Jurnal Sains Farmasi & Klinis
p-ISSN: 2407-7062 | e-ISSN: 2442-5435
homepage: http://jsfk.ffarmasi.unand.ac.id
DOI : 10.25077/jsfk.11.2.95-102.2024

ORIGINAL ARTICLE J Sains Farm Klin 11(2):95–102 (November 2024) | DOI: 10.25077/jsfk.11.2.95-102.2024

Pharmacological Profile and Therapeutic Potential of Sungkai Plant (*Peronema canescens* Jack.): An Emerging Indonesian Herbal Medicine

Asep Kokom[1,4], Yasmiwar Susilawati[1,3]*, Sri Adi Sumiwi[2], & Okta Nama Putra[5]

[1]*Department of Biology Pharmacy, Faculty of Pharmacy, Padjadjaran University, Sumedang, Indonesia*
[2]*Department of Pharmacology and Clinical Pharmacy, Faculty of Pharmacy, Padjadjaran University, Sumedang, Indonesia*
[3]*Herbal Study Center, Faculty of Pharmacy, Padjadjaran University, Sumedang, Indonesia*
[4]*Department of Pharmacy, Faculty of Mathematics and Natural Science, Garut University, Garut, Indonesia*
[5]*Research Center for Agroindustry, National Research and Innovation Agency Soekarno Science and Technology Area, Bogor, Indonesia*

ABSTRACT: This study aimed to summarize the pharmacological activities of the sungkai plant (*Peronema canescens* Jack.) as a potential Indonesian herbal medicine. A literature review was conducted using Google Scholar and Scopus, with keywords such as "pharmacology," "activity," "sungkai," and "Peronema canescens." Inclusion criteria were articles with these keywords, published between 2014 and 2024, in English or Indonesian. Exclusion criteria were review articles, articles not related to sungkai plants, and *in vitro* and *in vivo* studies not available in full text. The study identified seven pharmacological activities of the sungkai plant: antioxidant, antibacterial, analgesic, antidiabetic, antihyperuricemic, anti-inflammatory, and immunomodulatory. The antioxidant activity was demonstrated using Thin Layer Chromatography (TLC) and IC_{50} values. The antibacterial activity was shown through bacterial growth inhibition using the Kirby-Bauer disk diffusion method. The analgesic activity was tested using the writhing test and hot plate methods. The antidiabetic activity was studied with alloxan induction method. Overall, the sungkai plant exhibits various pharmacological activities, suggesting its potential as an herbal medicine for treating various diseases.

Keywords: **analgesic; antibacterial; antioxidant; *peronema canescens*; pharmacological activities.**

Introduction

Nowadays, the global trend of using plants as herbal medicines are increasing rapidly. This is supported by growing research on the benefits of plants for medicinal purposes [1]. Growing public awareness of health has led to an increased use of plants as herbal medicines, a tradition passed down through generations. This shift is largely due to their proven effectiveness in treating diseases with fewer side effects compared to conventional medicines [2].

In Indonesia, the use of plants as herbal medicines dates back to ancient times, serving as a means to maintain health, prevent illness, and treat diseases [3]. Currently, around 5,000 plant species in Indonesia have been identified and are used as herbal medicines [4]. One commonly used plant is the sungkai plant (*Peronema canescens* Jack.). It is traditionally used to treat fever, worms, colds, and as a mouthwash to prevent toothaches. Additionally, the sungkai plant is now widely used to boost the immune system, especially during exposure to the Covid-19 virus [5].

The sungkai plant is actually a wild species. However, due to its economic value, it is widely cultivated by communities. Typically, this plant can be found in ricefields, gardens, and yards. The sungkai plant grows easily without special care, so many people use it as a living fence or barrier in their yards [6]. In terms of ethnobotany, the sungkai plant is prevalent among the Dayak tribe of Kalimantan. However, it can also be found in Sumatra under regional names such as sekai, sungkai, and singkih, as well as in Java known as jati sabrang and sungke [7,8]. Sungkai plants can reach heights of 20-30m and have diameters of up to 60 cm. They typically thrive at elevations of 0-600 masl, preferring soil rich in nutrients [9].

According to Ramadhani et al. (2022), the bark of the sungkai plant contains alkaloids, flavonoids, phenols, and saponins [10]. On the other hand, the leaves contain alkaloids, flavonoids, tannins, saponins, steroids, terpenoids, and phenolics [11]. The flavonoids found in sungkai leaves can serve as antihypertensives. Additionally, the

Article history
Received: 09 Sep 2024
Accepted: 16 Oct 2024
Published: 30 Nov 2024

Access this article

***Corresponding Author:** Yasmiwar Susilawati
Department of Biology Pharmacy, Faculty of Pharmacy, Padjadjaran University, Sumedang, Indonesia, 45363 | Email: yasmiwar@unpad.ac.id

presence of flavonoids and tannins can act as antioxidants, guarding against oxidation reactions in the body's cells. Moreover, compounds like alkaloids, saponins, and phenols also possess antihypertensive properties [12].

