International Journal of Phytopharmacy
Vol. 5 (3), pp.25-29, May-Jun 2015
ISSN: 2277-2928 (Online)
Journal DOI: 10.7439/ijpp

www.ssjournals.com

Research Article

Biochecmial composition of marine brown alga *Lobophora variegata* from Mandapam in the South East Coast of Tamil Nadu

Thennarasan S[*1] and Murugesan[2]

[1]*Research Fellow, PG and Research Dept. of Botany, Unit of Algal Biotechnology and Bionano Technology, Pachaiyappa's College, Chennai 600 030, India*
[2]*Faculty of Botany, PG and Research Dept. of Botany, Unit of Algal Biotechnology and Bionano Technology, Pachaiyappa's College, Chennai 600 030, India*

***Correspondence Info:**
Sathyaseelan Thennarasan
Research Fellow,
PG and Research Dept. of Botany,
Unit of Algal Biotechnology and Bionano Technology,
Pachaiyappa's College, Chennai 600 030, India
E-mail: thenna_2000@yahoo.co.in

Abstract

Marine algae are well-known as a functional food for their richness in lipids, minerals, certain vitamins and also several bioactive substances like polysaccharides, proteins and polyphonies. Thus, the brown alga was analyzed for its biochemical properties for rich source of all essential nutrients which is promising as a source of pharmacognosical value. In the present study, brown alga *Lobophora variegata* was studied for the biochemical properties, such as carbohydrates, protein, lipids, vitamins, sterols, fatty acid and minerals composition were carried out by using gas chromatography method and flame atomic absorption spectrophotometry method respectively. Among biochemical content total protein were present in higher quantity 23.13 ± 0.05%, followed by total carbohydrates-19.34 ± 0.10% and total lipid-0.27± 0.5%. Also the experimental alga were rich in vitamins (especially vitamin C), Fatty acids (Omega fatty acid), and minerals (calcium) respectively. Comparatively the sterols also been noted. Thus, the results of biochemical composition of marine brown alga seem to be more valuable for the nutraceutical as well as pharmaceutical industry as a potential source.

Keywords: *Lobophora variegata*, Nutraceutical, Carbohydrates, Protein, Lipids, Minerals, Vitamins, Sterols, Fatty acids.

1. Introduction

Seaweeds have been used since ancient times as food, fodder, fertilizer and as source of medicine. They are the raw material for many industrial continue to be widely consumed as food in Asian countries, as it contains carotenoids, dietary fibres, proteins, essential fatty acids, vitamins and minerals[1]. In particular, certain edible seaweeds contain significant quantities of protein, lipids, minerals and vitamins[3-5]. The nutritional properties of seaweeds are not yet noted and they are usually estimated from their chemical composition alone[9,10]. Compared to land plants, the chemical composition of seaweeds has been poorly investigated and most of the available information deals only with traditionally Japanese seaweeds[11-13]. The chemical composition of seaweeds varies with species, habitats, maturity, environmental conditions, and geographical location.[7,8,14]. The use of seaweeds in the production of foods for fish farmed by aquaculture is another application of this food resource[17]. The distinctive salty taste of marine plants is due to a balanced chelated combination of sodium, potassium, calcium,

magnesium, phosphorus, iron and trace minerals. The levels of these minerals are ten to twenty times the total mineral content of land plants. The types and abundance of carbohydrates vary strongly between algae species. The typical carbohydrates in brown algae varieties consist of fucoidan, laminaran (b-1.3-glucan), cellulose, alginates, and mannitol[20]. The fatty acids content of marine macroalgae accounts for 1–6 g/100 g d.w.[19]. In addition, to that, seaweeds are rich sources of vitamin C, vitamin B, i.e., folic acid and B12, and vitamin A as a precursors, such as b-carotene[21]. Clinical studies have demonstrated that dietary intake of plant sterols (as part of the normal diet, or as a supplement) may help reduce blood cholesterol levels[25]. Additionally, it has been suggested that sterols have anti-inflammatory, antibacterial, antifungal, antiulcerative and antitumoral activity.

In general the phaeophyceae members (brown algae) constitute the major component of the seaweed population of the tropical countries of the world and hence *Lobophora variegata* belonging to the order Dictyotales of Phaeophyta was selected for the studies of biochemical analysis such as Total Carbohydrates, Total Proteins, Total Lipids, Fatty acids, Vitamins, Sterols and Minerals.

