

ON THE BIOCHEMICAL COMPOSITION OF TEN SPECIES OF THE GENUS *CAULERPA*, (CAULERPALES – CHLOROPHYTA), COLLECTED FROM KARACHI COAST

Phool B. Zahid

Department of Botany, University of Karachi, Karachi-32

(Received September 30, 1987; revised February 11, 1989)

This paper deals with the biochemical composition of a set of ten species of sea weed belonging to the genus *Caulerpa* of class Chlorophyceae (green algae), studied during 1985-87. Protein, cholesterol, triglycerides, phospholipids, nitrogen, iron, ash and total fat have been estimated. Significant variations were observed in some of the constituents among ten different species of the genus *Caulerpa*.

Key words: *Caulerpa*, Biochemical, Karachi.

INTRODUCTION

The coastal area of Pakistan is known to very rich in valuable food and energy resources. But unfortunately no substantive economic advantages have been derived from it so far. However some work on taxonomy, morphology and life history of *Caulerpa* were studied by Boergessen [1,2], Anand [3] and Nizamuddin [4].

In this connection attempts were made by other workers to exploit sea weed as unconventional source of supplementary food and as a source of fertilizer [5-8]. Recently some reports were made on biochemical composition of sea weeds of Karachi coast by Qasim [9], Hasani and Zahid [10].

An attempt has been made to determine the protein, cholesterol, triglycerides, phospholipids, nitrogen, iron, ash and total fat contents in a set of ten species of the genus *Caulerpa* which grows luxuriantly along Karachi coast in order to make them utilizable directly or indirectly as food, feed and fodder.

MATERIALS AND METHODS

The experimental work includes the studies of some of the biochemical analysis of the ten-species of genus *Caulerpa* viz; *Caulerpa chemnitzu* Lamouroux, *C. faridii* Nizamuddin, *C. fastigiata* Montagno, *C. lentillifera* J. Agardh, *C. peltata* Lamouroux, *C. quveshii* Nizamuddin *C. racemosa* J. Agardh, *C. scalpelliformis* C. Agardh *C. sertularoides* Howe and *C. taxifoba* C. Agardh were collected from the coast of Manora, Paradise Point, Buleji, Hawks Bay and Cape Monze during October to March in the year 1985-87. Identification of species were done according to Nizamuddin [4].

Collected materials were washed with sea water followed by rinsing under tapwater. The plants were then dried on wire nets in open air under sunshine, further kept in an

oven at 60° then ground to fine powder and kept in tightly covered bottles for biochemical analysis. The results were summarized in (Table 1). Each value is a mean of seven samples calculated as percentage dry weight of the species separately. Standard methods AOAC [11] were followed generally for the estimation.

Cholesterol was determined according to Zak method [12]. Triglyceroid was estimated by Stern-Shapiro method [13] phospholipid was determined according to Zilver-smith and David's method [14]. Total nitrogen and protein contents were determined by Microkjaldhal method [15]. Fe⁺⁺ contents was determined by method adapted by Harold [16]. Ash content was estimated according to official methods of AOAC [11]. Fat content of the seaweeds was analysed by Soxhlet extraction with *n*-hexane as solvent.

RESULTS AND DISCUSSIONS

The mean results of the percentage of total protein, cholesterol, triglyceroids, phospholipids, nitrogen, iron, ash and fat as mg % dry weight are summarized in Table 1.

Results represented in the tables have been discussed by comparing their nutritional contents with each other, with the values reported by other workers and with the conventional foods [1-17] in order to give a clear picture of nutritional significance and utility of *Caulerpa* species as food and fodder.

The biochemical composition of the genus *Caulerpa* vary among species to species and their ecological conditions. Protein contents of a set of ten species vary between 24.42-48.98 % mg dry wt. On comparison among the species it appear that *Caulerpa faridii* has nearly double the amount of protein contents than other species of *Caulerpa* (Table 1), and nearly 3-5 times greater than conventional food such as wheat, spinach, mutton and Oranges [17]. On the basis of these observations it is

suggested that *Caulerpa* species may be utilized for the supplementation of conventional and common food proteins for animals and human beings.

