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TAXONOMY AND SOME BIOCHEMICAL VALUES OF *CAULERPA TAXIFOLIA* AND *HYPNEA MUCIFORMIS* COLLECTED FROM KARACHI COAST

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Two species of sea-weeds, *Hypnea muciformis* and *caulerpa taxifolia,* belonging to the glasses of red and green algae respectively were selected for studying their morphology and biochemical composition. Nutrients-carbohydrates, protein, vitamin 'C' and inorganic elements-Na^+, K^+, Cu and Fe contents were determined and have been reported here.

Key words: Sea Weed; Nutritional Analysis

INTRODUCTION

Arabian Sea contains a variety of sea-weeds in large quantities. The marine plants have attracted the attention of phycologist and biochemists because of their possible economical uses. As compared to land plants, seaweeds are composed of a better variety of carbohydrates, protein, fat, vitamins and minerals as investigated by Fink [1], Dean *et al* [2]; Peat and Turvey [3]; Lee [4]; Midwick and Raiph [5]; Levering *et al* [6]; Chapman [7]; Jensen [8] and Parekh *et al* [10].

The coast of Karachi has a very luxuriant marine algal vegetation. Biochemical studies of *Caulerpa taxifolia* and *Hypnea muciformis* were followed in order to make use of them as food, feed or fodder for man, poultry and cattle. A comprehensive record of taxanomy and biochemistry with the point of view to investigate the nutritive value of marine algae of Karachi coast in order to make them utilizable directly or indirectly as food, feed or fodder has been attempted in this paper. Morphological and anatomical studies were made to confirm the species nomenclature.

DESCRIPTION OF SPECIES

Caulerpa taxifolia [11, 13]; Plant aseptate coenocyclic, differentiated into prostrate branched horizontal axis and erect assimilators are with ramuli, horizontal axis terete, prostrate, branched, upto 1.5 mm. broad, with much branched rhizoids. Assimilators erect and flat, lanceolate, stalked, upto 15 cm. long and upto 3 mm. broad, ramuli laterally compressed, opposite, sickle-shaped, apex mucronate, constricted at the base.

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Internal structure composed of trabeculate which are extension of the cell-wall (Fig.1).

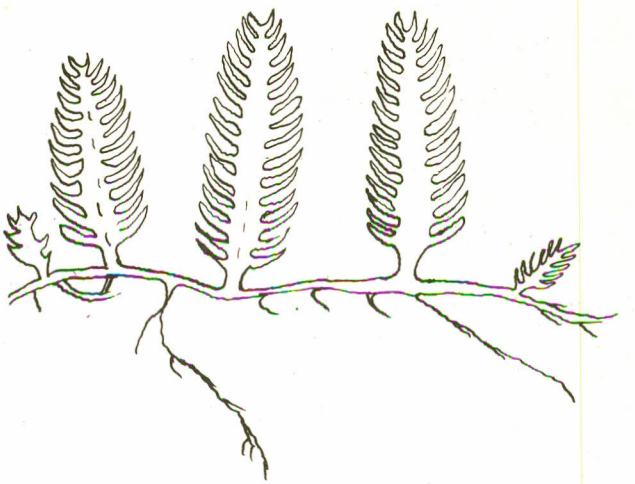

Fig. 1. *Caulerpa Taxifolia*

Plants occur along the coast of Manora, Hawk's Bay, Paradise Point and Buleji and was collected from November to February .

Hypnea muciformis. [12] Fronds filiform, purple red in colour, much branched, cartilaginous, branches irregular giving a bushy look to the plant, tips of the main and principle lateral branched elongate, typically swellen and crozier hooked.

The internal structure shows a central cell 16-18 μm in dia. surrounded by a ring of 6-7 large angular cells, 25-38 μm in dia. (Fig.2).

Plant which occurs in drift algae, was collected at Manora, Sandspit and Buleji in January.

Fig. 2. *Hypnea muciformis*

MATERIALS AND METHODS

The experimental work includes studies of morphology and biochemical analysis of the algae in order to determine their ash contents-carbohydrate, protein, fat and vitamin 'C', Na^+, K^+, Cu^{++} and Fe. Biochemical studies were carried out in sun dried samples except for vitamin C which was estimated in fresh samples of algae.

Sea-weeds were collected from different localities such as Manora, Paradise Point, Hawk's Bay and Buleji during the months of November-February 1983. These were washed with seawater followed by the rinsing under tapwater.

After species identification, the material was divided into two portions; one portion was dried 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 other portion of the fresh algae was used for analysis of vitamin C.

