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## Biochemical composition of seaweeds from Veraval coastal regions along Saurashtra coast of Gujarat, India

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### Abstract

Seaweeds are the macrophyte marine algae; a primitive variety of plants absent of true roots, stem and leaves. The term seaweed gives the erroneous impression that it is a useless plant but seaweeds are miracle plants of the sea and extremely useful plants. Among all these Indian coastal states Tamil Nadu and Gujarat states contributes more seaweed resource. Seaweeds were mainly utilized for food, medicine, fertilizers etc. In this study, four seaweed species were identified viz., red seaweed species *Gracilaria corticata* and *Hypnea musciformis*, Green seaweed species *Ulva reticulata* and Brown seaweed species *Sargassum cinctum*. The biochemical composition of those species were studied for Crude Protein, Fat, Carbohydrate, Moisture and Ash content. The values of biochemical composition were varies from; crude protein:  $12.21 \pm 0.01$ - $16.59 \pm 0.03\%$ , lipid content:  $0.20 \pm 0.02$ - $3.10 \pm 0.04\%$ , carbohydrate content:  $46.74 \pm 0.03$ - $58.16 \pm 0.05\%$ , moisture content:  $2.75 \pm 0.01$ - $7.90 \pm 0.03$  and ash content:  $21.86 \pm 0.02$ - $32.08 \pm 0.01\%$ , which represents these available seaweed resources in future could become one of the supreme important resource and so in future this scenario ultimately causes the utilization and demand of seaweed was goes on increasing, not only along the India, but also from all over the world.

**Keywords:** Seaweed, biochemical composition, protein, lipid

### Introduction

Seaweeds are the macrophyte marine algae; a primitive variety of plants absent of true roots, stem and leaves. The term seaweed gives the erroneous impression that it is a useless plant but seaweeds are miracle plants of the sea and extremely useful plants. Majority of seaweed species are growing in the shallow water. Major seaweeds belongs to three division green algae (Chlorophyta), brown algae (Phaeophyta) and red algae (Rhodophyta). Over all 900 species of green seaweed species, 4,000 species of red seaweed and 1500 species of brown seaweed found in nature. The maximum variety of red seaweeds are found in tropical and subtropical waters, while brown seaweeds are common in temperate and cooler waters. Seaweeds grow richly in two states of India one in east coast, Tamil Nadu and second one in west of coasts, Gujarat also found in Lakshadweep, Andaman and Nicobar Islands.

Seaweeds are rich source of proteins, carbohydrates, fiber, lipids, vitamins and minerals also entitled as a medicinal food of the 21<sup>st</sup> century. Seaweed genus *Gracilaria corticata* and *Hypnea musciformis* are almost extensively huge available during all months of seaweed growing season at Veraval coast, Gujarat. The genus *Gracilaria* and *Hypnea* (Rhodophyta) befalls naturally in tropical and subtropical coastal areas of the world and it has been regularly considered as one of the best auspicious candidates as an alternative source of nutrients for aqua feeds, mostly herbivorous gastropods (Capinpin and Corre, 1996; Reyes and Fermin, 2003; Vieira *et al.*, 2005) [3, 18, 24] but also sea urchin (Shpigel *et al.*, 2005) [20], fish (Neori *et al.*, 2000; Valente *et al.*, 2006) [14, 23] and shrimp (Marinho-Soriano *et al.*, 2007; Di Silva and Barbosa, 2009) [7]. Seaweeds are traditionally used in human and animal nutrition. Seaweed nutritional composition especially protein contents fluctuate according to the species to species and seasonal conditions. Most nutritional studies have suggested low dietary inclusion rate (less than 10%) for being effective as an efficient (binding effect), food and pharmaceutical (positive protective effect) supplement in food of shrimps and fishes by seaweed or seaweed

extract. The combination of nutrition from algae has been recorded well and include mainly: protein, carbohydrate, fat and nutrients such as vitamins, minerals, antioxidants and rare elements (Darcy-Vrillon, 1993; Mabeau and Fleurence, 1993) [6, 11].