2. Materials and Methods

The brown seaweed *Lobophora variegata* was collected from Mandapam coastal regions, Southeast coast of Tamilnadu, India. The seaweed sample was picked with hand and immediately washed with seawater to remove the foreign particles, sand particles and epiphytes. Freshly collected algae were shade dried for about a week then the dried samples were powdered using a coffee blender, packed in sterile polythene bags and stored at 4ºC until use. The powder was then used for the estimation of proteins, lipid, carbohydrates, vitamins, sterols and minerals.

2.1 Carbohydrate Estimation

The total carbohydrate was estimated by following the Phenol-sulphuric acid method.[26]

2.2 Protein Estimation

The total protein was estimated using the Biuret method.[27]

2.3 Lipid Estimation

The extraction of lipid was done by the chloroform-methanol mixture method (Folch *et al*., 1956).[28]

2.4 Estimation of Fatty acids

Fatty acids in the sample were identified and quantified methyl esters in NEON II gas chromatography instrument following the procedure outlined by Niller and Berger (1985).[29]

2.5 Estimation of vitamins

An Agilent 1100 chromatographic system [30] was used for the analysis and quantification of vitamins in the algal samples.

2.6 Mineral analysis

The mineral composition of experimental algae was determined by atomic absorption spectrophotometer (Perkin–Elmer model 303). Samples were subjected to acid digestion and analyzed according to the procedure described by Farias *et al*., (2001).[31]

2.7 Sterol analysis

The sterol composition of experimental algae was determined by atomic absorption spectrophotometer (Perkin–Elmer model 303). The fractions was extracted in to a mixture of n-hexane:chloroform (94:1 v/v) with heating at 80^0C for 2 hrs.

3. Results and Discussion

The results are shown in the form of tables with statistical significance. Carbohydrate is one of the important components for metabolism and it supplies the energy needed for respiration and other most important processes[32]. Any macrobiotic diet should contain carbohydrates, lipids and protein which the algae possess in the following proportion as given in Table **1**, among that protein occupies a major compound and follows carbohydrates. The lipids show very least quantity.

Table 1: Biochemical content of *Lobophora variegata*

S. No	Biochemicals	Composition (%)
1	Total carbohydrates	19.34 ± 0.10
2	Total proteins	23.13 ± 0.05
3	Total lipids	0.27± 0.5

Table **2** gives the vitamin content of the experimental algae, in that eleven vitamins, calcium panthothenate, vitamin A and niacin were detected in average amount when compared with vitamin C, which is present in huge amounts. Gas chromatographic analysis of the shade dried samples showed the presence of ten fatty acids where Omega fatty acid formed the bulk of the total fatty acid content (Table **3**). Among the thirteen minerals Calcium formed the major ones as depicted in Table **4.** Finally there are four sterols were identified and in that Stigmasterol & Campesterol is the higher amount, which is present in the Table **5.**

Table 2: Vitamin contents of *Lobophora variegata*

S. No	Vitamins	mg/100g (Mean ± SD)
1	Vitamin C	23.430 ± 0.152^{h}
2	Vitamin B6	0.3040 ± 0.002^{b}
3	Vitamin B12	0.1190 ± 0.002^{a}
4	Vitamin A	10.340 ± 0.010^{g}
5	Vitamin E	2.1330 ± 0.0153^{e}
6	Vitamin B1	0.3771 ± 0.002^{b}
7	Vitamin B2	0.3491 ± 0.002^{b}
8	Vitamin D	0.6442 ± 0.0015^{c}
9	Niacin amide	4.0162 ± 0.0150^{f}
10	Folic acid	1.983 ± 0.002^{d}
11	Calcium pantothenate	10.3600 ± 0.010^{i}
F- Value		98220.000
P- Value		0.000

Values are expressed as Mean ± SEM, n=3 as Anova test p<0.05% level.

Table 3: Fatty acid profile of *Lobophora variegata*

S. No	Fatty acids	*Composition (%)*
1	Palmitic acid	0.0816 ± 0.1000^{c}
2	Margaric acid	0.1137 ± 0.0010^{g}
3	Stearic acid	0.0834 ± 0.010^{d}
4	Oleic acid	0.1134 ± 0.0010^{f}
5	Linolenic acid	0.2834 ± 0.0020^{i}
6	Alapha linolenic acid	0.1184 ± 0.0010^{h}
7	Moroctic acid	0.0096 ± 0.0001^{a}
8	Omega Fatty Acid	0.9832 ± 0.002^{j}
9	DHA	0.0871 ± 0.001^{e}
10	EPA	0.1948 ± 0.003^{b}
F- Value		7803.000
P- Value		0.000

Values are expressed as Mean ± SEM, n=3 as Anova test p<0.05% level.