From the description provided, it's evident that the sungkai plant contains secondary metabolite compounds with diverse pharmacological activities, suggesting its potential as an herbal medicine. However, there's a scarcity of studies consolidating the results of these tests. Hence, this research aims to identify reported pharmacological activities of the sungkai plant, providing a convenient reference for researchers interested in conducting further tests on its herbal medicinal properties.

Methods

Literature Search

The literature search was conducted using the Google Scholar and Scopus databases to identify relevant studies on the pharmacology and activity of Sungkai (*Peronema canescens*). These two databases are used because they are high-quality, credible, and have a wide scope. Scopus is one of the most recognized databases, with tight criteria for selecting indexed articles to ensure their quality. Google Scholar can provide access to a variety of sources, including books, theses, and other indexed publications. This can make it easier to find substance on sungkai plants, which have received not much study so far. The search strategy employed the following combination of keywords: "pharmacology", "activity", "sungkai", "peronema canescens". The search was performed between January and April 2024. The search results yielded 190 articles.

Screening and Selection

To ensure the relevance and quality of the selected articles, a screening process was applied using the following criteria:

Inclusion Criteria

For articles to be considered, they must include the keywords "pharmacology," "activity," "peronema," and "canescens" or "sungkai." Additionally, they should have been published between 2014 and 2024 and be available in English or Indonesian.

Exclusion Criteria

Review articles, systematic reviews, studies that do not focus on Sungkai (*Peronema canescens*), studies that are not conducted *in vitro* or *in vivo*, and articles that are not available in full text were excluded from consideration.

Selection Process

Out of the 190 articles retrieved from the search, 15 were chosen for further examination as they met the inclusion criteria and did not violate any exclusion criteria.

Data Extraction

The selected articles were thoroughly reviewed and relevant data were extracted, including the study design, methodology, results, and conclusions. The extracted data were analyzed and summarized to provide an overview of the pharmacology and activity of Sungkai (*Peronema canescens* Jack.).

Quality Assessment

The quality of the selected articles was assessed using the Cochrane Risk of Bias Tool for randomized controlled trials. The quality assessment was used to evaluate the methodological quality of the studies and to ensure that the results were reliable and generalizable.

Data Analysis

The extracted data were analyzed using descriptive statistics and thematic analysis. The results were presented in a clear and concise manner, and the findings were discussed in the context of the existing literature on sungkai (*Peronema canescens*).

Conclusion

The comprehensive method outlined above ensures that the literature search and selection process are rigorous and systematic as seen in Figure 1,and that the data extracted are relevant and reliable. The quality assessment and data analysis procedures ensure that the results are accurate and generalizable, making the study suitable for publication in indexed journals.

Result and Discussion

Data collection for literature review materials involved searching the Google Scholar and Scopus databases using the advanced search feature. Keywords were combined with "AND" and "OR" to narrow the search according to the research topic. Articles obtained were then sorted based on predetermined inclusion and exclusion criteria. Out of 190 articles, 15 were selected and are listed in Table 1 as literature review materials for this research. The study results reveal seven pharmacological activities of the sungkai plant, including antioxidant, antibacterial, analgesic, antidiabetic, antihyperuricemic, anti-inflammatory, and immunomodulatory properties.

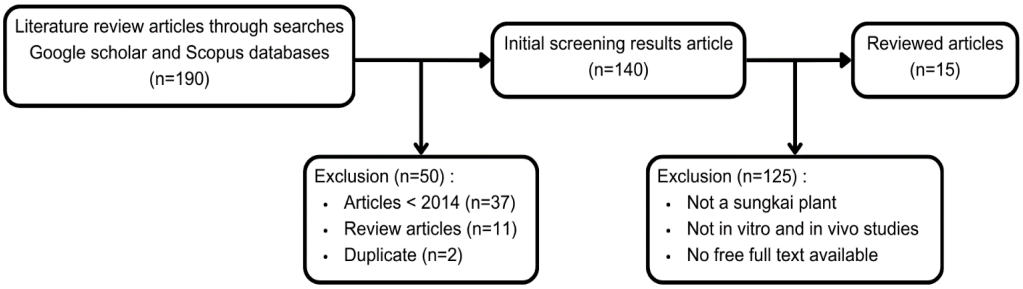

Figure 1. Literature review flow chart.

Antioxidant

Antioxidant compounds play a crucial role in maintaining health by scavenging free radicals, potentially reducing the risk of chronic diseases like coronary heart disease and cancer [13]. According to Sutomo et al. (2022), sungkai leaves exhibit antioxidant potential, confirmed both qualitatively and quantitatively. Qualitative analysis involved Thin Layer Chromatography (TLC), where sungkai leaf extract was spotted on a silica gel plate and sprayed with a DPPH solution, revealing yellow spots indicative of antioxidant activity under a 254 nm detector. Quantitative assessment demonstrated that sungkai leaf methanol extract possesses strong antioxidant properties, with an IC_{50} value of 63,977 ppm using quercetin as a standard [14]. Antioxidant activity is categorized based on IC_{50} values: very strong (<50 ppm), strong (50-100 ppm), medium (100-150 ppm), weak (150-200 ppm), and very weak (>200 ppm) [15]. Furthermore, fractions of sungkai leaves, including n-hexane, ethyl acetate, and ethanol, displayed antioxidant activity, with the ethyl acetate fraction exhibiting very strong activity. GC-MS analysis revealed fatty acid compounds like decanoic acid, dodecanoic acid, and others, along with alkane and alcohol compounds [13]. Additionally, endophytic fungi isolated from sungkai leaves, particularly *Penicillium oxalium*, exhibited potent antioxidant activity [16].

