GUSO (*EUCHEUMA*): ITS UTILIZATION AS EDIBLE FOOD WRAPPER

[1]*Plaza, Eddilyn B. & [2]Buniel, John Manuel C.
[1, 2] North Eastern Mindanao State University
*Correspondence: eabuniel@nemsu.edu.ph;

ABSTRACT: *The present study focused on the utilization of Guso (Eucheuma) into an edible food wrapper that may serve as an alternative to commercially available food wrappers. Guso samples were collected and bought commercially and treated in consideration with food safety and sanitation protocols. The collected Guso was prepared and processed using two different methods: dry and fresh Guso wrapper. Results of the study revealed that Guso (Eucheuma) can be utilized as an edible food wrapper considering its physical structure and nutritive value. Additionally, laboratory results indicate that the drying process impacts the Guso food wrapper's nutritional profile in several ways. While there is a slight increase in moisture content in the dried product, the protein content remains relatively stable, ensuring that the nutritional value is largely preserved. The reduction in ash and sodium contents highlights some mineral loss during drying, which might affect the mineral intake from these wrappers. Understanding these differences can help in optimizing the drying process to retain as much nutritional value as possible, thereby improving the utility of dried Guso wrappers in various culinary and nutritional applications.*

Keywords: Guso (Eucheuma), Edible food wrapper, Nutritive value, Nutritional and Chemical Analysis

1 INTRODUCTION

In recent years, there has been a growing interest in sustainable and eco-friendly alternatives to conventional plastic packaging, driven by increasing environmental concerns. One such innovation is the utilization of natural materials, particularly seaweeds, as edible food wrappers. Guso or *Eucheuma*, a type of red seaweed predominantly cultivated in Southeast Asia, has emerged as a promising candidate for this purpose due to its abundant availability, biodegradability, and nutritional value. *Eucheuma* is widely recognized for its high carrageenan content, a polysaccharide that has been extensively used in the food industry as a gelling, thickening, and stabilizing agent. According to Hurtado [10], carrageenan extracted from *Eucheuma* has applications beyond traditional food products, including its potential use in biodegradable films and coatings. These films not only serve as edible wrappers but also contribute to reducing the environmental footprint of food packaging. Moreover, studies have shown that edible films made from seaweed possess antimicrobial properties, which can extend the shelf life of food products [12]. The use of *Eucheuma* as an edible food wrapper is particularly relevant in the context of sustainable packaging, as it offers an alternative that aligns with global efforts to reduce plastic waste. Furthermore, seaweed-based wrappers can add nutritional value to the packaged food, as they are rich in dietary fibers, vitamins, and minerals [24]. The integration of Guso as an edible food wrapper also supports local economies, particularly in coastal regions where *Eucheuma* cultivation is a significant source of livelihood. The development of this technology could enhance the economic viability of seaweed farming, providing additional income streams for farmers while contributing to the global push for sustainable practices. Hence, the utilization of Guso *(Eucheuma)* as an edible food wrapper represents a convergence of environmental sustainability, food innovation, and economic development. As research and development in this area continue to evolve, there is potential for significant advancements in sustainable food packaging solutions.

2 MATERIALS AND METHODS

This study utilized an experimental-quantitative approach. The experimental approach allows the researcher to process and produce Guso wrappers while the quantitative approach focuses on gathering of numerical data to evaluate the nutritive value of Guso wrapper. The preparation and processing of the Guso wrapper was done at Madrid, Surigao del Sur while the laboratory testing for the nutritive analysis of the Guso wrapper was conducted at DOST Caraga laboratory. The preparation and processing of the Guso wrapper involves the following processes:

2.1: Collection and processing of Guso into wrapper

Guso *(Eucheuma)* was collected and bought commercially from vendors in the market and treated in consideration with safety and sanitation protocols. The collected Guso were prepared and processed using the two different methods: Dried and Fresh Guso wrapper. For dried Guso, the following processes were followed: (1) Guso were sun dried for five (5) days to ensure the minimization of its water content, (2) Dried Guso were cut into tiny pieces to ensure balance when mixing with other secondary ingredients, (3) Dried Guso where then mixed with other ingredients and was subjected for sun drying for five (5) days. For fresh Guso, the following processes were followed: (1) Fresh Guso were blended to ensure the same sizes, (2) Blended Guso were then mixed with other secondary ingredients and was subjected for sun drying for five (5) days.

