Nutritional Evaluation of *Ulva* sp. from Sepanjang Coast, Gunungkidul, Indonesia

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Nutritional Evaluation of *Ulva* sp. from Sepanjang Coast, Gunungkidul, Indonesia

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Abstract. Seaweed is a food ingredient that abundant availability and high nutritional content. The chemical composition of seaweed differs depending on geographical and seasons and the environmental factors. This present study aim is to evaluate the nutritional composition, including proximate and mineral analysis, of green algae *Ulva* sp. from Sepanjang coast for utilization in the future for functional food. The results of the nutritional analysis of *Ulva* sp. show that the dominant element in the proximate analysis of *Ulva* sp. was carbohydrate (49.09%). Moisture, ash, fat and protein content were 9.89%, 31.4%, 0.38%, and 9.24% respectively, while crude fiber was 3.68%. The sodium and magnesium were dominant minerals than other minerals in *Ulva* sp. According to the results of this study, *Ulva* sp. from Sepanjang coast, Gunungkidul has the potential as an alternative source of an ingredient food for health benefits in the future.

Keywords— *Ulva* sp., proximate, mineral, Gunungkidul.

1. Introduction

Edible macroalgae, also known as seaweeds, is an attractive source of nutrition. Seaweed is a food ingredient commonly consumed in Asia and some Pacific countries because of its abundant availability and high nutritional content [1–4]. The highest consumption of seaweed is in Asia, especially in Japan, China, and Korea, consisting of green algae (5%), brown algae (66.5%) and red algae (33%). However, now the demand for seaweed also extends to America and Europe [5].

Although seaweed has been widely consumed and is an essential food ingredient for diets, the nutritional properties of seaweed have not been fully known, and they are usually estimated only for its chemical composition [6]. There are very few studies on the nutritional composition of seaweed, and most of the information available is only related to traditional Japanese seaweed. The chemical composition of seaweed differs depending on species, geographical and seasons and the environmental factors such as salinity, light, water temperature, nutrients, and minerals availability [1,4,6,7].

Seaweed is known to have low-calorie content, rich in polysaccharides, vitamins, proteins, minerals, and dietary fiber that makes it attracted for commercial purposes. Seaweed or macroalgae has the potential as a value-added food because seaweed is claimed to have health benefits and some types of seaweed have been shown to have antibacterial and anticoagulant activities [8].

Ulva is one of the genera in edible green algae found along the coast in the world, and its nutritional content has the potential to be used as functional or health [7,9,10]. *Ulva* has been regarded as a good source of dietary fiber and a potential source of prebiotics since it cannot be digested in the

human gastrointestinal tract [7,10]. There are only a few species of *Ulva* that have been investigated for their utilization in food manufacturing [7]. There is less information about chemical and nutrient composition of *Ulva* sp. from Gunungkidul coast, especially from Sepanjang coast. This study aims to determine the proximate composition as well as the mineral content of *Ulva* sp. from Sepanjang coast, Indonesia.

2. Materials and Methods

2.1. Materials

Fresh *Ulva* sp. obtained from the coast of Sepanjang, Gunungkidul and then dried using Memmert oven at 50ºC until constant weight.

2.2. Proximate and minerals analysis

The moisture content, ash, fat, protein was determined according to AOAC [11]. The carbohydrate was estimated by difference: 100 – (moisture + ash + protein + fat) %. The moisture content was determined by drying the *Ulva* in an oven at 105 °C until a constant weight was obtained. Ash content determined by heating *Ulva* sp. in a muffle furnace at 550°C until turned white and free of carbon. Then it is cooled in the desiccator to room temperature and immediately weighed again. Soxhlet extraction used to determine the total fat content, 2 g *Ulva* sp. wrapped with a filter paper and submerged in 120 mL of petroleum ether then heated and allowed to reflux for five hours. The total crude protein content was calculated by multiplying the nitrogen content, which was determined according to the standard AOAC method by a factor of 6.25. All analytical determinations were conducted at least in triplicate. The value expressed as the mean ± standard deviation. Mineral content determined using SEM-EDX of Hitachi SU3500 equipped with EDAX Element for EDX analysis.