Antibacterial

Besides functioning as an antioxidant, endophytic fungi within sungkai leaves also possess antibacterial properties. Oktiansyah et al. (2023), identified the bioactive compound 4-hydroxybenzoic acid in *Trichoderma asperellum* fungus isolated from sungkai leaves. The paper disc diffusion method was performed to determine the compound's antibacterial activity using MHA (Muller Hinton Agar) as the media. Based on the Minimum Inhibitory Concentration (MIC) values, 4-hydroxybenzoic acid compounds identified in sungkai leaves indicate strong antibacterial activity against *Escherichia coli*, *Staphylococcus aureus*, *Salmonella typhi*, and *Bacillus subtilis* bacteria [17]. Furthermore, ethanol extract from sungkai leaves exhibited antibacterial potential by inhibiting *Escherichia coli* growth using the Kirby-Bauer disk diffusion method [9]. Sumilat et al. (2022), categorized antibacterial activity as very strong (≥ 20 mm), strong (10-20 mm), medium (5 to < 10 mm), and weak (≤ 5 mm) [18].

Analgesic

Pain or discomfort indicates underlying issues within the body, such as inflammation (e.g., rheumatism and gout), bacterial contamination, or muscle tension. This discomfort arises from mechanical or chemical impulses that can harm body tissues, prompting the release of pain mediators like histamine, serotonin, and prostaglandins [19]. To alleviate pain, compounds with analgesic properties are necessary.

Research by Wahyuni and Muin (2023), suggests that the sungkai plant can serve as an analgesic, offering a nearly equivalent effect to paracetamol. The flavonoid content in sungkai leaves can protect the fat layer and block the development of cyclooxygenase 1 enzymes, an initial phase synthesizing pain mediators like prostaglandins. Testing various doses—300, 600, and 900 mg/kg BW—highlighted 600 mg/kg BW of sungkai leaf ethanol extract as the most effective in analgesic activity [20]. Similarly, Sinaga et al. (2022) investigated the analgesic potential of sungkai leaf ethanol extract at doses of 100, 200, and 300 mg/kg BW. They employed the writhing test method using male mice, avoiding interference from an estrous cycle. The induced writhing was triggered by 1% acetic acid, known for its stomach mucous membrane irritation effect, causing pain and writhing in mice. The sungkai leaf

ethanol extract at 300 mg/kg BW exhibited the highest analgesic effectiveness at 115.3% when compared to 1% methampirone as a positive control [8]. Rahayu (2024), found that a dose of 400 mg/kg BW of sungkai leaf ethanol extract provided an analgesic effectiveness of 111.44%, with diclofenac sodium as a positive control [21]. In another study, Muharni et al. (2022), explored the analgesic activity of sungkai leaf ethanol extract

Table 1. List of articles on the pharmacological activity of sungkai leaves.