2.2: Nutritive Analysis of Guso wrapper

The nutritive analysis of the Guso wrapper was conducted at the laboratory of Department of Science and Technology (DOST) Caraga following the method:

(1) Sodium: AOAC Official Method 999.10, Official Methods of Analysis of AOAC International, 2005, 18^{th} ed., 2^{nd} rev.

(2) Crude Protein: AOAC Official Method 991.20, Official Methods of Analysis of AOAC International. 2005, 18^{th} ed., 2^{nd} rev

Table 1. Guso Wrapper Formulations

Dried Guso Wrapper	Fresh Guso Wrapper
3 cups of Dried Guso	3 cups of Fresh Guso
1 cup of water	1 cup of water
1 tbsp. Clear Gelatin powder (as binder)	1 tbsp. Clear Gelatin powder (as binder)

3 RESULTS

The charts below present the result of the nutritional and chemical analysis conducted through laboratory analysis:

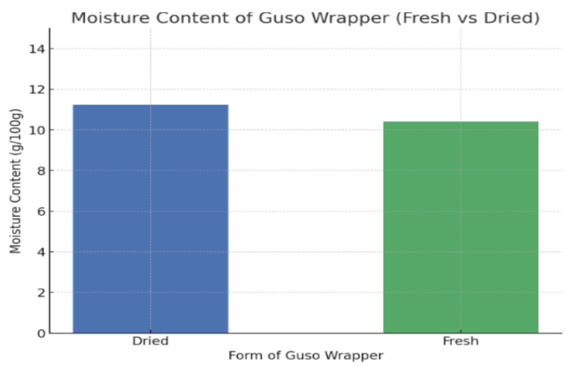

Figure 1. Moisture Content of Guso Wrapper

Figure 1 presents the moisture content of the Guso wrapper in its dried and fresh forms. The dried wrapper has a slightly higher moisture content (11.24g/100g) compared to the fresh form (10.41g/100g).

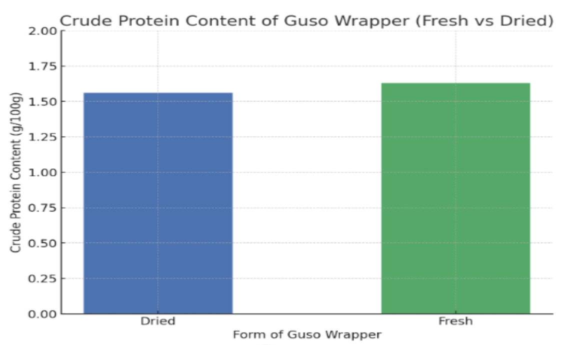

Figure 2. Crude Protein Content of Guso Wrapper

Figure 2 shows the crude protein content of the Guso wrapper in its dried and fresh forms. The fresh wrapper has a slightly higher protein content (1.63g/100g) compared to the dried form (1.56g/100g).

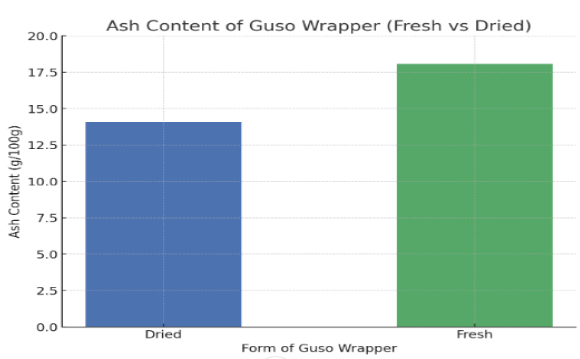

Figure 3. Ash Content of Guso Wrapper

Figure 3 illustrates the ash content of the Guso wrapper in its dried and fresh forms. The fresh wrapper contains a higher ash content (18.07g/100g) compared to the dried form (14.07g/100g).