Table 4: Mineral contents of *Lobophora variegata*

S. No	Minerals	mg/100g (Mean ± SD)
1	Calcium	135.4 ± 0.20^{j}
2	Magnesium	2.343 ± 0.015^{d}
3	Iron	0.119 ± 0.002^{a}
4	Sodium	25.56 ± 0.152^{h}
5	Potassium	34.43 ± 0.152^{i}
6	Copper	0.119 ± 0.0012^{a}
7	Zinc	5.653 ± 0.0153^{f}
8	Iodine	3.110 ± 0.021^{e}
9	Phosphorus	14.65 ± 0.020^{g}
10	Manganese	1.960 ± 0.0152^{c}
11	Chromium	2.440 ± 0.200^{b}
12	Lead	0.454 ± 0.200^{b}
13	Cadmium	0.214 ± 0.201^{a}
P- Value		60521.00
F- Value		000

Values are expressed as Mean ± SEM, n=3 as Anova test p<0.05% level.

Table 5: Sterol content of *Lobophora variegata* (mg/g)

S. No	Sterol	*Lobophora variegata*
1	Beta-sitosterol	0.3443 ± 0.002^{b}
2	Sistostanol	0.1936 ± 0.0015^{a}
3	Campesterol	0.5943 ± 0.0015^{c}
4	Stigmasterol	0.6044 ± 0.001^{d}
F- Value		71840.000
P- Value		0.000

Values are expressed as Mean ± SEM, n=3 as Anova test p<0.05% level.

4. Conclusion

The investigation revealed the richness of alga in protein and carbohydrate content; the lipid content being least, the Vitamin C formed the major part in addition to Vitamin A and Vitamin B1. The alga is rich source of omega fatty acid, calcium and phosphorus formed the major bulks in the minerals as well as in fatty acid content. Likewise, the sterol compounds such as Stigmasterol and Campesterol which is present in the experimental alga. Thus, the overall observation of the present study suggests that the brown alga *Lobophora variegata*, shows nutritive biochemical properties and promising as a source of pharmacognosical value. Hence, it can be used in food industry for nutritional purpose and pharmaceutical industry as a source of basic materials in the preparation of nutrient supplement products and fine chemical synthesis.

Reference

[1] Mishra, V.K., F. Temelli, P.F. Ooraikul Shacklock and J.S. Craigie, Lipids of the red alga *Palmariapalmata*. Botanica Marina, 1993; 36 (2): 169-174.

[2] Burtin P. Nutritional value of seaweeds. *EJEAFChe* 2003; 2(4):498-503.

[3] Norziah, M.H. and Y. Ching Ch, Nutritional composition of edible seaweeds *Gracilaria changgi*. *Food Chemistry*, 2002; 68: 69-76.

[4] Sanchez-Machado, D.I., J. Lopez-Hernandez and P. Paseiro-Losada, High-performance liquid chromatographic determination of "-tocopherol in macroalgae. *J. Chromatography*, 2002; 976: 277-284.

[5] Wong, K.H. and P.C.K. Cheung, Nutritional evaluation of some subtropical red and green seaweeds. Part I-proximate composition, amino acid profiles and some physico-chemical properties. *Food Chemistry* 2000; 71: 475-482.

[6] Robledo, D. and Y.F. Pelegrin, Chemical and mineral composition of edible seaweed species of Yucatan. *Botanica Marina* 1997; 45: 58-65.

[7] Dawes, C.J., C. Kovach and M. Friedlander, Exposure of *Gracilaria* to various environmental conditions II. The effect on fatty acid composition. *Botanica Marina* 1993; 36: 289-296.

[8] Kaehler, S. and R. Kennish. Summer and winter comparisons in the nutritional value of marine macroalgae from Hong Kong. *Botanica Marina* 1996, 39: 11-17.

[9] Darcy-Vrillon, B., Nutritional aspects of the developing use of marine macroalgae for the human industry. *Intl. J. Food Sci. Nutrition* 1993; 44: 23-35.

