

Mineral Profile of Edible Marine Algae *Padina Tetrastromatica*, Hauck

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ABSTRACT

Seaweeds are an important ingredient of functional foods recommended for daily food due to their unique compositions and nutritional value. They are the vital source of rich nutrition in dietary fibre, low lipid content, high polysaccharide concentration, minerals, polyunsaturated fatty acids and vitamins. The nutritional and pharmacological potential of marine macroalgae drives our continuous interest in investigating the edible seaweeds. The present study mainly focuses on the mineral profile of the edible algae *Padina tetrastromatica*, collected from Thikkodi coast, Kerala. *P. tetrastromatica*, belongs to the family Dictyotaceae, which have the copious source of pharmacologically active compounds and exhibits unlike properties such as antibiotic, anticoagulant, antihyperglycemic, antiviral and anti-cancerous. Thus the present study reveals the mineral profile of the edible marine algae *P.tetrastromatica*, which has higher amount of Calcium, Potassium, Magnesium and low amount of Iron . The results concluded that the marine brown algae selected for the present study holds a good amount of primary and secondary metabolites.

KEYWORDS: Seaweeds, Secondary metabolites, Minerals, Nutritional value, Pharmacology.

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INTRODUCTION

Algae provide valuable nutrients to the human diet. As the human population is increasing the demand of nutrition is increasing concomitantly. The algae can be used as the source of minerals and supplements. The algae can be named as a food of future, that will help to feed the increasing population. Daily supplementations with algae derived calcium may increase bone mineral density in women with age related problems. They are rich in dietary fibre and proteins than the beans and grains. *Padina tetrastromatica*, belongs to the family Dictyotaceae and is known to have the rich source of pharmacologically active compounds and exhibits the properties such as antibiotic, anticoagulant, antihyperglycemic, antiviral and anti-cancerous. It is important to develop a strategy to use local algae resources. Marine algae can be developed as a resource with wide industrial and medical uses, notably for commercial interest as well as versatile sustainable ecological development.

Seaweeds have significant economic value since they can be utilized as vegetables, traditional medicines, organic fertilizers, and livestock feed. (Da Costa *et al.*, 2018). In general the phaeophyceae members constitute the major

component of the seaweed population of the tropical countries of the world. The *P.tetrastromatica* is a marine brown algae commonly distributed in Atlantic, Indian, Pacific oceans. The plants grow on rocks or dead coral in subtidal zones along moderately wave exposed shorelines. They are widely consumed by Asians as nutraceutical food due to their antioxidant properties. It's one of the prominent and dominant perennial algae that confirm its presence throughout the year. They are rich in calcium deposits. Brown seaweed is used as animal feed, food ingredients and fertilizers. They are rich in mineral sources like Sodium, Potassium, Magnesium, Calcium, Iron, Carbohydrates, Proteins and vitamins.

Minerals are naturally occurring inorganic elements that are essential for the proper functioning of the body. They perform several roles in the body. These are not produced by the body in larger amounts, therefore they need to be taken through the food. Minerals are needed for the composition of body fluids, bone, teeth, muscles and nerves. They have a role such as maintenance of osmotic pressure, as coenzymes, for growth and development, immune response, healing, chemical balance etc.

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Systematic classification

Kingdom: Chromista
Phylum : Ochrophyta
Class : Pheophyceae
Order : Dictyotales
Family : Dictyotaceae
Genus : *Padina*
Species : *tetrastromatica*



Figure:1 *Padina tetrastromatica*

MORPHOLOGY

P.tetrastromatica has flabellate thallus ,divided into several narrow overlapping blades almost to the base ,in the upper part the thallus split into small blades with inrolled edges ,7-15 cm high ,15-29 cm broad ,lightly calcified ,yellowish brown,olivegreen to dark brown ,markedly zonated due to reproductive organs on both sides of narrow rows of hairs.Hairs develop in concentric bands on the lower surface of the blade .Blades in young (inrolled) portion composed of 2 cell layers in the middle part of 3 cell layers to 90µm thick ,and at the base of 4 cell layers.Attachment by stypose holdfast to low intertidal and upper subtidal rocks and dead corals ,in areas with moderate wave activity.

MATERIALS AND METHODS COLLECTION OF SAMPLE

Padina tetrastromatica Hauck was collected from the rocky shores of Thikkodi coast of Kozhikode district ,Kerala.The collections were made in month of January.Freshly collected algae were shade dried for about a month ,then the dried samples were powdered and packed in sterile polythene bags.