No.	Reference	Activity	Method	Result
1	[16]	Antioxidant	In vitro: DPPH Doses 1000, 500, 250, 125, 62.5, 31.25, and 15.625 µg/mL	Ethyl acetate extract from endophytic fungi shows very strong antioxidant activity with an IC_{50} value < 20 ppm
2	[14]	Antioxidant	In vitro: TLC and DPPH Doses 20, 40, 60, 80, and 100 ppm	A dose of 20 ppm has the potential as a strong anti-oxidant with an IC_{50} value of 63,977 ppm
3	[13]	Antioxidant	In vitro: DPPH Ethanol extract dosage: 10, 30, 50, 70 ppm; n-hexane fraction: 100, 200, 300, 400, 500 ppm; ethyl acetate and ethanol fractions: 1, 5, 10, 15, 20 ppm	The ethyl acetate fraction showed very strong antioxidant activity with an IC_{50} value of 12.986 ppm
4	[17]	Antibacterial	In vitro: Disc diffusion Doses 256, 128, 64, 32, 16, 8, and 4 µg/mL	Ethyl acetate extract of endophytic fungi shows moderate antibacterial activity against *Escherichia coli* and *Staphylococcus aureus* and strong activity against *Bacillus subtilis*
5	[9]	Antibacterial	In vitro: Kirby-Bauer disc diffusion Concentration 25, 50, 75 and 100%	A concentration of 25% provides the most effective effect of inhibiting the growth of *Escherichia coli* bacteria
6	[22]	Analgesic	In vivo: Hot plate Doses 100, 200 and 400 mg/Kg BW	A dose of 400 mg/Kg BW provides the highest analgesic effect, namely 40.26%
7	[20]	Analgesic	In Vivo: Male white rats induced by 1% acetic acid Doses 300, 600, 900 mg/Kg BW	A dose of 600 mg/Kg BW provides an analgesic effect close to the effect of paracetamol
8	[8]	Analgesic	In Vivo: Male white mice were induced with 1% acetic acid Doses 100, 200 and 300 mg/Kg BW	A dose of 300 mg/Kg BW provides the best analgesic effect with a percentage of 66.2%
9	[21]	Analgesic	In vivo: Siegmund test Doses 100, 200, 300 and 400 mg/Kg BW	A dose of 400 mg/Kg BW provides a better analgesic effect than diclofenac sodium
10	[26]	Antidiabetic	In vivo: Male white mice are induced by alloxan Doses 100, 200 and 300 mg/Kg BW	A dose of 300 mg/Kg BW reduced blood glucose levels by 114% on day 14
11	[30]	Antihyperuricemia	In vivo: Male white mice were induced with potassium oxonate and chicken liver juice Doses 125, 250 and 500 mg/Kg BW	A dose of 500 mg/Kg BW reduces uric acid levels by 38.66%
12	[34]	Anti-inflammatory	In vivo: Male white mice are induced by carrageenan Doses 5, 10 and 15%	The ethanol and n-hexane fractions provided analgesic activity with percent inhibition of 58.12 and 56.59%, respectively.
13	[12]	Anti-inflammatory	In vivo: Male Swiss Webster white mice are induced by carrageenan Doses 5, 10 and 15%	Sungkai leaf ethanol extract with concentrations of 5%, 10%, 15% provides an anti-inflammatory effect characterized by a decrease in the volume of exudate, lymphocytes, stem neutrophils and segment neutrophils
14	[39]	Immunomodulator	In Vitro: RAW 264.7 cells induced by LPS Doses 1, 10, 100 µg/mL In vivo: Male white mice were induced with Staphylococcus suspension Doses 200, 400 and 800 mg/Kg BW	Increases concentrations of TNF-α and IL-6 Increases phagocytic capacity activity in macrophage cells, increases total leukocytes and lymphocytes
15	[40]	Immunomodulator	In Vivo: Male white mice induced by the Moderna vaccine Doses 1, 10 and 100 mg/Kg BW	The butanol fraction at a dose of 1 mg/Kg BW increases the concentration of NK cells The water fraction dose of 100 mg/Kg BW increased CD8+T cells

by examining its mechanisms of action on muscarinic receptors, dopamine receptors, and opioid receptors. Using the Hot Plate method and rats as test animals, they discovered that a dose of 400 mg/kg BW achieved the highest analgesic activity at 40.26% via the muscarinic receptor mechanism [22].

Antidiabetic

Diabetes mellitus (DM) belongs to a group of metabolic diseases characterized by elevated blood glucose levels, often resulting from abnormalities in insulin secretion, insulin action, or both [23]. DM is typically classified into type 1 and type 2. Type 1 DM stems from pancreatic β-cell damage, leading to a lifelong reliance on insulin. Conversely, type 2 DM arises from insulin resistance, insufficient insulin production, or a combination of both [24]. Traditionally, oral antidiabetics have been the go-to treatment for DM. However, herbal medicines are gaining popularity due to their reduced side effects [25].

The sungkai plant is one such herbal remedy used for antidiabetic purposes. Research by Naldi et al. (2022), demonstrated that the ethyl acetate extract of sungkai leaves lowered blood sugar levels in male mice. Using the alloxan induction method, three doses of sungkai leaf ethyl acetate extract 100, 200, and 300 mg/kg BW were tested, with metformin as a comparison [26]. Alloxan, a diabetogenic compound, damages pancreatic β-cells by generating hydroxyl radicals that disrupt calcium ion mobilization, ultimately diminishing insulin production and secretion, as well as receptor sensitivity in insulin-receptive cells [25]. The test results showed that the ethyl acetate extract of sungkai leaves at a dose of 300 mg/kg BW reduced blood sugar levels in male mice by 114%, indicating the potential of the sungkai plant as an antidiabetic agent [26].

Anti-Hyperuricemia

Hyperuricemia refers to elevated levels of uric acid in the blood, typically considered hyperuricemia in men when levels exceed 7 mg/dL and in women when above 6 mg/dL. If left untreated, hyperuricemia can lead to kidney damage, such as urate nephropathy and uric acid nephropathy [27]. Allopurinol is commonly prescribed for hyperuricemia treatment, functioning as a xanthine oxidase inhibitor to reduce uric acid production and purine synthesis, thus lowering blood uric acid levels. However, allopurinol may cause side effects like diarrhea, nausea, and skin redness accompanied by itching [28]. Prompting individuals to seek alternative treatments, such as non-pharmacological therapy using herbal medicines [29].

One such herbal remedy for hyperuricemia is the sungkai plant. According to research by Latief et al. (2021), sungkai plant extract demonstrates antihyperuricemia activity by reducing blood uric acid levels in mice. Male white mice were induced with potassium oxonate and chicken liver juice. Potassium oxonate inhibits the uricase enzyme, preventing the conversion of uric acid to allantoin and leading to increased uric acid levels. Meanwhile, chicken liver juice, rich in purines, further elevates uric acid levels. Testing three doses of sungkai leaf ethanol extract—125, 250, and 500 mg/kg BW—against allopurinol as a positive control, the results indicated that the 500 mg/kg BW dose exhibited the most effective reduction activity, with a percentage reduction of 38.66%. This suggests that this particular dose contains more active compounds than the others, affirming the potential of the sungkai plant as an antihyperuricemia treatment [30].

