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Evaluation of the phytochemical and nutritional value of the halophyte (*Suaeda maritima*)

Tanaporn Nungtala[1], Chutikan Sakphisutthikul [2*]

[1]Doctor of Public Health Program, Faculty of Public Health, Khon Kaen University, Thailand.
[2]Faculty of Public Health, Khon Kaen University, Thailand.

*Corresponding author: Dr. Chutikan Sakphisutthikul. E-mail: Chusak@kku.ac.th

ABSTRACT

Background: *Suaeda maritima*, a halophyte recognized for its adaptability to saline environments, holds promise as a valuable resource in nutrition and health. This study aimed to comprehensively assess the nutritional composition and phytochemical content of *Suaeda maritima*, exploring its potential as a dietary resource and source of bioactive compounds.

Objectives: To analyze and compare the nutritional composition, phytochemical content, and antioxidant properties of fresh and dried *Suaeda maritima* samples. The investigation sought to determine the impact of the drying process on the plant's nutritive value and bioactive compounds.

Methods: Fresh and dried *Suaeda maritima* samples were recruited for nutritional analysis which includes carbohydrates, proteins, fats, dietary fiber, minerals, and sodium content per 100 grams. Phytochemical content and antioxidant properties were assessed through total phenolics, total flavonoids, and antioxidant assays (DPPH and TBARS).

Results: The results indicated that *Suaeda maritima* possesses significant nutritional value which contains carbohydrates, proteins, dietary fiber, essential minerals, and low-fat content in fresh and dried forms. Importantly, no statistically significant differences ($p > 0.05$) were observed between fresh and dried samples regarding macronutrients and minerals, suggesting effective preservation of nutritional value during drying. However, notable distinctions were found in the phytochemical content and antioxidant properties. Fresh *Suaeda maritima* exhibited significantly higher levels of total phenolics and flavonoids than dried samples. Additionally, DPPH and TBARS assays identified that the antioxidant activities were more noticeable in fresh samples and allow to understand their health-promoting potential.

Conclusion: *Suaeda maritima* demonstrated substantial nutritional value with significant levels of carbohydrates, proteins, dietary fiber, essential minerals, and minimal fat content. The drying process effectively preserved its nutritional composition but it reduced phytochemical content and antioxidant activities. Careful consideration of processing techniques is essential to maximize the retention of health-promoting compounds, especially for applications in the nutraceutical and pharmaceutical industries.

Keywords: Nutritional value, Phytochemicals, *Suaeda maritima*

1. Introduction

The quest for sustainable and diversified sources of phytochemicals and essential nutrients is paramount in contemporary nutrition science. As the global population increases, ensuring a secure and nutritious food supply remains challenging, particularly in regions affected by salinity and environmental stressors. Within this context, halophytes, a group of salt-tolerant plants, have emerged as a promising avenue for exploration [1]. One such halophyte, *Suaeda maritima*, has garnered attention for its resilience and adaptability to saline habitats.

Halophytes, which thrive in saline environments are an increasingly significant research focus due to their unique ability to flourish under conditions unsuitable for most crops [2]. *Suaeda maritima*, commonly called "sea blite" or "annual sea-blite," exemplifies halophytic adaptation. Beyond its ecological significance, this plant holds great promise for human nutrition and health.

Phytochemicals is the bioactive compounds found in plants have received considerable attention for their diverse biological activities [3]. *Suaeda maritima* is posited as a repository of various phytochemicals, encompassing flavonoids, alkaloids, and phenolic compounds, exhibiting antioxidative, anti-inflammatory, and potentially anticancer properties in other botanical sources [4]. Understanding the phytochemical constituents of *Suaeda maritima* can provide valuable insights into its potential applications in pharmaceutical and nutraceutical industries [5].

Furthermore, evaluating the nutritional value of *Suaeda maritima* is instrumental in determining its suitability as a food source or dietary supplement. This assessment will encompass the plant's macronutrient composition, vitamin content, and mineral profile, elucidating its role in mitigating nutritional deficiencies and promoting human health.

In this study, we aim to assess the phytochemical and nutritional composition of *Suaeda maritima*, exploring its potential as a sustainable source of bioactive compounds and essential nutrients. By illuminating the multifaceted attributes of this halophyte, we seek to contribute to the expanding body of knowledge concerning novel food resources that can augment human nutrition and environmental sustainability.