MINERAL ANALYSIS

The mineral analysis was found out using EDAX APEX software .The minerals were quantified for analysis. EDAX APEX software is a new microanalysis software package that offers uncomplicated and practical user interface, which makes it easier for novice and advanced users alike to accomplish their EDS analysis goals. Data quality is maintained while increasing productivity with the addition of common user interface tools in an appealing and flexible software display .(EDAX Smart Insight).

RESULTS AND DISCUSSION

The sample *P.tetrastromatica* was analysed to find out the mineral profile and was represented (table:1 and chart:1).In the present study based on mineral composition, Calcium (8g) and Potassium (7g) ,Magnesium (6g) has showed maximum content ,followed by Aluminium and Chlorine (4g each) ,Phosphorus and Sodium (2g each) and Iron (1g) was found to be very low. The Recommended Dietary Allowance (RDA) is the average daily level of intake

sufficient to meet the nutrient requirements of nearly all (97-98%) healthy people.From the data analysis it evident that the algal sample is nutritionally rich and better alternative for mineral consumption.The vitamin and mineral contents of edible seaweeds makethem nutritionally valuable.

The *P.tetrastromatica* contains essential elements and trace elements that mediate various biochemical reactions and cellular functions.

CALCIUM: The most abundant mineral in the body, it is especially important to bone and dental health, but is also involved in neural transmissions to the muscles.It plays a role in muscle movement and cardiovascular function. Calcium is a co-factor for many enzymes.

POTASSIUM: It's the third most abundant mineral in the body. A crucial mineral that regulates body electrolyte balance. It helps your nerves to function and muscles to contract. It helps your heart beat stay regular. It helps move nutrients into cells and waste products out of cells. Deficiency can cause heart arrest, hypertension, adrenal exhaustion and muscular collapse.

MAGNESIUM: Magnesium is needed for more than 300 biochemical reactions in the body. It helps to maintain normal nerve and muscle function, supports a healthy immune system, keeps heart beat steady ,and helps bones remain strong. It also helps adjust blood glucose levels. It aids in production of energy and protein. Deficiency can lead to spasmodic muscle disorders, including cardiac irregularities. Helps assimilation of vitamin C, vitamin B and protein.

PHOSPHORU: The second most abundant mineral in the human body, it is found practically in every cell. The main function of phosphorous is in the formation of bones and teeth. Functions with calcium to maintain bone density. Helps to digest carbohydrates and the B vitamins niacin and riboflavin. Its also needed for the body to make protein for the growth. Phosphorus plays a major role in the growth of new tissue and division of cells. It is a vital component of DNA which contains the genetic data of all living things. Phosphorus is an essential mineral primarily used for growth and repair of body cells and tissue

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IRON : Promotes formation of haemoglobin, the oxygen-carrying blood pigment found in healthy red blood cells. Iron deficiency is most common among women in their reproductive years. Its the mineral that the body needs for growth and development .The body also needs iron to make some hormones.

SODIUM: The human body requires a small amount of sodium to conduct nerve impulses, contract and relax muscles and maintain the proper balance of water and minerals.

ALUMINIUM: Aluminium is a common component of fruits and vegetables and that is the main cause of our consumption.Ancient greeks used it as an astringent .They use aluminium additives today to make vaccinations more effective, aluminium sulfates are used for water purification and aluminium hydroxide is used to cure stomach ulcers.

CHLORINE:Chloride is one of the most important electrolytes in the blood.It helps keep the amount of fluid inside and outside of your cells in balance.It also helps maintain proper blood volume,blood pressure and pH of your body fluids

Kishneth *et al* (2021) reported the nutritional profile,antioxidant,antihyperglycemic properties,mineral composition of *P.tetrastromatica* from Tioman Island,Malaysia.A significant amount of calcium (Ca), was quantified. It is also noteworthy that the ratio of sodium/potassium (Na/K) in the algae was low, therefore, its advantageous to prevent hypertension (Aroyehun *et al.*,2020).Seaweeds with low ratios of Na/K are ideal for sodium chloride replacement. The Fe content in this brown alga is higher than several terrestrial vegetables, including

legumes, cereal grains, nuts, and green leafy vegetables. As it is required for haemoglobin and myoglobin production, its deficiency is characterised by anaemia causing symptoms, such as fatigue and body weakness (Abbaspour *et al.*,2014).

