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EVALUATION OF THE PHYSICOCHEMICAL PROPERTIES OF MORINGA LEAVES (*Moringa oleifera*) IN DIFFERENT PROCESSING METHODS

EVALUASI SIFAT FISIKOKIMIA DAUN KELOR (*Moringa oleifera*) PADA METODE PENGOLAHAN YANG BERBEDA

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Abstract

Moringa leaves (*Moringa oleifera*) are well known for their high nutritional value and extensive health benefits. However, processing methods can significantly affect the essential nutrients in moringa leaves, including moisture, ash, and vitamin C levels. This study aims to evaluate the effects of three processing methods—oven drying, blanching followed by drying, and boiling—on these parameters. The results showed that the moisture content of fresh moringa leaves, initially at 73.2%, significantly decreased after drying (6.91%) and blanching (14.23%), while boiling increased the moisture content to 85.06%. The ash content increased with processing, from 2.61% in fresh leaves to 9.02% after drying, 11% after blanching, and 11.8% after boiling. Vitamin C degradation occurred due to heating, with drying causing a drastic reduction from 32.31 mg/100 g to 8.7 mg/100 g. Blanching better-preserved vitamin C levels (30 mg/100 g), while boiling surprisingly increased the vitamin C content to 49.08 mg/100 g, possibly due to enhanced extraction of compounds from cellular structures into the water. In conclusion, processing methods significantly impact the nutritional quality of moringa leaves. Drying is effective in reducing moisture content for prolonged storage, whereas boiling and blanching better preserve vitamin C content. These findings provide crucial insights for the food and pharmaceutical industries in determining the optimal processing method to maintain the nutritional value of moringa leaves.

***Keywords**: ash content, Moringa leaves, moisture content, processing methods, vitamin C*

Abstrak

Daun kelor (Moringa oleifera) dikenal memiliki nilai gizi tinggi dan manfaat kesehatan yang luas. Namun, metode pengolahan dapat mempengaruhi kandungan nutrisi utama dalam daun kelor, termasuk kadar air, kadar abu, dan vitamin C. Penelitian ini bertujuan untuk mengevaluasi pengaruh tiga metode pengolahan—pengeringan oven, blansir diikuti pengeringan, dan perebusan—terhadap parameter tersebut. Hasil penelitian menunjukkan bahwa kadar air daun kelor segar sebesar 73,2% mengalami penurunan signifikan setelah pengeringan (6,91%) dan blansir (14,23%), sedangkan perebusan justru meningkatkan kadar air menjadi 85,06%. Kadar abu meningkat seiring proses pengolahan, dari 2,61% pada daun segar menjadi 9,02% setelah pengeringan, 11% setelah blansir, dan 11,8% setelah perebusan. Vitamin C mengalami degradasi akibat pemanasan, dengan pengeringan menyebabkan penurunan drastis dari 32,31 mg/100 g menjadi 8,7 mg/100 g. Blansir lebih mampu mempertahankan vitamin C (30 mg/100 g), sedangkan perebusan justru meningkatkan kandungannya menjadi 49,08 mg/100 g, kemungkinan akibat

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pelepasan senyawa dari struktur seluler ke dalam air. Kesimpulannya, metode pengolahan berpengaruh signifikan terhadap kualitas nutrisi daun kelor. Pengeringan efektif dalam menurunkan kadar air untuk daya simpan lebih lama, sedangkan perebusan dan blansir lebih baik dalam mempertahankan kandungan vitamin C. Hasil penelitian ini memberikan informasi penting bagi industri pangan dan farmasi dalam menentukan metode pengolahan yang optimal guna mempertahankan kandungan gizi daun kelor.

Kata Kunci : Daun kelor, kadar air, kadar abu, metode pengolahan, vitamin C

INTRODUCTION

Moringa leaves (*Moringa oleifera*) have long been recognized as a plant with high nutritional value and diverse health benefits. This plant is widely used in various industries, from food to pharmaceuticals, due to its rich nutrient and bioactive compound content (Wadu *et al*., 2021). Moringa leaves contain essential proteins, vitamins, and minerals that contribute to overall health. One of the key components in moringa leaves is vitamin C, which plays a major role as an antioxidant to protect the body from free radicals and strengthen the immune system (Kusmardika, 2020). Additionally, moisture and ash content in moringa leaves serve as important indicators in determining the quality and stability of moringa-based processed products (Satriyani, 2021).