[10] Mabeau, S. and J. Fleurence, Seaweed in food products: Biochemical and nutritional aspects. Trends in Food Sci. Technol., 4: 103-107. Fujiwara-Arasaki, T., N. Mino and M. Kuroda, 1984. The protein in human nutrition of edible marine algae in Japan. Hydrobiologia 1993; 116/117: 513516

[11] Nisizawa, K., H. Noda, R. Kikuchi and T. Watanabe. The main seaweed foods in Japan. *Hydrobiologia* 1987, 151/152: 5-29.

[12] Watanabe, T. and K. Nisizawa, The utilization of wakame (*Undaria pinnatifida*) in Japan and manufacture of "haiboshi wakame" and some its biochemical and physical properties. *Hydrobiologia* 1984; 116/117: 106-111.

[13] Ito, K. and K. Hori, Seaweed: Chemical composition and potential uses. *Food Review International* 1980; 5: 101-144.

[14] Lewis, E.J., a. Studies on the proteins, peptides and free aminoacid contents in some species of *Padina* from South-eastern coast of India. *Current Sci.* 1962; 31: 90-92.

[15] Lewis, E.J., b. Studies on the proteins, peptides and free aminoacid contents in some species of brown algae from South-eastern coast of India. *Review of Algalogy*, 1962; 6: 209-216.

[16] Fleurence J. Seaweed proteins: Biochemical, nutritional aspects and potential uses. *Trends Food Sci Technol* 1999; 10:25-28.

[17] Galland-Irmouli, A. V., Fleurence, J., Lamghari, R., Luc_on, M., Rouxel, C., Barbaroux, O., et al. Nutritional value of proteins from edible seaweed *Palmaria palmata* (Dulse). *Journal of Nutritional Biochemistry*, 1999; 10: 353–359.

[18] Fleurence, J., Gutbier, G., Mabeau, S., & Leray, C. Fatty acids from 11 marine macroalgae of the French Brittany coast. *Journal of Applied Phycology* 1994; 6: 527–532.

[19] McDermid, K. J., & Stuercke, B. Nutritional composition of edible Hawaiian seaweeds. *Journal of Applied Phycology*, 2003; 15: 513–524.

[20] Takenaka, S., Sugiyama, S., Ebara, S., Miyamoto, E., Abe, K., Tamura, Y. et al. Feeding dried purple laver (Nori) to vitamin B12-deficient rats significantly improves vitamin B12-status. British Journal of Nutrition, 2001; 85: 699–703.

[21] Dawes, C.J., Marine Botany. John Wiley &Sons, Inc. New York, 1998. pp: 480.

[22] Wong, K. and Cheung, P.C. Nutritional evaluation of some subtropical red and green seaweeds. Part 1-proximate composition, amino acid profiles and some physico-chemical properties. *Food Chemistry* 2000; 7: 475– 482.

[23] Nabil S and Cosson J. Seasonal variations in sterol composition of *Delesseria sanguinea* (Ceramiales, Rhodophyta). *Hydrobiologia* 1996; 326/327: 511–514.

[24] Dunford NT and King JW. Phytosterol enrichment of rice bran oil by a supercritical carbon dioxide fractionation technique. *Journal of Food Science* 2000; 65 (8): 1395–1399.

[25] Beveridge THJ, Li TSC, and Dover JCG. Phytosterol content in American ginseng seed oil. *Journal of Agriculture and Food Chemistry* 2002; 50: 744–750.

[26] Dubois, M., K.A. Giles, J.K. Hamilton, P.A. Rebors and F. Smith, Analytical Chemistry, 1956; 28: 350-356.

[27] Raymont, J.E.G., J. Austin and E. Lineford,. *J. Cans. Perm. Emplor. Mer*. 1964; 28: 354-363.

[28] Folch, J., M. Lees and G.H. Solane Stanley, *J. Biological Chemistry* 1956; 226: 497-509.

[29] Niller, S and Berger, T. Bacteria identification by GC Hewlet Packard Application note oo 1985; 228-241.

[30] AOAC. Official methods of analysis, 16th ed. Association of Official Analytical Chemists 1995.

[31] Farias, W.R.L., Nazareth, R.A and Mourao, P.A.S. *Thromb. Haemost* 2001; 86: 1540-1546.

[32] Bligh, E. G. and Dyer, W. J. () A rapid method of total lipid extraction and purification. *Can. J. Biochem. Physiol* 1959; 37: 911 - 917.