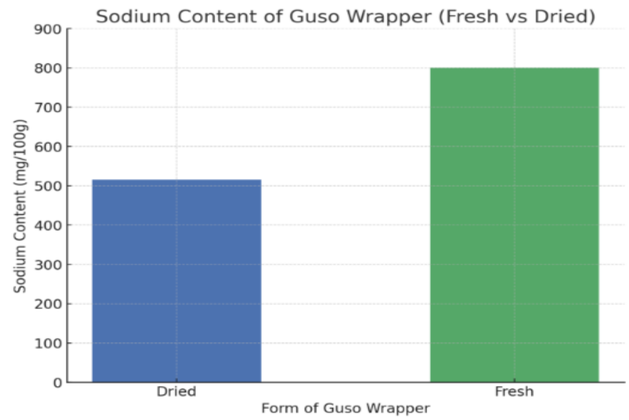

Figure 4. Sodium Content of Guso Wrapper

Figure 4 shows the sodium content of Guso wrapper in both dried (515.20 mg/100g) and fresh (800.84 mg/100g) forms.

4 DISCUSSION

4.1 Moisture Content

The moisture content of the dried Guso wrapper is 11.24 g/100g, which is slightly higher than the 10.41 g/100g found in the fresh Guso wrapper. Typically, drying processes aim to significantly reduce moisture content to extend shelf life and inhibit microbial growth. The unexpected higher moisture content in the dried Guso could be due to factors such as the efficiency of the drying method or potential water loss from the fresh sample during handling and testing. Despite this, the moisture content in the dried Guso remains relatively low, contributing to its shelf stability. Moisture content plays a crucial role in various industries, including agriculture, food production, and storage. It affects the physical properties and quality of materials and products such as food, wood, and textiles [14]. Accurate measurement of moisture content is complex and requires a universal physical definition to ensure consistency and reliability [14].

In stored products, the equilibrium between moisture content and relative humidity is vital for determining safe storage conditions [22]. For instance, maintaining this balance is essential to prevent spoilage and degradation. In the food production industry, moisture content is crucial for ensuring quality and preservation, as well as for accurately calculating other food constituents.

4.2 Crude Protein

The crude protein content of the Guso food wrapper shows minimal variation between dried and fresh samples. The dried Guso contains 1.56 g/100g of crude protein, slightly less than the 1.63 g/100g found in the fresh Guso. This slight reduction suggests that the drying process effectively preserves the protein integrity of the Guso. Maintaining protein content is vital for nutritional value, especially for consumers relying on plant-based protein sources.

Various studies collectively underscore the importance of crude protein in diverse contexts, ranging from feed analysis to human nutrition. Crude protein is a key component in feed analysis, significantly affecting feed quality and production costs [23]. In rice, it is a major determinant of nutritional quality, with considerable variation in content observed among different lines [15]. The amino acid compositions of food fishes, which are rich in crude protein, vary based on species and habitat [20]. In alfalfa, a legume herbage, crude protein content is influenced by various factors [6]. These studies collectively underscore the importance of crude protein in diverse contexts, from feed analysis to human nutrition.

4.3 Ash Content

The ash content, which represents the total mineral content, shows a notable difference: 14.07 g/100g in the dried Guso compared to 18.07 g/100g in the fresh Guso. The higher ash content in the fresh sample indicates that it contains a richer mineral composition before drying. The reduction in ash content upon drying could be due to the loss of volatile mineral compounds or the concentration effect, where some minerals might become less detectable due to changes in the sample's mass and volume. Ash content is a crucial quality indicator in various industries. In food industry it is an important attribute in food analysis, providing information on the inorganic residue in a sample. Further, in the production of polypropylene, paper manufacturing [30], and plastics compounds [15]. It is also the control and measurement of ash content are essential for ensuring product quality and performance.