Various processing methods applied to moringa leaves can affect moisture content, ash content, and vitamin C levels (Marhaeni, 2021). For instance, drying and heating processes may cause vitamin C degradation due to exposure to heat and oxygen (Elvira *et al*., 2024). Therefore, research on the effects of processing methods on the nutritional components of moringa leaves is essential in identifying the best techniques to preserve their quality. This study aims to determine how different processing methods impact moisture content, ash content, and vitamin C levels in moringa leaves, as well as to identify the most suitable method for maintaining their high nutritional value.

To address these concerns, this study examines the influence of processing techniques on moisture content, ash content, and vitamin C levels in moringa leaves. The findings are expected to provide valuable insights for the food and pharmaceutical industries and the general public in selecting the best processing methods to retain moringa leaf nutrients. As a result, this study can serve as a reference for the food and supplement industries in developing moringa-based products while increasing public awareness of the importance of proper processing methods to preserve moringa's nutritional value.

Several aspects considered in this study include moisture content as a key parameter affecting product shelf life and stability, ash content as an indicator of mineral levels in food, and vitamin C as an antioxidant compound essential for boosting immunity and combating free radicals, yet highly susceptible to degradation from heat and oxidation. Additionally, various processing techniques such as drying, heating, and extraction are the primary focus of this study, as they directly influence the nutritional composition of food.

To ensure a focused and systematic study, moringa leaf samples were processed using drying and boiling methods. The analyzed parameters included moisture, ash, and vitamin C

levels. Understanding the effects of processing techniques on the nutritional quality of moringa leaves is expected to contribute to the development of natural ingredient-based food and health products.

RESEARCH METHODS

Materials

The material used in this study was young moringa leaves separated from their stems. The moringa leaves were sourced from Kendari, Southeast Sulawesi Province.

Data Collection Procedure

This research was a true experimental study aimed at observing differences in the nutritional content of moringa leaves based on different processing methods, including oven drying, blanching followed by oven drying, and boiling.

Moringa Leaf Processing

Oven Drying: 50 grams of moringa leaves were dried in an oven at 60°C for 8 hours.

Blanching : 50 grams of moringa leaves were briefly immersed in boiling water and then drained. Subsequently, the leaves were dried in an oven at 60°C for 9 hours.

Boiling : 15 grams of moringa leaves were placed in 100 mL of boiling water. After 2 minutes, the leaves were drained.

Moisture and Ash Content Determination

Moisture Content: Determined using the hot air oven method according to AOAC (2005).

Ash Content **:** Measured using standard AOAC (2005) procedures.

Data Analysis

Analysis was performed in triplicate. Mean values and standard deviations were calculated using SPSS (Statistical Package for the Social Sciences) version 17.

RESULTS AND DISCUSSION

Table 1. Moisture, Ash, and Vitamin C Content of Moringa Leaves with Different Processing Methods.

Test Parameters	Treatment			
	Fresh	Drying	Blanching	Boiling
Moisture (%)	73,2±25,56	6,91±0,18	14,23±0,90	85,06±0,35
Ash (%)	2,61±0,34	9,02±0,35	11±0,85	11.8±10,32
Vitamin C (mg/100 g)	32,31±6,87	8,7±1,06	30±2,68	49,08±8,66

Effect of Processing Methods on the Moisture Content of Moringa Leaves

Moisture content in food products is a crucial factor that determines quality, texture, and shelf life (Engelen, 2018). Based on the research findings, the moisture content of moringa leaves

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undergoes significant changes following different processing methods. In their fresh state, moringa leaves contain 73.2±25.56% moisture, which drastically decreases to 6.91±0.18% after the drying process. This reduction in moisture content occurs due to evaporation during drying, causing a substantial loss of water from the leaves (Pertiwi, 2023). Lower moisture content is highly beneficial for storage, as microorganisms responsible for spoilage are less likely to thrive in low-moisture environments (Lisa *et al*., 2015).