### Material Methods

Fresh marine red seaweed species *Gracilaria corticata* and *Hypnea musciformis*, Green seaweed species *Ulva reticulata* and Brown seaweed species *Sargassum cinctum* were collected from shore regions of Somnath-Veraval coast, Saurashtra region, Gujarat. The collected seaweeds were washed systematically with freshwater in order to eradicate other marine micro and macro organisms, epiphytes after removing fixed on herbarium sheet for preparation of identification of specimen and using the standard literature for identification. The seaweeds species was then dried under at room temperature and dried seaweeds samples were ground well by using mixer grinder and sieved using a nylon sieve in order to remove seaweed fiber and prepared fine powder.

### Proximate composition analysis

Proximate composition of collected seaweed samples were analyzed by using of AOAC standard methods (Anon., 2000) [1]. The micro-kjeldahl digestion and distillation method was use for the crude protein estimation. The Soxhlet apparatus was use for the crude lipid estimation. Ash and Moisture content were determined using the incubator and muffle furnace.

### Crude protein (CP)

The protein concentration of the samples was assessed as nitrogen content by micro kjeldahl method after acid digestion. The nitrogen content of the sample was estimated constitutively by the semi-automatic micro-kjeldahl digestion and distillation apparatus (Gerhardt, Germany) than titration. The crude protein was estimated by multiplying nitrogen percentage by a constant factor of 6.25.

Crude protein (%) = N2 (%) X 6.25

### Crude lipid

Crude lipid was investigated through the ether extraction by Soxhlet apparatus with petroleum ether (Boiling point 40-60 °C) as the solvent. The crude lipid concentration were resolute gravimetrically following overnight drying of extracts by using of oven (80 °C).

Crude lipid/Fat (%) =  $\frac{\text{Weight of the ether extract}}{\text{Weight of the sample}} \times 100$

### Moisture

The moisture content of the feed ingredients, diet and animal were determined by takings known weight of the sample in the petri dish and drying it in a hot air oven at 100-105 °C till a constant weight was achieved. The difference in weight of the sample gave the moisture content, which was calculated by using the following formula.

Moisture (%) =  $\frac{\text{Wet weight of sample} - \text{Dried weight of sample}}{\text{Wet weight of sample}} \times 100$

### Ash

Ash content was estimated by taking the known weight of the sample in the silica crucible and placing it in a muffle furnace at 600 °C for 6 hours. The calculation was done as follows:

Ash (%) =  $\frac{\text{Weight of Ash}}{\text{Weight of sample}} \times 100$

### Carbohydrate Estimation

The total carbohydrate was estimated by following the Phenol-sulphuric acid method of Dubois *et al.* 1956 [8].

### Results

The proximate composition of Red seaweeds species *Gracilaria corticata*, *Hypnea musciformis*, Green seaweed species *Ulva reticulata* and Brown seaweed species *Sargassum cinctum* is shown in the Table 1. Results of the analysis revealed the major components of seaweeds *Gracilaria corticata*, *Hypnea musciformis*, *Ulva reticulata* and *Sargassum cinctum* with carbohydrate 52.17±0.05%, 46.74±0.03%, 51.78±0.02% and 58.16±0.05%, followed by ash content of 32.08±0.01%, 28.57±0.01%, 26.64±0.04% and 21.86±0.02% respectively. Crude protein component of seaweeds was obtained in amount with 12.56±0.03% (*G. corticata*), 16.59±0.03% (*H. musciformis*), 12.21±0.01% (*U. reticulata*) and 10.29±0.02% (*S. cinctum*). Crude lipid component of seaweeds was obtained in little amount with 0.44±0.01% (*G. corticata*), 0.20±0.02% (*H. musciformis*), 2.84±0.01% (*U. reticulata*) and 3.10±0.04% (*S. cinctum*). Moisture level of seaweeds was 2.75±0.01% (*G. corticata*), 7.90±0.03% (*H. musciformis*), 6.53±0.02% (*U. reticulata*) and 6.59±0.05% (*S. cinctum*).