3. Results and discussion

The proximate analysis result of *Ulva* sp. collected from the Sepanjang coast, Gunungkidul, Indonesia is shown in Table 1. Moisture content is an essential factor in determining the storage time and quality of the material. High moisture content was causing the growth of microorganisms that will damage the material [12]. The moisture content of *Ulva* sp. in this study was 9.89%. This result agreed with the previous study by Khairy and El-Shafay (2013) that moisture content of *Ulva lactuca* range 8.9–14.57% [13]. But another study report higher moisture content for *Ulva* like Yaich et al. (2011) 14.94% and Rasyid (2017) 16.9%, but Rohani (2012) report lower moisture content for *Ulva* at 6.8%.

Table 1. Nutrient content of *Ulva* sp.

Component	Value (% db)
Moisture content	9.89 ± 3.37
Ash	31.40 ± 0.62
Protein	9.24 ± 0.31
Fat	0.38 ± 0.24
Crude fiber	3.68 ± 0.16
Carbohydrate	49.09 ± 3.99

Ash content shows the total mineral content in a sample. Ash content of *Ulva* sp. in this study was 31.4% which was higher than the ash content of some previous studies by Rasyid (2017) which ranged from 11-18%, Khairy and El-Shafay (2013) range from 17.56- 23.19%, and Yaich et al. (2011) 19.59%.

The fat content (0.38%) of the green algae *Ulva* sp. studied in this work agreed with the literature that in seaweeds, in general, the content of lipids is less than 4% [10]. Ortiz et al. (2006) study found that the fat content of *Ulva lactuca* was 0.3 g/100 g dry weight. Another study by Rasyid (2017) shows that the fat content of *Ulva lactuca* 0.19%, Khairy and El-Shafay (2013) 3.6%, Yaich et al. (2011) 7.87%.

The protein content in green algae is high, ranging from 10% to 30% [8]. In this study protein content of *Ulva* sp. approximately close to a range of another study. Khairy and El-Shafay (2013) reported that the protein content of *Ulva lactuca* range between 16.78–20.12%, Yaich et al. (2011) 8.46%.

Carbohydrate is an essential nutrition for metabolic processes. (Khairy and El-Shafay, 2013). The proximate composition of *Ulva* sp. examined in this study dominate by carbohydrate; approximately 49.09%. This result is higher than reported by Khairy and El-Shafay (2013) range between 42.09–46.42% [13] but lower than reported by Rohani (2012) for *Ulva lactuca* was 59.1% [12] and 58.1% by A Rasyid (2017) 59.1% [4].

The different content of nutrient in the *Ulva* sp from Sepanjang coast, Gunungkidul with another study prove that geographical location and local environmental conditions can influence the proximate composition of seaweeds [4,6,9,10,12,13].

Table 2. The result of EDX analysis of *Ulva* sp.

Element	Weight %	Atomic %
Na	6.86	6.07
Mg	7.92	6.63
S	11.05	7.01
Cl	11.58	6.64
K	4.46	2.32
Ca	1.95	0.99
I	0.27	0.04
Fe	0.86	0.31

The sodium and magnesium were dominant minerals than other minerals in *Ulva* sp. The study by Rohani (2012) shows that dominant mineral from *Ulva lactuca* was Potassium (515.6 mg/100 g) and magnesium (79.1 mg/100 g), Rasyid (2017) was Calcium (1828 mg/100 g) and Potassium (467 mg/100 g). The heavy metal content not detected by EDX sensor and its show that the heavy metal content was lower than the limit of the quality criteria applied to edible seaweeds sold in Indonesia.

4. Conclusion

Green alga *Ulva* sp. from Sepanjang coast, Gunungkidul has great potential for cultivation as a functional food raw material because it has high levels of carbohydrates, minerals, and proteins but low in fat. Its nutritional content is very potential for food and health products.

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