

Nutrient Composition of Two Edible Indonesian Marine Seaweeds from Binuangen Coast, Banten

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Abstract

Indonesia has a potency to be the biggest producer of seaweed in the world but most of the seaweeds are under-utilized and their health benefits are unknown. Seaweeds can be a very interesting natural source of new compounds with biological activity. This study was conducted to create a nutritional data for two species of seaweeds commonly found in Binuangen coast of south Banten in order to popularize its consumption and utilization. The proximate composition, minerals, protein, fat, carbohydrate profiles of two tropical edible seaweeds, *Ulva fasciata* and *Rhododymenia palmata*, were studied. The protein and carbohydrate content of seaweed were 11.55-17.61 g/100 g and 24.23-25.90 g/100 g dry weight (d.w.) respectively. The seaweeds were low in lipid content on dry weight basis. These seaweeds contain 7.98-11.01% macro-minerals (Na, K, Ca and Mg) and 695.48- 2048.19 ppm trace elements (Fe, Zn, Cu, and Mn). These seaweeds are nutritionally valuable thus making them a potential health ingredient for use as nutrition.

Keywords: nutrient composition, *U. fasciata*, *R. palmata*, Binuangen beach, Banten

Komposisi Nutrisi Dua Jenis Rumput Laut yang Tumbuh di Daerah Binuangen, Banten, Indonesia

Abstrak

Indonesia mempunyai potensi untuk menjadi produsen rumput laut terbesar di dunia tetapi sebagian besar tumbuhan tersebut masih belum dimanfaatkan dan manfaatnya untuk kesehatan belum banyak diketahui. Rumput laut adalah sumber bahan alami yang memiliki aktivitas biologis. Penelitian ini bertujuan mengetahui data kandungan gizi dari dua spesies rumput laut yang banyak ditemukan di pantai Binuangen, Banten dalam rangka mempopulerkan penggunaannya sebagai nutrisi di Indonesia. Profil mineral, protein, lemak dan karbohidrat dari dua jenis rumput laut yang biasa dikonsumsi, yaitu *Ulva fasciata* dan *Rhododymenia palmata* dianalisis. Kandungan protein dan karbohidrat rumput laut tersebut berkisar 11,55-17,61 g/100 g dan 24,23-25,90 g/100 g berat kering. Rumput laut tersebut mengandung lemak yang rendah, mengandung 7,98-11,01% mineral makro (Na, K, Ca dan Mg) dan 695,48- 2048,19 ppm elemen renik (Fe, Zn, Cu, dan Mn). Kandungan gizi kedua rumput laut tersebut bermanfaat untuk menjadi bagian nutrisi.

Keywords: kandungan gizi, *Ulva fasciata*, *Rhododymenia palmata*, pantai Binuangen, Banten

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Indonesia has potency to be a biggest producer of seaweed in the world but unfortunately, most of the Indonesian seaweeds are under-utilized, and its health benefits are unknown. Seaweeds can be a very interesting natural source of new compounds with biological activity.¹

Recently, the demands for seaweed product is increase, both as food and as an ingredient. The aim of this study was to investigate the nutritional composition of two species of seaweeds commonly found in Binuangen coast of south Banten in order to popularize its consumption.

The harvested seaweeds *Ulva fasciata* and *Rhododymenia palmata*, from Binuangen coast of South Banten were used for this study. The collected seaweeds were processed to remove the attached specimens on its surface. Afterward, the samples were washed using tap water, followed by distilled water. To remove the adhered microflora, the seaweeds were washed with 70% alcohol. The processed seaweeds were ready to be analyzed.

Evaluation of mineral contents was done by flame atomic absorption spectroscopy

(AAS). The minerals analyzed were Sodium, Potassium, Calcium and Magnesium and trace elements (Iron, Zinc, Copper and Manganese). Total carbohydrate estimation was done by Phenol-sulphuric acid method. The content of total dietary fibre (TDF) in seaweeds was determined according to the AOAC enzymatic gravimetric method (AOAC official methods of Analysis; 2005: 962 09).² Crude lipids were extracted from the powdered seaweed sample using Soxhlet apparatus. The contents of the crude lipids were determined gravimetrically after oven-drying (80°C) the extract overnight. Estimation of crude protein content was determined by Lowry *et al.*³

Ulva fasciata and *R. palmata* have reasonable levels of proteins and carbohydrate (Table 1). The seaweeds were low in lipid content (below 1%) on dry weight basis. *Ulva fasciata* and *Rhododymenia palmata* contain 7.98 and 11.01% macro-minerals (Na, K, Ca and Mg) respectively, 695.48 and 2048.19 ppm trace elements (Fe, Zn, Cu, and Mn) respectively. The presence of heavy metals such as cadmium and lead was also detected.