Significant variation in the cholesterol levels were observed between 27.88-71.52 % mg dry wt. Greater values were observed in *Caulerpa faridii* and lowest in *Caulerpa lentillifera* respectively.

Marked variations were observed in triglyceroid contents which vary in between 44.00-76.65 % mg dry wt. Highest percentage was recorded in *Caulerpa faridii* and lowest in *Caulerpa chemnitzii* respectively, which is almost double in quantity as compared to conventional foods [1-17].

Phospholipids were observed in between 13.30-27.80% mg dry wt. Greater values were recorded in *Caulerpa*

taxifolia and smaller in *Caulerpa faridii*, which is in any way is greater than common leafy food [1-17].

Nitrogen content was greater in *Caulerpa faridii* and lowest in *Caulerpa chemnitzii* in between 3.90-7.80 % mg dry wt. which is not very good as compared to some of the nitrogen fixing blue, green algae [7,15].

The iron content was present in between 0.25-2.00 % mg. dry wt. was recorded in greater quantity in *Caulerpa faridii* and smallest in *Caulerpa chemnitzii*, which is poor in quantity as compared to other conventional food [1-17].

For the analytical purpose it is essential to determine the ash contents, because the presence of ash affects the percentage composition of other contents. Ash contents was found to be highest in *Caulerpa racemosa* and lowest in *Caulerpa lentillifera* i.e. in between 17.60-33.20 % mg

Table 1. Biochemical composition of *Caulerpa* species.
(Results are expressed as percentage dry weight of seaweed).

Parameters mg % D.wt.	Name of species									
	<i>Caulerpa chemnitzii</i>	<i>Caulerpa faridii</i>	<i>Caulerpa fastigiata</i>	<i>Caulerpa lentillifera</i>	<i>Caulerpa peltata</i>	<i>Caulerpa qureshii</i>	<i>Caulerpa racemosa</i>	<i>Caulerpa scalpelliformis</i>	<i>Caulerpa sertularoides</i>	<i>Caulerpa taxifolia</i>
Protein	24.42 ± 0.01	48.98 ± 0.27	37.92 ± 0.23	40.63 ± 0.25	46.90 ± 0.98	42.50 ± 0.20	27.55 ± 0.10	30.02 ± 0.81	28.12 ± 0.15	26.25 ± 0.18
Cholesterol	63.22 ± 0.22	71.52 ± 0.12	69.42 ± 0.45	27.88 ± 0.10	65.05 ± 0.12	40.05 ± 0.35	53.50 ± 0.39	66.65 ± 0.15	33.80 ± 0.15	43.53 ± 0.22
Triglyceride	44.06 ± 0.02	76.65 ± 0.10	51.55 ± 0.99	44.25 ± 0.16	46.52 ± 0.16	53.02 ± 0.17	48.72 ± 0.09	74.05 ± 0.11	61.08 ± 0.08	65.53 ± 0.06
Phospholipid	15.55 ± 0.02	27.82 ± 0.07	15.22 ± 0.07	20.00 ± 0.05	16.06 ± 0.06	16.65 ± 0.03	14.50 ± 0.09	19.08 ± 0.02	15.52 ± 0.08	13.33 ± 0.06
Nitrogen	3.93 ± 0.06	7.81 ± 0.04	5.92 ± 0.01	6.52 ± 0.05	7.52 ± 0.06	6.82 ± 0.02	4.45 ± 0.02	4.80 ± 0.01	4.55 ± 0.02	4.25 ± 0.03
Iron	0.55 ± 0.01	1.66 ± 0.00	0.50 ± 0.01	0.62 ± 0.03	0.33 ± 0.05	2.00 ± 0.02	0.25 ± 0.06	0.75 ± 0.05	1.27 ± 0.02	0.50 ± 0.02
Ash	30.00 ± 0.01	28.02 ± 0.09	31.20 ± 0.06	17.65 ± 0.05	30.00 ± 0.09	32.00 ± 0.08	33.25 ± 0.09	19.82 ± 0.02	22.00 ± 0.10	18.91 ± 0.03
Total fat	3.00 ± 0.04	3.81 ± 0.04	3.25 ± 0.04	2.82 ± 0.06	3.55 ± 0.05	3.33 ± 0.03	1.65 ± 0.06	3.89 ± 0.07	2.95 ± 0.09	2.62 ± 0.03

