cahetomorpha* 6.3%, *Dictyota* 7.5%, *Enteromorpha* 6.4%, *Gracilaria* 9.7%, *Padina* 3.5%, *Sargassum* 6.8%, *Ulva* 7.2%. These wide ranges of proteins, lipids, carbohydrates, fiber, and ash additionally, edible land plants typically lack minerals, in contrast to aquatic weeds. These differ depending on the species, season, location, environment, and processing.

Aquatic macroalgae are an excellent nutrient source, containing high amounts of macro and micronutrients. The seaweeds *Bryopsis, Chaetomorpha, Dictyota, Enteromorpha, Gracilaria, Padina, Sargassum, Ulva* exhibited selected marine macroalgae exhibited a broad spectrum of nutritional compositions which make excellent dietary sources for a healthy food for human nutrition.

4. Conclusion

Fast food has become an extremely important part of our modern lifestyle. Fast food is now so appealing because, unlike traditional natural food, it is not only hot and delicious but also filling, convenient, and saves time. In China, Japan, and the Republic of Korea, seaweeds have been a major part of the diet and culture, and their consumption has been associated with numerous health benefits. Seaweeds are consumed by up to 20% of the population in Asia. They are prized not only for their unique flavor but also for the numerous health benefits they provide. This custom has changed as people from these countries have moved around the world, so there are now many more countries where seaweed consumption has significantly increased.

Ocean growth is used to make hydrocolloids today, but unlike compost, it has not yet been used on a larger scale for other purposes due to a lack of awareness among the Indian masses. In India likewise, no genuine endeavor has been made so far to use ocean growth as dietary nourishment. Ocean growth is rich wellsprings of minerals, follow metals, some wellbeing advancing atoms, materials, for example, dietary fiber, omega - 3 unsaturated fats, basic amino acids, and so on. At first, one of a kind of ocean growth won't be promptly acknowledged by the buyers with regards to taste. There is a not insignificant rundown of ocean growth that has been the customary wellsprings of human nourishment and formula books are accessible around the globe. This data could be utilized as a source of perspective to get ready explicit Indian dishes. Advancement, development and specialty showcase, a blend of each of the three may prompt more noteworthy agreeableness of the kelp utilized items. Relentless ads, alluring ideas for items, appropriate showcasing systems, and so forth, however, may lead to the introduction of the seaweed diet into Indian cuisine. Seaweeds can be used in a variety of products in the Indian food industry to ensure long-term health for consumers. The food industry should take note of the many uses for seaweeds. In order to use seaweeds in both fast and traditional foods for the nourishment and well-being of the Indian populace, additional research in this area is required.

To better comprehend the bioactive components and antibacterial activity of marine macro algae (sea weeds) collected from the coastal and marine environment, additional research is required.

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