Table 1. Nutritional Content of Dry Materials of Two Edible Indonesian Marine Seaweeds

Type	Parameter	Results		Method
		<i>U. fasciata</i>	<i>R. palmate</i>	
Seaweed	Dry material			
	Fe (ppm)	617.95	1876.41	AAS
	Mn (ppm)	45.68	128.20	AAS
	Cu (ppm)	11.48	14.88	AAS
	Zn (ppm)	20.37	28.70	AAS
	Pb (ppm)	0.64	19.13	AAS
	Cd (ppm)	4.73	5.53	AAS
	Co (ppm)	ud	Ud	AAS
	K (%)	2.14	7.70	AAS
	Na (%)	1.01	0.13	AAS
	Ca (%)	2.32	0.63	AAS
	Mg (%)	2.51	2.55	AAS
	Protein (%)	11.55	17.61	Kjedhal
	Water (%)	11.56	7.54	Gravimerti
	Fat (%)	0.63	0.92	Soxhlet
	Carbohydrate (%)	25.90	24.23	Titrimetri

ud: undetectable; AAS: Atomic absorption spectroscopy

The average daily consumption of 5 g of *U. fasciata* is sufficient to meet 2.3-5% of Fe daily requirement (12-26 mg) and 0.1-0.2% of Zn daily requirement (10-16mg) in people. The average daily consumption of 5 g of *Rhodomenia palmata* is sufficient to meet 7.2%-15.6% of Fe daily requirement and 0.1%- 0.2% of Zn daily requirement for adults (age 19 and older).

Garcia-Casal *et al.*⁴ reported that *Ulva* sp. is one of a good sources of Fe.⁴ The bioavailability of Fe in seaweed makes its consumption could help to combat Fe deficiency and anaemia. A human study in 83 subjects received maize- or wheat-based meals containing marine algae (*Ulva* sp., *Sargassum* sp. and *Porphyra* sp.) showed that algae significantly increased Fe absorption in maize- or wheat-based meals, especially *Sargassum* sp., due to its high Fe content. Increases in absorption were dose-dependent and higher in wheat-based than in maize-based meals.

The nutritive value of seaweeds is also due to their polysaccharide and polyunsaturated fatty acid contents. The high levels of non-digestible polysaccharide in their cell wall, causes seaweeds a rich source of dietary fibre (330-500g kg⁻¹, on dry weight basis).⁵ Alamsjah *et al.*⁶ stated that poly unsaturated fatty acid (PUFA) commonly found in *U. fasciata* are hexadeca-4,7,10,13-tetraenoic acid (HDTA), octadeca-6,9,12,15-tetraenoic acid (ODTA) and α -linoleic acid.

The fraction of *U. fasciata* showed very low toxicity to mice (LD₅₀ of 20.66 mg kg⁻¹) and non toxic to its liver and kidney.⁷ These seaweeds are nutritionally valuable despite the presence of heavy metals. Cleaned seaweeds represent a potential food alternative for older people after appropriate processing and environmental remediation to guarantee food safety.

Ulva fasciata also has bioactivity range and potency such as antioxidant, antiviral,

antibacterial and antitumor activity. Since marine algae is a rich source of dietary fibre, minerals, proteins and vitamins, a documented bioactivity data would elevate their value in the human diet as food and pharmaceutical supplements.

Total polyphenol content was 10.84 gallic acid equivalents/g for *Ulva* sp. The polyphenol content found could be partly responsible for the antioxidant potency.⁴

Munifah and Krisnawang⁸ in 2007, found out that the antioxidative assay of each fraction showed that the chlorophyll fractions from green algae (*U. fasciata* and *Caulerpa racemosa*) had higher antioxidative activity against free radicals than three species of brown algae (*Padina australis*, *Sargassum* sp., and *Turbinaria deccurens*). Mendes *et al.*⁹ evaluated the antiviral activity of *U. fasciata*, collected from Rasa beach and Forno beach, Búzios, Rio de Janeiro, Brazil on the replication of human metapneumovirus (HMPV). The results demonstrated that the majority of the extracts (five out of six) has virucidal activity and therefore possess the ability to interact with the extracellular viral particles and prevent the infection.

The secondary metabolites of *U. fasciata* collected from southeast and southwest coast of India, has been tested for biotoxicity potential. The green alga *U. fasciata* exhibited broad-spectrum antibacterial activity whereas the red alga *Hypnea musciformis* showed narrow spectrum antibacterial activity. The brine shrimp cytotoxicity profile indicated that seaweeds were moderately toxic. The overall activity profile indicated that *U. fasciata* contained more biological potency than *H. musciformis*.¹⁰

Alcoholic extracts of *U. fasciata* and *Ulva lactuca* from the Gujarat coast exhibited antiviral and anti-inflammatory activities, respectively. Ethanolic extracts of the Indian marine algae belonged to the Rhodophyceae,

Phaeophyceae, and Chlorophyceae have been tested against *Semiliki forest* (SFV), *Ranikhet disease* (RDV) and *Vaccinia* viruses (VV). The bioactivity of the extracts was significantly exhibited by the green algae *Ulva fasciata* (70%, SFV).¹¹

These Indonesian seaweeds shown high nutritive value, thus making them as a good health ingredient for use in nutrition. More research is needed to establish the nutritional value of these seaweeds, especially, in the fields of biochemical analysis and evaluation of their bioavailability using human and animal feeding studies.

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