### Discussion

Seaweeds were reported to contain significant quantities of proteins, lipids, carbohydrates, minerals and vitamins (Kumar and Kaladharan 2007; Manivannan *et al.*, 2008; Thinakaran and Sivakumar, 2012) [10, 12, 22].

Burtin (2003) [2] reported that the protein content of green, red and brown seaweed are generally ranging 10 to 30%, 10 to 20% and 5 to 15% respectively. The protein content of 12.56±0.03% (*G. corticata*), is similar to those obtain by Chithra and Chandra (2013) [5] whereas 16.59±0.03% (*H. musciformis*) also similar to those obtain by Parthiban *et al.* (2009)., *U. reticulata* (12.21±0.01%) is similar to those obtained in *Ulva spp.* by Manivannan *et al.* (2009) [13] but higher than those obtained by Manivannan *et al.* (2008) [12] whereas in *S. cinctum* (10.29±0.02%) is similar to those obtained in *Sargassum spp.* by Rohani-Ghadikolaei *et al.* (2012) [19] and Manivannan *et al.* (2008) [12]. Seaweeds are relatively low in lipid (1–5% of dry weight) (Burtin, 2003; Polat and Ozogul, 2008) [2]. In the present study crude lipid content of 0.44±0.01% (*G. corticata*), 0.20±0.02% (*H. musciformis*), *U. reticulata* (2.84±0.01%) and *S. cinctum* (3.10±0.04%) is similar to those reported by Rohani-Ghadikolaei *et al.* (2012) [19] but higher than those estimated by Manivannan *et al.* (2008) [12] and Chithra and Chandra (2013) [5] for same genus of both seaweeds. In *G. corticata* ash content (32.08±0.01) and moisture content (2.75±0.01) and *H. musciformis* ash content (28.57±0.01) and moisture content (7.90±0.03) comparatively similar and higher to those obtained in same species by Rohani-Ghadikolaei *et al.* (2012) [19] and Temkar *et al.* (2012). In *U. reticulata* the ash content (26.64±0.04%) and moisture content (6.53±0.02) are comparatively higher and similar to those obtained in *Ulva spp.* by Rohani-Ghadikolaei *et al.* (2012) [19], whereas in *Sargassum cinctum* ash (21.86±0.02%) and moisture (6.59±0.05%) contents are comparatively lower than *Sargassum spp.* those obtained by Rohani-Ghadikolaei *et al.* (2012) [19]. Carbohydrates was the major component in the

proximate composition of *G. corticata* (52.17±0.05), *H. musciformis* (46.74±0.03) and *U. reticulata* (51.78±0.02%) comparatively lower to those obtained by Ortiz *et al.* (2006)<sup>[15]</sup> and Rohani-Ghadikolaei *et al.* (2012)<sup>[19]</sup> for *Ulva spp.*, whereas in *S. cinctum* (58.16±0.05%) it is similar to *Sargassum spp.* obtained by Kumar *et al.* (2017)<sup>[9]</sup>. These results are comparatively higher than those reported for same genus by Chakraborty and Santra (2008)<sup>[4]</sup> and Manivannan *et al.* (2008)<sup>[12]</sup>.

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**Table 1:** Biochemical composition of seaweeds

Ingredients (%)	Moisture	Crude Protein	Crude Lipid	Ash	Carbohydrate
<i>Gracilaria corticata</i>	2.75±0.01	12.56±0.03	0.44±0.01	32.08±0.01	52.17±0.05
<i>Hypnea musciformis</i>	7.90±0.03	16.59±0.03	0.20±0.02	28.57±0.01	46.74±0.03
<i>Ulva reticulata</i>	6.53±0.02	12.21±0.01	2.84±0.01	26.64±0.04	51.78±0.02
<i>Sargassum cinctum</i>	6.59±0.05	10.29±0.02	3.10±0.04	21.86±0.02	58.16±0.05

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