Conversely, boiling increases the moisture content to 85.06±0.35%, attributed to water absorption during the cooking process, which makes the moringa leaves softer and more hydrated than in their fresh state. Meanwhile, blanching results in a moisture content of 14.23±0.90%, which is still relatively high but not as much as in boiling. Blanching allows some water to evaporate while retaining sufficient moisture within the cellular structure (Maga *et al*., 2023).

From these results, it can be concluded that drying is the most effective method for reducing moisture content, making moringa leaves more durable and easier to store for extended periods. On the other hand, boiling increases moisture content, making it more suitable for direct consumption. Blanching, which lies between these two methods, maintains a more balanced moisture level, making it a viable alternative for preserving the quality of moringa leaves.

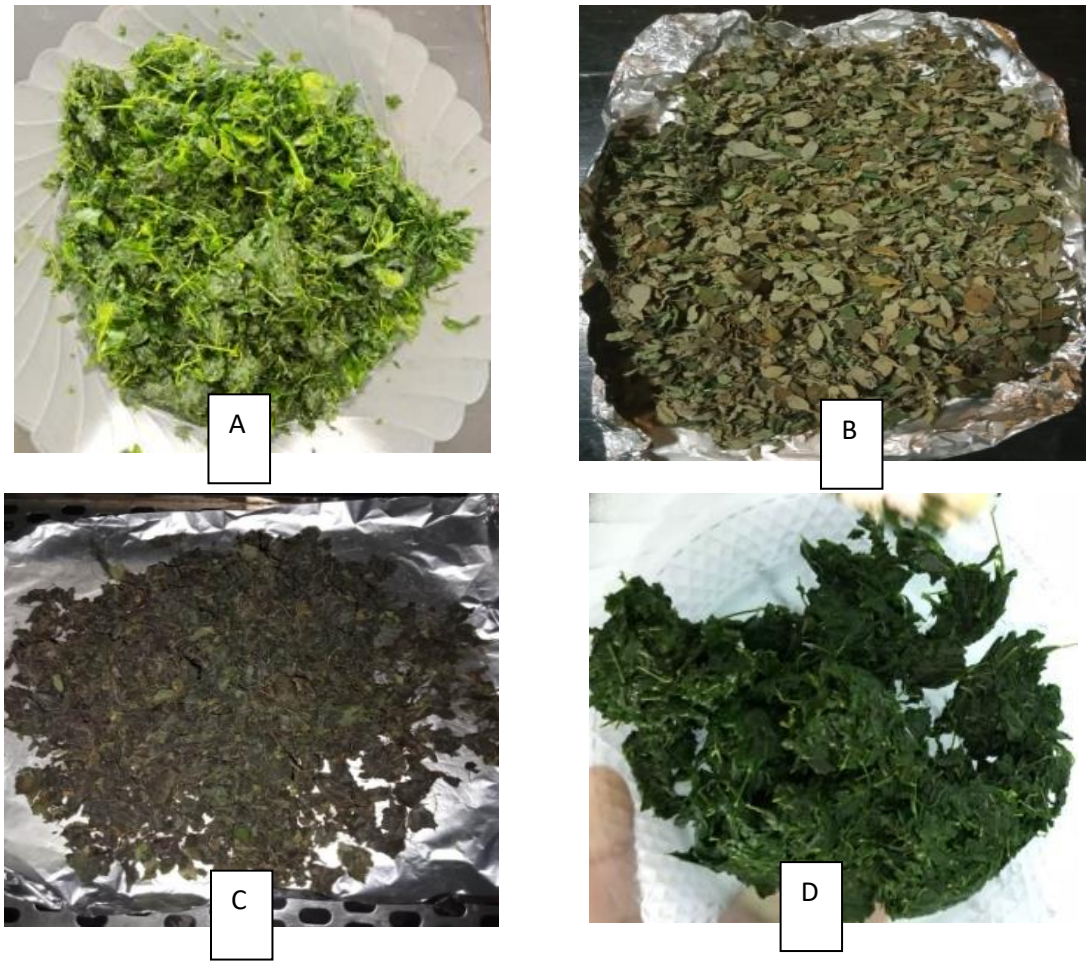

Figure 1. Fresh Moringa Leaves (A), Drying (B), Blanching + Drying (C), Boiling (D)

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Effect of Processing Method on Ash Content of Moringa Leaves

The ash content in a food ingredient reflects the mineral content remaining after the complete combustion of the ingredient (Tuapattinaya *et al.*, 2021). Based on research results, the ash content in Moringa leaves increased after undergoing the processing process. In fresh Moringa leaves, the ash content was recorded at 2.61 ± 0.34%. After the drying process, the ash content increased to 9.02 ± 0.35%, while blanching and boiling produced ash content of 11.00 ± 0.85% and 11.80 ± 10.32%, respectively.