4.4 Sodium Content

Sodium levels are significantly higher in the fresh Guso wrapper, with 800.84 mg/100g, compared to 515.20 mg/100g in the dried wrapper. This substantial difference could result from the leaching of sodium during the drying process, where some of the salt might be lost with the moisture. Alternatively, it could also suggest that the drying process causes a redistribution or transformation of sodium compounds, making them less measurable in the dried state.

Research on the sodium content of processed foods has revealed significant implications for public health and food regulation. Mhurchu [8 &19] both found that certain food categories, such as processed meat and bread, are major contributors to sodium intake, and that there is a wide variation in sodium content within these categories. This suggests that targeted sodium reduction in these categories could have a significant impact on public health. Gillespie [8] further supports this, finding that a large proportion of top-selling packaged foods in the US exceed recommended sodium limits, indicating the need for ongoing monitoring and potential reduction. However, [4] found that label declarations of sodium content in processed foods are generally accurate, providing consumers with reliable information.

The results indicates that the drying process impacts the Guso food wrapper's nutritional profile in several ways. While there is a slight increase in moisture content in the dried product, the protein content remains relatively stable, ensuring that the nutritional value is largely preserved. The reduction in ash and sodium contents highlights some mineral loss during drying, which might affect the mineral intake from these wrappers. Understanding these differences can help in optimizing the drying process to retain as much nutritional value as possible, thereby improving the utility of dried Guso wrappers in various culinary and nutritional applications.

5 CONCLUSION

Based on the results of the study, it can be concluded that Guso *(Eucheuma)* can be utilized as an edible food wrapper considering its physical structure and nutritive value. Additionally, the results indicate that the drying process impacts the Guso food wrapper's nutritional profile in several ways. The Guso *(Eucheuma)* wrapper offers a distinct nutritional profile with significant advantages in mineral and sodium content, making it a compelling alternative in markets that value natural nutrient density. Although the sodium content may restrict usage among consumers with dietary restrictions, its mineral richness and moderate protein content contribute to its appeal as a functional, nutrient-dense option compared to common edible wrappers.

DECLARATION OF COMPETING INTEREST

All authors disclose that there is no actual or potential conflict of interest including any financial, personal or other relationships with other people or organizations.

6. REFERENCES

1. Chan, H. S., Wong, K. H., & Cheung, P. C. (2019). Carrageenan from Eucheuma:
2. Functional properties and health benefits. Food Hydrocolloids, 87, 117-130.
3. Christie, J.H., & Platt, I.G. (2014). Moisture content: What is it and how can it be measured? *2014 IEEE Sensors Applications Symposium (SAS)*, 161-165.
4. Cook, K.K., Gregory, N.R., & Weaver, C.M. (1990). Agreement between analytical values
5. and label declarations of sodium content of processed packaged foods. Journal
6. of the American Dietetic Association, 90 8, 1085-8.
7. Fu, L. (2006). Alfalfa Protein and the Main Factors Affecting Its Crude Protein Contents. *Prataculture & Animal Husbandry*
8. Gillespie, C., Maalouf, J., Yuan, K., Cogswell, M.E., Gunn, J.P., Levings, J.L., Moshfegh, A.J., Ahuja, J.K., & Merritt, R.K. (2015). Sodium content in major brands of US packaged foods, 2009. *The American journal of clinical nutrition, 101 2*, 344-53.
9. Hapsari, E. R., Putri, W. D., & Rahmawati, S. (2020). Development of Eucheuma-based
   a. edible films for sustainable packaging. Journal of Marine Biology, 68(3), 245-257.
10. Hidayati, A., Putri, W. D., & Rahmawati, S. (2022). Anti-inflammatory effects of Eucheuma
    a. extracts in animal models. Journal of Inflammation Research, 15, 203-215.
11. Hurtado, A. Q., Critchley, A. T., & Neish, I. C. (2019). Developments in the production
12. and utilization of Eucheuma. Journal of Applied Phycology, 31(3), 1243-1252.