Moisture content was determined by drying the algal powder at 100-105° in an oven [14]. Ash content was estimated according to official method of A.OA.C. [15]. Protein content was determined by Macrokjeldahl method [16]. Total lipids was extracted by double solvent extraction [17]. For vitamin C estimation the Rockenther procedure was adopted [18]. The ash of the sea-weeds was analyzed for different inorganic elements by using different standard methods. Na^+ and K^+ were estimated by flame photometer [19-20]. The Fe and Cu^{++} content of these sea-weeds could not be detected by the methods applied in this study [16 and 21].

RESULTS AND DISCUSSION

The results are summarized in the Table. Energy nutrients (carbohydrate, fat and protein) and inorganic elements were calculated as g. (%) of the dry weight of sea-weeds. Vitamin C was calculated as of fresh samples due to its heat labile nature.

Results represented in the Table have been discussed by comparing their nutritional content with each other, with the values reported by other workers and with the conventional foods (data obtained from literature ref.no.22) to give a clearer picture of nutritional significance and utility of marine algae as food and fodder for man and animals.

For the analytical purpose it is essential to determine the ash content because the presence of ash affects the percentage composition of other contents. Ash contents of *Hypnea muciformis* was found to be much higher than of *Caulerpa taxifolia.* In an earlier study less ash value has been reported for *Caulerpa taxifolia* but approximately the same for *Hypnea muciformis* [23]. If these values are compared with some commonly consumed conventional foods, e.g. wheat, spinach, mutton and oranges (see the Table), appear to be very high. This is mainly due to the presence of the higher content of inorganic elements and sand particles which is a common feature of marine plants.

Carbohydrate contents of *Caulerpa taxifolia* (green algae) is 2½ times higher than that of *Hypnea muciformis* (red algae). Similar results were reported in 1981 [24]. The carbohydrate content of *Caulerpa taxifolia* is very close to even a very good source of the carbohydrate among the conventional foods that is wheat and far higher than other common foods – spinach, mutton, oranges (see Table 1). On the basis of these results it is suggested that *Caulerpa taxifolia* can be used as a good source of energy nutrients in calorie deficiency diseases.

Table 1. Values/100 g of dried sea-weeds chemical composition of two different sea-weeds

Sea-weeds	Ash gm %	Carbohydrate gm %	Protein gm %	Fat gm %	Vitc mg %	Na^+ gm %	K^+ gm %
Caulerpa Taxifolia (green algae)	14.77	65.80	5.84	–	6.5	0.138	0.116
Hypnea Mucifomis (red algae)	35.34	24.98	15.23	3.7	9.25	0.258	0.032
Name of conventional* foods							
Wheat (Punjab 14)	1.6	77.1	9.9	1.1	–	–	–
Spinach	1.5	4.2	2.0	0.3	52.3	–	–
Mutton	1.3	1.0	18.5	13.3	–	–	–
Oranges	0.5	7.9	1.2	0.2	38.4	–	–

*Values have been taken from the literature Ref. No. 22.
1. Each value is a mean of five samples.
2. Vitamin C was estimated in fresh samples.

Protein content of *Caulerpa taxifolia* is approximately three times less than that of *Hypnea muciformis*. On comparison with conventional foods it appears that the protein content of *Caulerpa taxifolia* is 2½ times greater than common leafy vegetables such as spinach while the protein content of *Hypnea muciformis* is very near to one of its best sources among the conventional foods that is mutton and nearly double to wheat and greater than spinach and oranges (see Table). On the basis of these observations it is suggested that these algae and especially *Hypnea muciformis* may be used for the supplementation of conventional and common foods proteins for animals and human beings.

The fat content of *Caulerpa taxifolia* could not be estimated due to scarcity of samples. *Hypnea muciformis* contains about 3.7 g of fat which is more than triple of wheat and far greater than spinach and oranges but four times less than mutton fat content (see Table 1). Marine algae can serve as a very cheaper and inexpensive source of edible fat and oil for which our country is spending lacs of money to import it from foreign countries to fulfil the country's requirements.

In vitamins only vitamin C content was determined. The vitamin C of both species is far less than the conventional sources of vitamin C such as oranges and spinach. As far as other micronutrients are concerned only Na^+ and K^+ could be detected by the method applied during this study. Na^+ content of *Hypnea muciformis* was greater than *Caulerpa taxifolia* while amount of K^+ is greater in *Caulerpa taxifolia* in comparison with other specie studied. Higher values of these minerals in these species have been reported in an earlier work [Rashida Qasim, 23]. Cu^{++} and Fe could not be detected by the methods applied in this study [16 and 17].

From the above results and discussion it becomes quite evident that *Hypnea muciformis* (red sea-weed) is a superior quality of marine algae than *Caulerpa taxifolia* (green sea-weed). Hence it may be concluded that *Hypnea muciformis* could be utilized as food, feed for men, chicks and animals as it is being used in different countries reported by many workers [6, 7, 8 and 9].

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