BIOCHEMICAL ANALYSIS OF SOME SPECIES OF SEAWEEDS FROM KARACHI COASTAL AREA

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Abstract

In many parts of the world seaweeds are used as a source of food, medicines, fertilizers etc. In the present work, biochemical analysis of some selected seaweeds from Karachi coastal were examined. In all fifteen species were studied including green algae (*Ulva fasciata, Codium tomentosum,Codium shameelii, Codium iyengarii, Caulerpa racemosa*), red algae (*Sarconema fucellatum, Campia compressa, Gelidium usmanghanii, Solieria robusta, Osmundea pinnatifida*) and brown algae (*Sargassum muticum, Stoechospermum marginatum, Stypopodium shameelii, Sargassum swartzii, Sargassum ilicifolium*). Biochemical analysis showed occurrence of protein (8.29 to 19.62 %), carbohydrate (11.43 to 24.57 %), lipid (2.65 to 4.97 %) and fiber (19.66 to 28.51%). The outcomes of the study can be used as a base for advance research on seaweed.

Introduction

Seaweeds are lower plants which grow in fresh or salt water. They do not have stems, roots, and leaves. Instead they are composed of a thallus which is a leaf-like structure and occasionally a stem and a foot (holdfast). They grow very fast and can spread sizes of up to 60 m in length (Mc Hugh, 2003). Usually on the basis of Pigmentation they are classified into three major groups brown (Phaeophyceae), green (Chlorophyceae) and red seaweeds (Rhodophyceae) (Mohamed *et al.*, 2012). There are about twelve hundred species of green, six thousand species of red and about two thousand species of brown seaweeds (Mohamed *et al.*, 2012).

Seaweeds live in environmental stress such as osmotic stress, rapid variations in temperature and aridity. All These effects can lead to the creation of free radicals and some other strong oxidants but in actual practice seaweeds rarely hurt by these stresses. It indicates that seaweed cells might have some type of protective mechanisms and compounds (Mc Hugh, 2003).

Biochemical analysis of seaweeds is important for the assessment of nutritional value to marine herbivores and it is also important for the assessment of possible sources of protein, carbohydrate and lipid for human consumption or commercial use (Hawkins and Hartnoll, 1983). This study was carried out to determine the biochemical composition of brown, green and red seaweeds that are found along Karachi coast.

Materials and Methods

Collection of sample: Total fifteen species of seaweeds in which five brown [*Sargassum swartzii* (Turner) C. Ag., *Stoechospermum marginatum* (C. Ag.) Kűtz, *Sargassum muticum* (Fensholt), *Stypopodium shameelii* (Nizam *et* Aisha), *Sargassum ilicifolium* (Turner) C. Ag.], five green [*Ulva fasciata* (Delile), *Codium tomentosum* (Stackhouse), *Codium shameelii* (Nizam), *Codium iyengarii* (Bϕrg), *Caulerpa racemosa* (Forssk) J. Ag.] and five red algae [*Solieria robusta* (Grev.) Kylin, *Sarconema fucellatum* (Zanard), *Campia compressa* (Harv.), *Gelidium usmanghanii* (Afaq *et* Shameel), *Osmundea pinnatifida* (Huds.) Stack] were collected from Karachi coastal area during the months of January-February 2015.The seaweed identification was based on the morphological characteristics. Each of them was washed by seawater to remove epiphytes and dirt particles and then 1 kg of each species was taken in wet state, followed by shade-drying for four days and then oven-drying at 70°C to obtain a constant weight and crushed in the grinder. The crushed samples were sieved to get uniform particle size.

Biochemical analysis: Samples of seaweeds were analyzed by following mentioned standard methods and results were reported in gram per 100 gram (or in %) of dry weight (DW) of sample.

Determination of total protein: Protein in the each sample of seaweed was determined by the method of Lowry *et al.* (1951).

Determination of total carbohydrate: The total carbohydrate of all samples was determined by the method of Dubois *et al.* (1956).

Determination of total lipids: The lipid content was estimated using chloroform-methanol mixture as described by Folch *et al*. (1957).

Determination of total fiber: Total fiber in the samples was determined according to the method described by AOAC (2000).