2. Methods

2.1. Sample collection and preparation

Suaeda maritima (annual sea-blite) specimens were collected from a coastal region with saline soil conditions in Samut Songkhram province, Thailand. The collected *Suaeda maritima* plants were carefully uprooted, and any adhering soil particles were gently removed. Subsequently, the plants were thoroughly rinsed with distilled water to eliminate extraneous contaminants. The samples were then separated into various plant parts, including leaves, stems, and roots, and were subsequently dried at 65OC, 48 hours until a constant weight was achieved. A mechanical grinder ground. The dried plant materials into a fine powder.

2.2. Phytochemical analysis

A. Extraction of phytochemicals

The extraction of phytochemicals was carried out using MetOH—an extraction method briefly. Ten grams of dried plant material were soaked in 100 mL of solvent in an Erlenmeyer flask. The mixture was shaken overnight. The resultant extract was then filtered through a Whatman Filter Paper No.1, and the filtrate was collected.

B. Phytochemical screening

Phytochemical screening was conducted to detect the presence of various bioactive compounds, including alkaloids, flavonoids, phenolic compounds, tannins, saponins, and terpenoids.

C. Quantitative analysis of phytochemicals

Quantitative analysis of specific phytochemicals, such as total phenolic content (TPC) and total flavonoid content (TFC), was performed using spectrophotometric methods with reference standards. The TPC was determined using the Folin-Ciocalteu method, and TFC was assessed by the aluminum chloride colorimetric method [6].

2.3. Nutritional analysis

Proximate analysis was carried out to determine the moisture content, ash content, crude protein, crude fat, and total dietary fiber in *Suaeda maritima* samples. Standard methods of the Association of Official Analytical Chemists (AOAC) were employed [7].

The mineral composition of *Suaeda maritima* samples was determined using an atomic absorption spectrophotometer (AAS) for elements such as Iron (Fe) and sodium (Na). Digestion and quantification were performed according to AOAC methods [8].

2.4. Data analysis

All data obtained from phytochemical and nutritional analyses were subjected to statistical analysis using SPSS. Results are presented as means ± standard deviation (SD),

and significant differences were determined using analysis of variance (ANOVA) followed by post-hoc tests.

2.5 Ethical Clearance

The ethical approval for this study was taken from the Research Ethics Committee of Khon Kaen University (HE652136).

3. Results

3.1 Nutritional Value of *Suaeda maritima* Samples

The analysis of the nutritional composition of *Suaeda maritima*, as presented in Table 1, provides essential insights into its potential as a dietary resource. When comparing fresh and dried samples per 100-gram basis, no statistically significant differences ($p > 0.05$) were observed within the same row, indicating that the drying process had minimal impact on the plant's macronutrient and mineral content. Fresh *Suaeda maritima* contains approximately 28.63 grams of carbohydrates, 12.96 grams of protein, 2.26 grams of fat, 21.78 grams of dietary fiber, 12.77 grams of ash, 4.41 mg of iron, and 3882.85 mg of sodium per 100 grams. The dried samples exhibited slightly reduced values, with 25.06 grams of carbohydrates, 12.31 grams of protein, 2.16 grams of fat, 20.52 grams of dietary fiber, 12.45 grams of ash, 4.35 mg of iron, and 3800 mg of sodium per 100 grams. These findings underscore the nutritional richness of *Suaeda maritima*, with significant levels of carbohydrates, protein, dietary fiber, essential minerals, and low-fat content. The absence of significant differences between fresh and dried samples suggests that the drying process effectively preserves the plant's nutritional value.

Table 1: Nutritional value of *Suaeda maritima* samples

Nutritional value/100 grams.	Fresh (Mean ± SD)	Dried (Mean ± SD)
Carbohydrate (g)^{ns}	28.63 ±2.11	25.06 ±1.82
Protein (g) ^{ns}	12.96 ±1.30	12.31 ±1.96
Fat (g)^{ns}	2.26 ±0.03	2.16 ±0.15
Dietary Fiber (g)^{ns}	21.78 ±1.44	20.52 ±1.65
Ash (g)^{ns}	12.77 ±1.03	12.45 ±0.94
Iron (mg)^{ns}	4.41 ±0.19	4.35 ±0.42
Sodium (mg)^{ns}	3882.85 ±0.95	3800 ±0.78

The superscript "ns" indicates no significant differences among the means in the same row. ($p > 0.05$)

3.2 Phytochemical Content and Antioxidant Activities of *Suaeda maritima* Samples

Table 2 presents the phytochemical content and antioxidant properties of *Suaeda maritima*, shedding light on its potential as a source of bioactive compounds and antioxidants. Chances in phytochemical content and antioxidant activities were observed comparing fresh and dried samples. Fresh *Suaeda maritima* displayed a significantly higher total

phenolic content (20.59 mg GAE/g) than dried samples (15.46 mg GAE/g). Similarly, total flavonoids were more abundant in fresh samples (13.81 mg QE/g) than in dried samples (7.65 mg QE/g). These findings suggest that the drying process may reduce these valuable phytochemicals, known for their potential health benefits.