This increase in ash content can be explained by the loss of air components and volatile compounds during the processing process, which causes the mineral concentration in Moringa leaves to be higher (Baihaqi *et al.*, 2023). Drying shows a significant increase in ash content (Aditya, 2021), but blanching and boiling methods produce even higher ash content. This is most likely caused by changes in the cellular structure of Moringa leaves that influence mineral release during thermal maintenance (Lamid *et al.*, 2015).

In the context of the food and pharmaceutical industries, high ash content can be an important indicator in determining the mineral content of a product. Therefore, the choice of processing method must consider its effect on the mineral content in Moringa leaves, especially if the resulting product will be used as a source of minerals in food or health supplements.

Effect of Processing Methods on the Vitamin C Content of Moringa Leaves

Vitamin C is an essential nutrient found in moringa leaves and functions as a natural antioxidant (Hendariyani *et al.*, 2018). However, vitamin C is highly susceptible to high temperatures (Dahlan *et al.*, 2024) and oxygen exposure, leading to degradation during processing (Amelia et al., 2020). According to the research findings, fresh moringa leaves contain 32.31±6.87 mg/100 g of vitamin C. After the drying process, the vitamin C content drastically decreases to 8.70±1.06 mg/100 g. This decline occurs due to prolonged exposure to high temperatures during drying, resulting in significant vitamin C degradation (Baihaqi *et al.*, 2024).

Meanwhile, blanching maintains a relatively stable vitamin C level of 30.00±2.68 mg/100 g. This suggests that blanching is effective in preserving vitamin C content, as the heating process is shorter than in drying. Interestingly, boiling increases the vitamin C content to 49.08±8.66 mg/100 g. This increase is likely due to the enhanced release of vitamin C from the cellular structure of moringa leaves during heating in water, making vitamin C extraction more efficient (Paramita, 2023).

These findings indicate that processing methods significantly affect the vitamin C content in moringa leaves. If the primary goal is to retain a high vitamin C content, boiling or blanching is recommended over-drying. However, if longer shelf life is the main priority, drying remains a better option despite vitamin C degradation. Therefore, selecting an appropriate processing method is crucial to maximize the nutritional benefits of moringa leaves based on their intended use.

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CONCLUSION

This study demonstrates that processing methods significantly affect the moisture content, ash content, and vitamin C levels in moringa leaves (*Moringa oleifera*). The results indicate that drying is the most effective method for reducing moisture content, from 73.2% in fresh leaves to 6.91%, contributing to improved storage stability. In contrast, boiling increased moisture content to 85.06% due to water absorption during cooking, while blanching maintained moisture at an intermediate level of 14.23%. Ash content increased after processing, indicating higher mineral concentrations due to the loss of volatile compounds and water. Fresh leaves had an ash content of 2.61%, which increased to 9.02% after drying, 11% after blanching, and 11.8% after boiling. This suggests that heat-based processing can enhance the mineral concentration in moringa leaves, benefiting food and health supplement applications. Vitamin C, which is highly susceptible to heat and oxidation, experienced significant degradation during drying (from 32.31 mg/100 g to 8.7 mg/100 g). However, blanching better-preserved vitamin C levels (30 mg/100 g), and boiling unexpectedly increased vitamin C content to 49.08 mg/100 g, likely due to enhanced release from leaf cells into the water. Overall, selecting an appropriate processing method depends on the intended product goal. Drying is suitable for extending shelf life while blanching and boiling are preferable for preserving vitamin C. These findings offer essential insights for the food and pharmaceutical industries in optimizing moringa leaf processing to retain its nutritional quality.

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