Results and Discussions

Total protein: Protein content in all samples of seaweeds ranged from 8.29 to 19.62 % (Table 1). Among all species higher protein content was found in the brown seaweed *Sargassum muticum* (19.62 %) and lower in the red seaweed *Gelidium usmanghanii* (8.29 %). Similar types of results were also reported by Dinesh *et al*., (2007) in brown alga *Tubinariaornata* from Gulf of Mannar region. Contrary, Selvi *et al*., (1999) reported more protein content in red alga *Hypnea valentiae*. There may be a large variation in protein content even in different species of the same genus which might be due to the surrounding water quality. (Dhargalkar *et al*., 1980).

Total carbohydrate: Carbohydrate content of in hand seaweeds ranged from 11.43 to 24.57 % (Table 1). Higher carbohydrate content was recorded in the green seaweed *Codium tomentosum* (24.57 %) and the brown seaweed *Stypopodium shameelii* recorded the minimum value (11.43 %). Similar types of results were also reported by Chakraborthy and Santra (2008) showing higher carbohydrate in the green seaweeds, *U. lactuca* (35.27%) and *E. intestinalis* (30.58%). Dhargalkar *et al*. (1980) reported higher values of carbohydrate content were in red algae than in brown and green algae. On the contrary, the present work showed high carbohydrate content in green algae than red or brown algae. The high content of carbohydrate in red algae might be due to higher phycocolloid content in their cellwalls (Dhargalkar *et al.,* 1980).

Table 1. Biochemical analysis (in % or g/100g of dry weight DW) of some seaweeds from Coastal Area, Karachi.

Seaweeds from Karachi Coastal Area	Biochemical Analysis			
	Total Protein (g/100g DW)	Total Carbohydrate (g/100g DW)	Total Lipids (g/100g DW)	Total Fiber (g/100g DW)
Brown Algae				
Sargassum muticum	19.62	17.08	4.26	28.51
Stoechospermum marginatum	14.24	13.61	4.19	21.47
Stypopodium shameelii	13.11	11.43	4.23	19.66
Sargassum swartzii	14.79	12.54	3.85	20.49
Sargassum ilicifolium	15.68	14.28	3.91	22.54
Green Algae				
Codium tomentosum	14.16	24.57	4.97	15.04
Codium shameelii	11.89	21.35	3.86	9.42
Codium iyengarii	9.47	20.48	3.59	10.38
Caulerpa racemosa	10.53	20.92	3.72	11.46
Ulva fasciata	11.06	21.27	4.16	11.94
Red Algae				
Sarconema fucellatum	10.05	12.46	2.65	6.84
Campia compressa	9.46	15.32	3.27	4.93
Gelidium usmanghanii	8.29	18.55	3.64	5.26
Osmundea pinnatifida	9.72	14.62	2.85	5.64
Solieria robusta	8.73	17.18	3.07	5.49

Total lipids: The Lipid content of under investigated species of seaweeds varied from 2.65 to 4.97 % (Table 1). The higher lipid content was recorded in green seaweed *Codium tomentosum* (4.97 %) and the red seaweed *Sarconema fucellatum* (2.65 %) the minimum. Similar types of results are also reported in green seaweeds *E.,intestinalis* by Chakraborthy and Santra (2008) in which they mentioned higher lipid content up to 7.13%.

Total fiber: The results showed a separate pattern of total fiber content of seaweeds ranging significantly from 19.66 to 28.51% DW for brown seaweed, followed by green seaweed (9.42 to 15.04% DW) and red seaweed (4.93 to 6.84% DW). The highest value of total fiber was shown by *Sargassum muticum* (28.51 % DW) followed by *Stoechospermum marginatum* (21.47 % DW). The present study showed lower fiber content than reported earlier (Dawczynski *et al*., 2007; Gupta & Abu-Ghannam, 2011; Holdt & Kraan (2011). The variation in biochemical composition in seaweeds is reported to depend on the season and the area of production (Connan *et al*., 2004; Khan *et al*., 2007; Zubia *et al*., 2008).

Conclusion

It appears that seaweeds may be of potential use in food industry as source of ingredients with high nutritional value.

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