Mean. ± Standard error of mean

Note: Each value is a mean of seven samples.

dry wt. These values appear to be very high as compared to some commonly consumed conventional foods such as vegetable, mutton and oranges [10]. This is mainly due to the presence of the higher content of inorganic elements which is a common feature of marine green algae.

Highest quantity of fat contents was recorded in *Caulerpa faridii* and *C. scalpelliformis* and lower percentage was observed in *Caulerpa racemosa* values vary in between 1.60-3.80 % mg. dry wt. respectively. The highest values are more than triple of the conventional food [10]. *Caulerpa* species, therefore can serve as a cheaper and inexpensive source of edible fat and oil.

It is evident from the above results and discussion that this set of ten species of *Caulerpa* exhibit a marked variation in some of their biochemical composition. *Caulerpa faridii* seems to be the best among all the ten species, because it contain a higher percentage of protein, cholesterol, triglyceroid, nitrogen and fat contents. However, percentage of iron was greater in *Caulerpa qureshii* and higher percentage of ash content has also been recorded in *Caulerpa racemosa*. A high percentage of phospholipid was observed in *Caulerpa taxifolia*. It is concluded, therefore, that green marine algae *Caulerpa* could be utilized as food and fooder for man and animals.

Acknowledgement. Author wishes to express her gratitude to Miss Iffat Bano and Mrs. Saleha Hasani of the Department of Biochemistry, University of Karachi, for their help in Biochemical analysis of the material.

REFERENCES

1. F. Boergessen, J. Indian Bot. Soc., **11** (1932).
2. F. Boergessen, J. Indian Bot. Soc., **13** (1934).
3. P.L. Anand, *Marine Algae from Karachi*, Chlorophyceae (Pub. Lahore, 1940), pp. 1-52.
4. M. Nizamuddin, Botanica Marina, **6**, 204 (1964).
5. E.H. Fink, Nutr. Rev., **16**, 22 (1958).
6. S.K. Lee, Disser. Abst. (B) **27**, 3584B (1954).
7. T. Levering, H.A. Hoppe and O.J. Schmid, *Marine Algae, A Survey of Research and Utilization* (Cram. de Gruyter and Co., Hamburg, (1969), pp. 288.
8. R.G. Parek, L.V. Maru and M.J. Dava, Bot. Marina, **20**, 359 (1977).
9. R. Qasim, A. Zain and B. Zain, J. Sc. Univ. Kar., **4**, 1 (1976).
10. S. Hasani and P.B. Zahid, Pak. J. Sc. Ind. Res., **29**, 4 (1986).
11. A.O.A.C., *Official Methods of Plant Analysis* (Association of Official Agricultural Chemist, Washington, 1960).
12. B. Zak *et al*, Am. J. Clinical Pathology, **24**, 1307 (1954).
13. R. Stern - Shapiro, J. Clinical Pathology, **6**, 158 (1953).
14. D.B. Zilversmith and A.K.J. Davis, J. Lab. Clin. Med., 35-155 as Cited in Clinical Lab. Methods and Diagnosis, **1**, 248 (1963), 6th ed.
15. B. Hawke, B.L. Oser and W.H. Summerson, *Practical Physiological Chemistry* (McGraw Hill Book Co., New York, 1954), 13th ed., pp. 560.
16. V. Harold, *Practical Clinical Biochemistry* (1969), 4th ed., pp. 254, 472.
17. M.I.D. Chughtai, A.W. Khan, Nutritive Value of Food Stuffs and Planning of Satisfactory Diets in Pakistan, Part I, 4, 9, 13 and 15 (1960)