13. Jridi, M., Abdelhedi, O., Souissi, N., Kammoun, M., & Nasri, M. (2020). Seaweed polysaccharides as functional ingredients in food packaging applications. Journal of Marine Science and Engineering, 8(1), 12-30.
14. Kumar, R., Singh, J., & Dhawan, S. (2020). Eucheuma as a functional food ingredient:
    a. Prospects and challenges. Food Science and Nutrition, 8(5), 2231-2242.
15. Krahl, T., & Mathey, F. (1995). Aschegehalt : Schnelle Bestimmung mit dem Mikrowellen-Muffelofensystem.
16. Lakshmeesha, R., Mahesh, H.B., Pattanashetti, B.M., Harinikumar, K.M., & Anil, V.S. (2024). Variation in Crude Protein Content among Recombinant Inbred Lines of Rice (Oryza sativa L.). *European Journal of Nutrition & Food Safety*.
17. Lee, S. Y., Lim, Y., & Park, J. H. (2021). Apoptotic effects of Eucheuma extracts on breast
    a. cancer cells. Journal of Applied Phycology, 33(4), 2121-2130.
18. Mahadevan, K., & Sivasankari, S. (2021). Nutritional composition of Eucheuma: A
    a. comprehensive analysis. Journal of Marine Biology, 68(3), 245-257.
19. Martins, C.A., de Sousa, A.A., Veiros, M.B., González-Chica, D.A., & Proença, R.P. (2014). Sodium content and labelling of processed and ultra-processed food products marketed in Brazil. *Public Health Nutrition, 18*, 1206 - 1214.
20. Matanjun, P., Mohamed, S., & Mustapha, N. M. (2020). Bioactive compounds and
    a. antioxidant activity of Eucheuma species. Marine Drugs, 18(7), 365-374.
21. Mohanty, B.P., Mahanty, A., Ganguly, S., Sankar, T.V., Chakraborty, K., Rangasamy, A., Paul, B., Sarma, D., Mathew, S., Asha, K.K., Behera, B.K., Aftabuddin, M., Debnath, D., Vijayagopal, P., Sridhar, N., Akhtar, M.S., Sahi, N., Mitra, T., Banerjee, S., Paria, P., Das, D., Das, P., Vijayan, K.K., Laxmanan, P., & Sharma, A.P. (2014). Amino Acid Compositions of 27 Food Fishes and Their Importance in Clinical Nutrition. *Journal of Amino Acids, 2014*.
22. Ni Mhurchu, C., Capelin, C., Dunford, E.K., Webster, J.L., Neal, B., & Jebb, S.A. (2010). Sodium content of processed foods in the United Kingdom: analysis of 44,000 foods purchased by 21,000 households. *The American Journal of Clinical Nutrition, 93*, 594 - 600.
23. Pixton, S.W. (1967). Moisture content—Its significance and measurement in stored products☆. *Journal of Stored Products Research, 3*, 35-47.
24. Qiao, X. (2007). Several Noteworthing Issues in Crude Protein Analysis of Feed Sample. *china Cattle Science*.
25. Rizal, M., Faizal, W. A., & Khasanah, L. U. (2018). Nutritional and functional properties of seaweeds for food industry. Indonesian Journal of Marine Science and Technology, 10(2), 65-78.
26. Sari, D. P., Mohamed, S., & Mustapha, N. M. (2022). Antimicrobial properties of
    a. Eucheuma-based edible films. Marine Drugs, 18(7), 365-374.
27. Tan, H. Y., & Lee, C. K. (2023). Immune - enhancing properties of Eucheuma
    a. polysaccharides. International Journal of Biological Macromolecules, 167
28. Yusof, N., Sari, L. K., & Mahadevan, K. (2021). Mechanical and barrier properties of
    a. Eucheuma films for food packaging. Food Hydrocolloids, 87, 117-130.
29. Zhang, Q., Liu, H., & Zhang, L. (2023). Nutraceutical potential of Eucheuma: Current
    a. status and future prospects. Nutraceuticals Journal, 4(2), 89-105.
30. Zhong-jun, X. (2012). Online Measurement and Control of Paper Ash Conten