Anti-Inflammatory

Inflammation serves as the body's protective response to tissue injury caused by harmful chemicals, microorganisms, or physical trauma. It aims to neutralize irritants, combat invading organisms, and facilitate tissue repair [31]. Managing inflammation focuses on two main objectives: alleviating pain during initial symptoms and slowing or halting tissue damage. While non-steroidal anti-inflammatory drugs and corticosteroids can alleviate inflammation symptoms, they often carry adverse effects like gastrointestinal issues, kidney damage, and liver toxicity [32]. Consequently, there's a growing interest in natural remedies for treatment [33].

The sungkai plant is among the natural options used as an anti-inflammatory treatment. Research by Latief et al. (2021), demonstrated that ethanol extract of sungkai leaves possesses anti-inflammatory properties, reducing exudate volume, lymphocytes, stem neutrophils, and segment neutrophils in male Swiss Webster mice induced by carrageenan. Carrageenan triggers cell injury by releasing mediators that kickstart inflammation. Testing three concentrations of sungkai leaf ethanol extract—5%, 10%, and 15% mixed in vaseline flavum—on mice, with hydrocortisone acetate as a positive control, revealed that the 15% concentration delivered the most effective anti-inflammatory effect, albeit falling short of the positive control's effect [12]. Similarly, Tarigan et al. (2023), conducted tests using the same method on the ethanol and n-hexane fractions of sungkai leaves. Characterization of the fractions using thin layer chromatography, UV-Vis spectrophotometer, and FTIR unveiled two compounds

with anti-inflammatory properties. The ethanol fraction contains the flavonoid apigenin, while the n-hexane fraction contains squalene, known to reduce redness and swelling as an anti-inflammatory agent. Both fractions exhibited anti-inflammatory activity, with percent inhibition rates of 58.12% and 56.59%, respectively. These findings underscore the sungkai plant's potential as an anti-inflammatory medication [34].

Immunomodulatory

The immune system acts as the body's defense mechanism, shielding against infections by identifying and neutralizing harmful substances [35]. Yet, pathogens possess strategies to evade the immune system, necessitating external agents to bolster its function. Immunomodulators, whether natural or synthetic, can stimulate, suppress, or regulate various immune components to combat pathogens [36]. However, synthetic immunomodulators have often faltered clinically due to issues like bioavailability, stability, and adverse effects. Hence, there's growing interest in exploring plant-based immunomodulators with fewer side effects [37].

The sungkai plant is among those believed to enhance the immune system [38]. Dillasamola et al. (2021), conducted tests to evaluate sungkai plants' immunomodulatory activity, both *in vitro* and *in vivo*. *In vitro* experiments were performed on RAW 264.7 cells induced by lipopolysaccharide (LPS). Sungkai leaf ethanol extract, administered at doses of 1, 10, and 100 µg/mL, exhibited immunomodulatory effects by upregulating TNF-α and IL-6, pro-inflammatory cytokine receptors. Meanwhile, *in vivo* trials were conducted on male white mice induced by *Staphylococcus aureus* suspension. Using doses of 200, 400, and 800 mg/kg BW, ethanol extract of sungkai leaves was tested on leukocyte parameters and macrophage cell phagocytosis. The 800 mg/kg BW dose showed the most effective immunomodulatory activity, evident by increased total leukocytes, lymphocytes, and macrophage cell phagocytic capacity, along with reduced neutrophil cells and elevated cytokine levels [39]. Furthermore, sungkai leaf fractions were tested for immunomodulatory activity against the SAR-COV-2 virus. Administration of water, butanol, n-hexane, and ethyl acetate fractions at varying doses to male white mice induced by the moderna virus showed promising results. The butanol fraction at 1 mg/kg BW enhanced NK cells, while the water fraction at 100 mg/kg BW increased the concentration of $CD8^{+}$T cells. These findings demonstrate the sungkai plant's potential as an immunomodulatory agent, either enhancing immune system function or acting as an immunostimulant [40].

Conclusion

The sungkai plant (*Peronema canescens* Jack.) has been found to exhibit a wide range of pharmacological activities, including antioxidant, antibacterial, analgesic, antidiabetic, antihyperuricemic, anti-inflammatory, and immunomodulatory properties. These activities are attributed to the presence of various bioactive compounds such as alkaloids, flavonoids, phenols, and saponins. The antioxidant activity of sungkai leaves was demonstrated using Thin Layer Chromatography (TLC) and IC_{50} values, while antibacterial activity was shown through bacterial growth inhibition using the Kirby-Bauer disk diffusion method. The analgesic activity was tested using the writhing test and hot plate methods, and the antidiabetic activity was studied with alloxan induction method. The antihyperuricemic activity was demonstrated through the reduction of blood uric acid levels in male mice. Overall, the sungkai plant exhibits various pharmacological activities, suggesting its potential as an herbal medicine for treating various diseases.

