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SIMPLICIA CHARACTERIZATION, SPECIFIC AND NON-SPECIFIC PARAMETERS OF MAHKOTA DEWA FRUIT (*Phaleria macrocarpa* (Scheff) Boerl)

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ABSTRACT

Background: *P. macrocarpa* (*Phaleria macrocarpa* (Scheff) Boerl) is known to contain various secondary metabolites, including alkaloids, tannins, terpenoids, saponins, flavonoids, and polyphenols. This study aims to evaluate the simplicia characterization and the specific and non-specific parameters of *P. macrocarpa* fruit (Phaleria macrocarpa (Scheff) Boerl).
Method: The simplicia characterization, along with specific and non-specific parameters, were determined according to the standards outlined in the Indonesian Herbal Pharmacopeia.
Results: The simplicia exhibited the following characteristics: form—transverse slices of the fruit with a semi-spherical shape, smooth surface, grooved texture, fibrous and rough inner surface, with remnants of thick and rigid endocarp, irregularly curved; color—yellowish-white to brownish flesh with dark purple edges; odor—distinctive; and taste—bitter. The infusa showed the following characteristics: form—infusion liquid; color—milky brown; odor—distinctive; and taste—bitter. The drying shrinkage test yielded a result of 1.51%. The total ash content, was 2.97%. The findings indicate that the specific and non-specific parameters of *P. macrocarpa* fruit (Phaleria macrocarpa (Scheff) Boerl) comply with the standards set by the Indonesian Herbal Pharmacopeia. In phytochemical screening, *P. macrocarpa* extracts are reported to contain flavonoids, alkaloids and saponins.
Conclusion: The study concluded that the specific and non-specific parameters of *P. macrocarpa* fruit (Phaleria macrocarpa (Scheff) Boerl) meet the requirements of the Indonesian Herbal Pharmacopeia.

Keywords: *P. macrocarpa*, SCOBY, simplicia characterization, specific parameter, non specific parameter

INTRODUCTION

Kombucha is a well-known fermented beverage made from green or black tea leaves, sucrose, and a Symbiotic Culture of Bacteria and Yeasts (SCOBY) (Barakat et al., 2022). It ferments over 7-21 days and is rich in polyphenols, organic acids, vitamins, minerals, and sugars. The drink is recognized for its strong antioxidant effects and other health benefits, including antibacterial, antihyperglycemic, antiproliferative, immune-modulatory, antihypercholesterolemia, and antihypertensive properties (Júnior et al., 2022).

Recent research has increasingly focused on producing kombucha using alternative substrates, such as herbal infusions, fruits, and vegetables. These alternative substrates have been found to produce kombucha with unique bioactive compounds and distinct pharmacological effects. This has led to the development of what is now referred to as "kombucha analogs," expanding the potential applications and health benefits of this traditional beverage (Barakat et al., 2022; Villarreal-Soto et al., 2018).

P. macrocarpa (Phaleria macrocarpa) is a medicinal plant native to Papua, Indonesia, widely used in traditional medicine across Asia. The plant, particularly its fruit and leaves, is employed in various forms—such as infusions, extracts, or boiled simplicia—for its numerous health benefits (Altaf et al., 2013). *P. macrocarpa* is known to possess antimicrobial, antihyperglycemic (Ali et al., 2012), cytotoxic and antioxidant (Lay et al., 2014), analgesic, antihypercholesterolemic, anti-inflammatory, and antihypertensive activities (Ahmad et al., 2023). Its rich phytochemical profile includes xanthones, flavonoids, terpenoids, and benzophenone derivatives(Lay et al., 2014).

Despite its medicinal potential, the use of *P. macrocarpa* as an alternative substrate in kombucha production remains unexplored. This study aims to address this gap by standardizing the use of *P. macrocarpa* in kombucha and investigating specific and non-specific parameters for its development. By integrating traditional medicinal plants like *P. macrocarpa* into kombucha production, this research seeks to advance the creation of functional fermented beverages with enhanced health benefits.

METHODS

Research instrument and material

The instrument used in this study includes a knife, basin, basket, oven, infusion pot, analytical balance (Mettler Toledo), thermometer (Yuwell), stirring rod, Erlenmeyer flask (Pyrex), beaker (Pyrex), volumetric flask (Pyrex), water bath, glass container, flannel cloth, drying tray, gas stove (Rinnai), flask (Iwaki), micropipette, desiccator, and furnace (Neycraft).

The materials used in this study include *P. macrocarpa* fruit sourced from Desa Bahar Mulya, Unit 16, RT.02, Kec. Bahar Utara, Muaro Jambi (specimen number: 48/HB/06/2023). The chemicals used are distilled water, commercial SCOBY, reagent for phytochemical screening.

Sample Collection and Preparation

The extraction yield of *P. macrocarpa* fruit simplicia was 75.65%, obtained from 10 kg of fresh fruit, yielding 756.5 grams of dried simplicia. Wet sorting was conducted to clean and separate fresh, high-quality fruit. The fruit was sliced transversely and dried on large trays under sunlight for four days. Once dried, the samples were finely ground and stored in airtight containers.