Among major macro elements, Ca remains the most abundant and accumulates in seaweeds at much higher levels than terrestrial food sources , not only to prevent bone-related diseases, but is necessary for intracellular functions and blood clotting . Overall, the variety of mineral and trace elements in seaweed in general and *P.tetrastromatica* in specific makes them one of the best approaches to address nutritional deficiencies.Asma *et al*(2015) reported , the mineral elements composition of three seaweeds chlorophytae (*U. lactuca*, *U.linza*) phaeophytae (*P.pavonica*).The primary macronutrient (N, PO₃⁻ and K⁺), secondary macronutrient: (Ca²⁺, Mg²⁺ and SO₂⁻), micronutrient (Na⁺ and Cl⁻), were determined.

Hema *et al* (2020) evaluated the phytochemical composition and mineral analysis *S.wightii*, *S.cristaefolium* and *P.tetrastromatica* from Thirumullavaram coastal region of Kollam, Kerala . Mineral analysis were done using ICP-AES method. Among the minerals, Calcium was found to be

higher in all the three brown algal members compared to Sodium and Potassium. An appreciable quantity of Iron was found to be more in *P.tetrastromatica* compared to other two species and all the other trace elements were found to be in low concentration. Thus the *P.tetrastromatica* can be provided as a dietary alternative due to its significant nutritional value.The commercial value can be enhanced by upgrading the quality and thereby expanding the range of seaweed – based products.

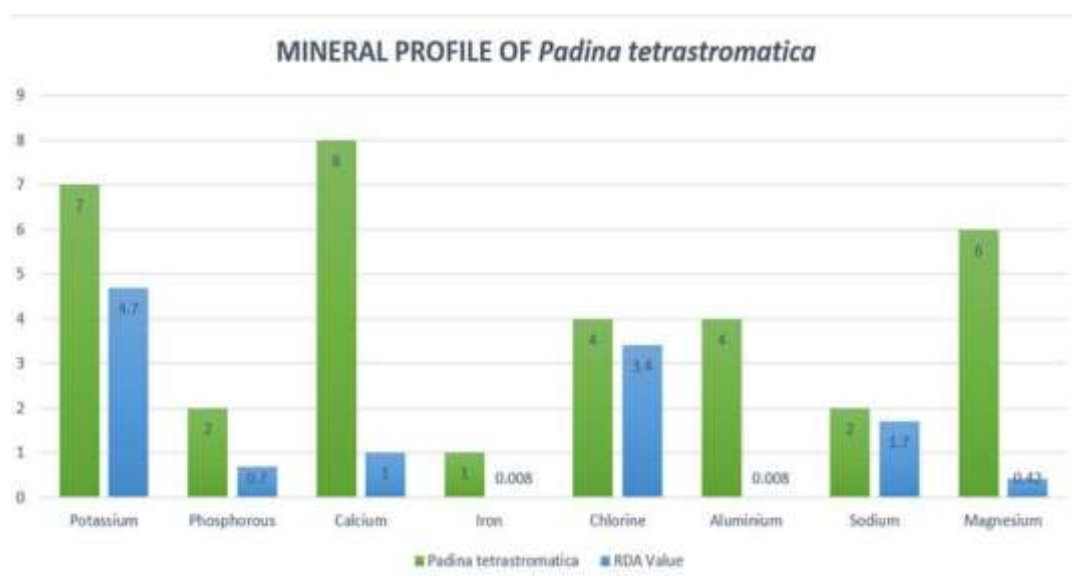


Chart-1: Chart representing the mineral profile of *Padina tetrastromatica*

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Table 1. Table representing comparison of Mineral profile *P.tetrastromatica* with RDA values.

SL NO	NUTRIENTS	CONCENTRATIONS (g/100g)	
		<i>P.tetrastromatica</i>	RDA Value
1	Potassium	7	4.7
2	Phosphorous	2	0.7
3	Calcium	8	1
4	Iron	1	0.008
5	Chlorine	4	3.4
6	Aluminium	4	0.008
7	Sodium	2	1.7
8	Magnesium	6	0.42

CONCLUSION

Mineral contents of the sample are found to be vary according to type of species, wave exposure, seasonal, annual, environmental and physiological factors. Apart from that the type of processing and method adopted for mineralization is also crucial. The present study reveals that seaweeds are a good source of mineral nutrients. Essential mineral content in seaweeds are at higher levels than many terrestrial mineral sources. With this possibility, further studies on biologically active secondary metabolites of *P.tetrastromatica* can be done to identify active components to be used as drugs. Seaweeds is a great source of functional food with various biological and nutritional properties essential for the requirements of increasing population. Thus, this natural resource must be sustainably maintained and cultivated for future stock and applications in mariculture, pharmaceuticals and nutraceuticals worldwide.

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