Future Prospect

Future studies should focus on further isolating and characterizing the bioactive compounds responsible for the pharmacological activities of sungkai. This could involve using advanced techniques such as high-performance liquid chromatography (HPLC) and mass spectrometry (MS) to identify and quantify these compounds. Additionally, *in vitro* and *in vivo* studies should be conducted to investigate the mechanisms of action of these compounds and to determine their efficacy and safety in treating specific diseases. Furthermore, the potential of sungkai as an herbal medicine should be explored through clinical trials. This would involve conducting randomized controlled trials to evaluate the efficacy and safety of sungkai extracts in treating various diseases, such as diabetes, hyperuricemia, and inflammatory conditions. The results of these studies could provide valuable insights into the therapeutic potential of sungkai and inform the development of new herbal medicines. In terms of safety, the acute toxicity test of ethanol extract of sungkai leaves at doses between 175 to 5000 mg/kg BW did not affect the test animals' deaths, even though it did cause kidney damage [41]. Meanwhile, the subchronic toxicity test with doses of 100, 200, 400, and 800 mg/kg BW indicated no damage to kidney organs [42]. Therefore, the ethanol extract of sungkai leaves is safe to use. Finally, the ethnobotanical and traditional uses

of sungkai should be documented and studied in more detail. This could involve conducting interviews with local communities and documenting the traditional methods of preparation and use of sungkai. This information could provide valuable insights into the cultural and historical significance of sungkai and inform the development of new herbal medicines.

Conflict of Interest

The authors declare no conflicts of interest related to this study.

References

[1]. Afriani T, Yulia R, Sanola R. Standardisasi Simplisia pada Proses Pembuatan Serbuk Herbaldasawisma Matahari yang Digunakan Sebagai Alternatif Pengobatan di Puskesmas Rasimah Ahmad. J Endur Kaji Ilm Probl Kesehat. 2022;7(1):128–37. https://doi.org/http://doi.org/10.22216/endurance.v7i1.789

[2]. Yulianto S. Penggunaan Tanaman Herbal Untuk Kesehatan. J Kebidanan dan Kesehat Tradis. 2017;2(1):1–7. https://doi.org/10.37341/jkkt.v2i1.37

[3]. Wulandari S, Nugroho Widhi A, Sukma Larasati N, Putri Handayani J. Edukasi Tentang Obat Herbal (Untuk Demam) Berdasar Formularium Ramuan Obat Tradisional Indonesia (Froti). BERNAS J Pengabdi Kpd Masy. 2022;3(4):507–12. https://doi.org/10.31949/jb.v3i4.3277

[4]. Manurung H, Susanto D, Kusumawati E, Aryani R, Nugroho RA, Kusuma R, et al. Phytochemical, GC-MS analysis and antioxidant activities of leaf methanolic extract of Lai (Durio kutejensis), the endemic plant of Kalimantan, Indonesia. Biodiversitas. 2022;23(11):5566–73. https://doi.org/10.13057/biodiv/d231104

[5]. Santoni A, Syukri D, Rahmi A. Kajian Bioaktivitas Daun Sungkai (Peronema canescens Jack). 1st ed. Ponorogo: Uwais Inspirasi Indonesia; 2023. 85 p.

[6]. Yanarita, Naiem M, Sukarna, Budiadi. Development of the Dayak Ngaju Community Forest in the Forest and Peatland Area, Central Kalimantan, Indonesia. IOSR J Environ Sci Toxicol Food Technol. 2014;8(3):40–7. https://doi.org/10.9790/2402-08314047

[7]. Carolina M, Araya W, Carolina P, Permatasari Iskandar D. Efektifitas Pemberian Seduhan Daun Sungkai (Peronema Canescens Jack) Terhadap Perubahan Tekanan Darah Pada Lansia Hipertensi Di Wilayah Upt Puskesmas Pahandut Palangka Raya. J Kesehat Tambusai. 2022;3(3):442–52. https://doi.org/10.31004/jkt.v3i3.6448

[8]. Sinaga MPB, Elysa Putri Mambang D, Sari Lubis M, Yuniarti R. Uji Aktivitas Analgesik Ekstrak Daun Sungkai (Peronema canescens Jack.) Terhadap Mencit Jantan (Mus musculus). Farmasainkes. 2022;2(1):100–10.

[9]. Fransisca D, Kahanjak DN, Frethernety A. Uji aktivitas antibakteri ekstrak etanol daun sungkai (Peronema canescens Jack) terhadap pertumbuhan Escherichia coli dengan metode difusi cakram Kirby-Bauer. J Pengelolaan Lingkung Berkelanjutan (Journal Environ Sustain Manag. 2020;4(1):460–70. https://doi.org/10.36813/jplb.4.1.460-470

[10]. Ramadhani N, Samudra AG, Pertiwi R, Utami CD, Muslimah A, Syahidah W, et al. Analisis Total Fenol Dan Flavonoid Ekstrak Etanol Kulit Batang Sungkai (Peronema canescens Jack). Pharm J Farm Indones (Pharmaceutical J Indones. 2022;19(1):66. https://doi.org/10.30595/pharmacy.v19i1.12554

[11]. Ramadenti F, Sundaryono A, Handayani D. Uji Fraksi Etil Asetat Daun Peronema canescens terhadap Plasmodium berghei pada Mus musculus. Alotrop J Pendidik dan Ilmu Kim. 2017;2(1):89–92.