The *P. macrocarpa* fruit extract was prepared using infusion. For the non-SCOBY infusion, 10 grams of simplicia were mixed with 100 ml of water, heated for 15 minutes at 90°C, and filtered through flannel while hot. For the SCOBY-fermented infusion, 20 grams of simplicia were mixed with 200 ml of water, heated similarly, filtered, and then 10% sugar was added while still hot. After cooling to ±25°C, 3 grams of SCOBY were added. The mixture was transferred to a glass container, covered with a clean cloth, and fermented at room temperature (25°C) for 14 days (Antolak et al., 2021).

Simplicia Characterization

Characterization of the extract included organoleptic assessments and physicochemical analyses, such as measurements of dry loss and total ash content

1. Organoleptic Assessment
   The organoleptic test was conducted to observe the extract's shape, color, odor and taste as per Indonesian Herbal Pharmacopeia (Ministry of Health Indonesia, 2017)
2. Physicochemical Analysis
   Physicochemical parameters involved determining the water content, total ash content, and acid-insoluble ash content.
   a. Loss on drying (LOD)
      Weigh 1 to 2 grams of simplicia in a shallow weighing bottle with a lid that has been pre-heated and tared. Spread the material evenly by shaking the bottle, creating a layer about 5 to 10 mm thick. Place it in the drying chamber, remove the lid, and dry at 105°C in 5 hours or until a constant weight is achieved. Before

each drying, allow the bottle to cool in a desiccator to room temperature with the lid closed. Loss on drying can be calculated using the formula (Ministry of Health Indonesia, 2017):

$$\% \text{ LOD} = \frac{initial\ sample\ weight - final\ sample\ weight}{initial\ sample\ weight}\ x\ 100\%$$

b. Determination of Total Ash Content

A one-gram sample was placed in a silicate crucible, evenly distributed, and gradually heated to 800±25°C until complete carbon combustion. After cooling in a desiccator, the crucible was reweighed, repeating the process until a stable weight was achieved (Ministry of Health Indonesia, 2017).

$$\% \text{ total ash content} = \frac{W2 - W1}{W2}\ x\ 100\%$$

Phytochemical Screening

1. Test for Alkaloids

   Each extract (0.5 g) was stirred with 5 ml of 2 N sulfuric acid on a steam bath and then filtered. A few drops of Mayer's reagent (potassium mercuric iodide) were added to 1 ml of the filtrate. The presence of alkaloids was indicated by the formation of turbidity and/or white-colored precipitation (Meneses et al., 2013).
2. Test for Flavonoids

   Each extract (0.5 g) was dissolved in aquabidest and then filtered. A few drops of the filtrate were treated with concentrated hydrochloric acid and magnesium powder. The formation of a red or orange color indicated the presence of flavonoids (Efendi et al., 2024)
3. Test for Saponins

   Each extract (0.5 g) was dissolved in distilled water in a test tube and mixed vigorously. The presence of saponins was indicated by the formation of a frothy layer that persisted upon heating (Harborne, 1984)

RESULTS AND DISCUSSION

The identification of the *P. macrocarpa* fruit plant was conducted at Padjadjaran University, yielding identification results documented under no. specimen: No. 48/HB/06/2023. The determination confirmed that the plant is a species of *Phaleria macrocarpa* (Scheff.) Boerl:

Kingdom	:	Plantae
Division	:	Magnoliophyta
Class	:	Magnoliopsida
Order	:	Malvales
Family	:	Thymelaeaceae
Genus	:	Phaleria
Species	:	*Phaleria macrocarpa* (Scheff.) Boerl.

Standardization of *P. macrocarpa* fruit

1. **Specific Parameter Results (Organoleptic)**

Table 1. Organoleptic result

Characterization	Simplicia	Non-Fermented Infusion	Kombucha *P. macrocarpa* fruit
Shape	Transverse fruit slices, half-spherical with a smooth, grooved surface; the inner surface was fibrous, rough, with thick, stiff endocarp remains, and irregularly curved	liquid	liquid
Color	yellowish-white to brownish with dark purple edges	Milky brown	Milky brown
Odor	Distinctive	Distinctive	Distinctive with a slight sour smell like fermented casava
Taste	Bitter	Bitter	Bitter and slightly sour

This study was conducted to produce both fermented and non-fermented *P. macrocarpa* fruit infusions. The method involved physical quality testing through several parameters, including organoleptic tests for shape, color, odor, and taste. The results for simplicia were as follows: shape—transverse fruit slices, half-spherical with a smooth, grooved surface; the inner surface was fibrous, rough, with thick, stiff endocarp remains, and irregularly curved; color—yellowish-white to brownish with dark purple edges; odor—distinctive; taste—bitter. For the infusion, the results were: form—liquid, color—milky brown, odor—distinctive, taste—bitter. The results refer to Indonesian Herbal Pharmacopeia (Ministry of Health Indonesia, 2017).