Furthermore, the antioxidant properties, as assessed by the DPPH and TBARS assays, were more pronounced in fresh *Suaeda maritima*. Fresh samples exhibited an EC50 of 77.93 mg/mL in the DPPH assay and 73.55 mg/mL in the TBARS assay, indicating more substantial antioxidant potential compared to dried samples, which had EC50 values of 61.23 mg/mL and 56.75 mg/mL, respectively. These results highlight the potential health-promoting properties of fresh *Suaeda maritima*, which may be attributed to its higher phytochemical content.

Table 2: Phytochemical content and antioxidant activities of *Suaeda maritima* samples

Treatment	Phenolic compound (Mean ± SD)		Antioxidant Properties (EC_{50}, mg/mL MetOH extract) (Mean ± SD).	
	Total Phenolics (mg GAE/g)	Total Flavonoids (mg QE/g)	DPPH assay	TBARS assay
Fresh	20.59±0.07a	13.81±0.44a	77.93±0.34a	73.55±1.83a
Dried	15.46±0.65b	7.65±0.27b	61.23±0.87b	56.75±0.07b

Values bearing different letters in the same column are statistically significant differences ($p < 0.05$) compared to the Duncan test.

4 Discussion

The observed differences between fresh and dried samples align with previous research on the impact of drying processes on phytochemical content and antioxidant activities in various plant species [9]. The reduction in phenolic compounds and antioxidant potential in dried *Suaeda maritima* underscores the importance of optimizing drying methods to preserve these bioactive constituents, especially for applications in the nutraceutical and pharmaceutical industries [10]. *Suaeda maritima* reveals significant nutritional value, with abundant carbohydrates, protein, dietary fiber, essential minerals, and low-fat content. However, drying reduces phytochemical content and antioxidant activities, suggesting the need to carefully consider processing techniques to retain its health-promoting properties [11].

The comprehensive evaluation of the phytochemical and nutritional value of the halophyte *Suaeda maritima*, as evidenced by the results presented in Tables 1 and 2, provides valuable insights into its potential applications in both dietary and health-related contexts.

The nutritional analysis revealed that *Suaeda maritima* is a rich source of carbohydrates, proteins, dietary fiber, essential minerals, and low-fat content. Its multifaceted value as a dietary resource and a potential source of natural antioxidants opens doors to diverse applications, offering solutions to various health and environmental challenges [12]. Notably, the drying process did not significantly alter the plant's macronutrient and mineral profile, emphasizing its potential as a stable dietary resource.

However, when examining the phytochemical content and antioxidant activities, distinctions between fresh and dried *Suaeda maritima* samples became evident. Fresh *Suaeda maritima* displayed higher levels of total phenolics and flavonoids and superior antioxidant potential than dried samples. These findings suggest that the drying process may reduce these bioactive compounds associated with various health benefits.

The findings from this study underscore the importance of carefully considering processing methods to retain the health-promoting properties of *Suaeda maritima*. Further research into optimizing drying techniques and storage conditions is essential to effectively preserve its phytochemical content and antioxidant capacity. The potential applications of *Suaeda maritima* in the nutraceutical and pharmaceutical industries should be explored, considering its nutritional richness and bioactive potential [12].

In summary, evaluating *Suaeda maritima* showcases its versatility and significance in both dietary and health-related domains, paving the way for innovative applications and sustainable solutions in salinity-affected regions and the broader field of nutrition and natural antioxidants [13].

5. Conclusion

In conclusion, *Suaeda maritima* is a promising subject for further investigation and its utilization particularly in addressing nutritional and health-related challenges in regions affected by salinity.

Careful consideration of processing techniques is essential to maximize the retention of health-promoting compounds, especially for applications in the nutraceutical and pharmaceutical industries.

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