[12]. Latief M, Fisesa AT, Sari PM, Tarigan IL. Anti Inflammatory Activity of Sungkai Leaves (Peronema Canescens Jack) Ethanol Extract in Carrageenan Induced Mice. J Farm Sains dan Prakt. 2021;7(2):144–53. https://doi.org/10.31603/pharmacy.v7i2.4532

[13]. Pindan NP, Daniel, Saleh C, Magdaleni AR. Uji Fitokimia dan Uji Aktivitas Antioksidan Ekstrak Fraksi n-Heksana, Etil Asetat dan Etanol Sisa dari Daun Sungkai (Peronema canescens Jack.) dengan Metode DPPH. J At. 2021;6(1):22–7.

[14]. Sutomo S, Arnida A, Yulistati FR, Normaidah N, Pratama MRF. Pharmacognostic Study and Antioxidant Activity of Sungkai (Peronema Canescens Jack.) Methanol Extract From Indonesia. Bull Pharm Sci Assiut. 2022;45(2):655–65. https://doi.org/10.21608/BFSA.2022.271585

[15]. Bahrul P, Rahman N, Diah AWM. Uji Aktivitas Antioksidan Ekstrak Daun Salam (Syzygium polyanthum) dengan Menggunanakan 1,1-Difenil-2- Pikrilhidrazil. J Akad Kim. 2014;3(August):143–9.

[16]. Elfita, Oktiansyah R, Mardiyanto, Widjajanti H, Setiawan A. Antibacterial and antioxidant activity of endophytic fungi isolated from Peronema canescens leaves. Biodiversitas. 2022;23(9):4783–92. https://doi.org/10.13057/biodiv/d230946

[17]. Oktiansyah R, Widjajanti H, Setiawan A, Nasution S, Mardiyanto, Elfita. Antibacterial and Antioxidant Activity of Endophytic Fungi Extract Isolated from Leaves of Sungkai (Peronema canescens). Sci Technol Indones. 2023;8(2):170–7. https://doi.org/10.26554/sti.2023.8.2.170-177

[18]. Sumilat DA, Lintang RAJ, Undap SL, Adam AA, Tallei TE. Phytochemical, antioxidant, and antimicrobial analysis of Trichoderma asperellum isolated from ascidian Eudistoma sp. J Appl Pharm Sci. 2022;12(4):90–5. https://doi.org/10.7324/JAPS.2022.120410

[19]. Afrianti R, Yenti R, Meustika D. Uji Aktifitas Analgetik Ekstrak Etanol Daun Pepaya (Carica papaya L.) pada Mencit Putih Jantan yang di Induksi Asam Asetat 1%. J Sains Farm Klin. 2015;1(1):54. https://doi.org/10.29208/jsfk.2014.1.1.12

[20]. Wahyuni L, Muin D. Jurnal Farmasi Sains dan Praktis Analgetic Activity Test of Ethanol Ekstract Sungkai Leaf (Peronema canescens Jack) in White Male Mouse (Mus musculus) Induced with Acetic Acid. 2023;9(2):88–95.

[21]. Rahayu EW. Uji Efektivitas Ekstrak Daun Sungkai (Peronema Canescens Jack .) dari Desa Petuk Katimpun Kalimantan Tengah Sebagai Analgetik Terhadap Tikus Putih Jantan (Rattus Norvegicus). J Surya Med. 2024;10(1):253–60. https://doi.org/10.33084/jsm.v10i1.7206

[22]. Muharni M, Cenora C, Yohandini H, Ferlinahayati, Eliza E. Evaluation of the analgesic activity of the ethanol extract of sungkai (Paronema canescens Jack) leaves in the albino rat. J Med Pharm Allied Sci. 2022;11(5):5221–6. https://doi.org/10.55522/jmpas.V11I5.4111

[23]. Nangoy BN, De Queljoe E, Yudistira A. Uji Aktivitas Antidiabetes dari Ekstrak Daun Sesewanua (Clerodendron squamatum Vahl.) Terhadap Tikus Putih Jantan Galur Wistar (Rattus norvegicus L.). Pharmacon. 2019;8(4):774. https://doi.org/10.35799/pha.8.2019.29353

[24]. Susilawati Y, Ahmad M, Moektiwadoyo M, Churnia Arifin P. Aktivitas Antidiabetes Ekstrak Etanol daun Iler (Plectranthus scutellarioides (L.) R.Br) pada Tikus Putih Galuh Wistar Dengan Metode Induksi Aloksan. Farmaka. 2016;14(2):82–95.

[25]. Liem S, Yuliet Y, Khumaidi A. Uji Aktivitas Antidiabetes Kombinasi Glibenklamid dan Ekstrak Daunn Salam (Syzygium polyanthumWight.) Terhadap Mencit (Mus musculus) yang Diinduksi Aloksan. J Farm Galen (Galenika J Pharmacy). 2015;1(1):42–7. https://doi.org/10.22487/j24428744.2015.v1.i1.4831

[26]. Naldi J, Darwin S, Zilfikri. The Effectiveness of Ethyl Acetate Extract of Sungkai Leaves (Peronema Canescens Jack.) Against Blood Glucose Levels in Alloxan-Induced Male Mice. J Asian Multicult Res Med Heal Sci Study. 2022;3(4):001–8. https://doi.org/10.47616/jamrmhss.v3i4.346

[27]. Cendrianti F, Muslichah S, Ulfa EU. Uji Aktivitas Antihiperurisemia Ekstrak n-Heksana , Etil Asetat , dan Etanol 70 % Daun Tempuyung (Sonchus arvensis L .) pada Mencit Jantan Hiperurisemia. e-Jurnal Pustaka Kesehat. 2014;2(2):205–7.