2. Non-Specific Parameter Results

a. Loss on drying Results

Table 2. Loss on drying results

Repetition	Empty crucible (g)	Crucible + sample (g)	(crucible + sample) – empty crucible (g)	Percentage (%)	Mean (%)	Requirements according FHI
1	67.34	68.24	0.9	1.1	1.51	no more than 10%
2	64.95	65.83	0.88	0.75		
3	65.69	66.65	0.96	2.7		

The Loss on drying parameter measures the remaining substance after drying at 105°C for 5 hours or until a constant weight is achieved, expressed as a percentage. This measure provides a maximum limit (range) for the amount of compound lost during the drying process (Ahn et al., 2014). Compounds lost during drying typically include volatile substances such as essential oils and water. The loss on drying test result obtained was 1.51%. Loss on drying should not exceed 10%. It also represents the amount of water evaporated (Ministry of Health Indonesia, 2017)

The Loss on drying parameter is crucial for assessing the quality and stability of dried substances. A low Loss on drying, such as 1.51% in this case, indicates that only a minimal number of volatile components and moisture were lost during the drying process (Department of Health of Republic Indonesia, 2000). This suggests that the sample retains most of its essential constituents and has been dried efficiently. High loss on drying can indicate excessive removal of volatile compounds or water, which might affect the stability and efficacy of the extract. Thus, maintaining loss on drying below 10% ensures that the product remains within acceptable limits for quality control, preserving its intended properties and effectiveness (Sutomo et al., 2019).

b. Total ash content

Ash content determination provides insight into the internal and external mineral content from the initial processing of simplicia to the formation of the extract (Department of Health of Republic Indonesia, 2000). The purpose is to assess the mineral content resulting from the entire process, from simplicia to the final extract. During this stage, simplicia is heated until organic compounds and their derivatives are destroyed and evaporated, leaving only the mineral and inorganic components. The total ash content measured using a furnace at 800°C for 8 hours was 2.97%. According to (Ministry of Health Indonesia, 2017), the total ash content should not exceed 5.6%. A lower ash content is desirable because this parameter indicates the presence of heavy metal contaminants that persist at high temperatures. The determination of ash content is essential for evaluating the purity and quality of the extract. A total ash content of 2.97% suggests that the extract contains a relatively low number of inorganic residues, indicating good quality and minimal contamination. High ash content may indicate the presence of impurities or heavy metals, which can affect the safety and efficacy of the extract (Prakash et al., 2019). Therefore, maintaining ash content below 5.6% is crucial to ensure the extract's quality and safety, as it reflects the minimal presence of undesirable inorganic residues (Ministry of Health Indonesia, 2017).

Tabel 3. Total ash content results

Repetition	Empty crucible (g)	Crucible + sample (g)	Initial sample weight (g)	Final sample weight (g)	Percentage (%)	Mean (%)	Requirements according FHI
1	65.79	67.91	65.85	63.71	3.25	2.97	no more than 2.97
2	65.46	67.62	65.62	63.66	2.99		
3	67.40	69.44	67.69	65.88	2.68		

Phytochemical Screening

Table 4. Phytochemical screening

Secondary metabolites	Results
Flavonoid	+
Saponin	+
Alkaloid	+

In this study, a phytochemical screening of *Phaleria macrocarpa* (*P. macrocarpa*) was conducted, identifying the presence of several key bioactive compounds: flavonoids, saponins, alkaloids, and tannin. It is consistent with the findings of a previous study by (Lay et al., 2014) which reported that the fruits of *P. macrocarpa* are rich in phytochemicals such as flavonoids (the primary component), glycosides, saponin glycosides, phenolic compounds, tannins, and terpenoids, all of which may contribute to the plant's bioactive properties, including antioxidant and cytotoxic activities. The study also noted the presence of moderate amounts of carbohydrates, steroids, and terpenoids in the fruits of *P. macrocarpa*.

P. macrocarpa extracts are reported to contain alkaloids and saponins as well. However, there is a need for a thorough investigation of these extracts to identify the specific alkaloids and saponins present and to correlate them with the reported biological properties of *P. macrocarpa* extracts(Altaf et al., 2013).

These screening results demonstrate that *P. macrocarpa* contains compounds with scientifically proven beneficial biological activities, further supporting the plant's potential in health and medicinal applications.

CONCLUSION

The study successfully evaluated the physical and chemical quality of fermented *Phaleria macrocarpa* fruit extracts using the infusion method. The drying loss was found to be 1.51%, within the recommended range of less than 10%, indicating minimal water content and enhanced stability. The total ash content was 2.97%, below the maximum allowable limit of 5.6%, reflecting a low presence of inorganic contaminants, including heavy metals. Additionally, *P. macrocarpa* extracts are known to contain flavonoids, alkaloids and saponins; however, further research is needed to specifically identify these compounds and correlate them with the reported biological properties. Overall, the findings indicate that the *P. macrocarpa* fruit extract has good physical and chemical quality, with potential for further development in bioactive compound research and health applications.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest

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