[28]. Alen Y, Agresa FL, Yuliandra Y. Analisis Kromatografi Lapis Tipis (KLT) dan Aktivitas Antihiperurisemia Ekstrak Rebung Schizostachyum brachycladum Kurz (Kurz) pada Mencit Putih Jantan. Jurnal Sains Farmasi Klinis. 2017;3(2):146–52. https://doi.org/10.29208/jsfk.2017.3.2.141
[29]. Febrianti DR. Analisis Kandungan Flavonoid dan AKtivitas Antihiperurisemia Ekstrak Etanol Daun Sirsak (Anona muricata L.) Pada Mencit Jantan Secara In Vivo. J Ilm Ibnu Sina,3(2). 2020;5(3):248–53.
[30]. Latief M, Tarigan IL, Sari PM, Aurora FE. Aktivitas Antihiperurisemia Ekstrak Etanol Daun Sungkai (Peronema canescens Jack) Pada Mencit Putih Jantan. Pharmacon J Farm Indones. 2021;18(1):23–37. https://doi.org/10.23917/pharmacon.v18i01.12880
[31]. Agustina R, Indrawati DT, Masruhin MA. Aktivitas Ekstrak Daun Salam (Eugenia polyantha) Sebagai Antiinflamasi pada Tikus Putih (Rattus norvegicus). Lab Penelit dan Pengemb FARMAKA Trop Fak Farm Univ Mulawarman, Samarinda, Kalimantan Timur. 2015;3(2):120–3.
[32]. Semiawan F, Ahmad I, Masruhim MA. Aktivitas Antiinflamasi Ekstrak Daun Kerehau (Callicarpa longifolia L.). J Sains dan Kesehat. 2015;1(1):1–4. https://doi.org/10.25026/jsk.v1i1.7
[33]. Sukmawati, Yuliet, Hardani R. Uji Aktivitas Antiinflamasi Ekstrak Etanol Daun Pisang Ambon (Musa paradisiaca L.) Terhadap Tikus Putih (Rattus norvegicus L.) Yang Diinduksi Karagenan. Galen J Pharm 126 J Pharm. 2015;1(2):126–32.
[34]. Tarigan IL, Sutrisno S, Rumaida R, Aini IPS, Latief M. Isolation of a Flavone Apigenin and a Steroids Squalene from Peronema canescens Jack Leaves with Anti-Inflammatory Activities. Pharmacogn J. 2023;14(6):744–52. https://doi.org/10.5530/pj.2022.14.162
[35]. Sudiono J. Sistem Kekebalan Tubuh. 1st ed. Juwono L, editor. Jakarta; 2014. 4 p.
[36]. Lestari IC. Potensi Herbal Sebagai Immunomodulator. J Kedokt Ibnu Nafis. 2021;9(2):33–44. https://doi.org/10.30743/jkin.v9i2.85
[37]. Mohamed SIA, Jantan I, Haque MA. Naturally occurring immunomodulators with antitumor activity: An insight on their mechanisms of action. Int Immunopharmacol. 2017;50(April):291–304. https://doi.org/10.1016/j.intimp.2017.07.010
[38]. Muharni M, Efita E, Ferlinahayati F, Julinar J, Yudono B. Diversifikasi Sediaan Daun Sungkai (Paromena Canescens Jack.) Sebagai Minuman Kesehatan untuk Meningkatkan Imun Tubuh. J Pepadu. 2023;4(1):133–41. https://doi.org/10.29303/pepadu.v4i1.2247
[39]. Dillasamola D, Aldi Y, Wahyuni FS, Rita RS, Dachriyanus, Umar S, et al. Study of Sungkai (Peronema canescens, Jack) leaf extract activity as an immunostimulators with in vivo and in vitro methods. Pharmacogn J. 2021;13(6):1397–407. https://doi.org/10.5530/PJ.2021.13.177
[40]. Dillasamola D, Wahyuni FS, Rita RS, Dachriyanus, Alen Y, Umar S, et al. Immunostimulating Study of Active Agent Fraction from Sungkai (Peronema canescens Jack.) Leaf from SARS-COV-2 Virus Antigen Exposure to NK and CD8+T Cells. Pharmacogn J. 2022;14(4):344–51. https://doi.org/10.5530/pj.2022.14.105
[41]. Melisa E, Muhaimin, Yuliawati, K FS. Acute toxicity of Sungkai leaf ethanol extract (Peronema cenescens jack) on kidney function. Maj Farm dan Farmakol. 2022;26(April):32–7. https://doi.org/10.20956/mff.v26i1.19447
[42]. Muharni M, Ferlinahayati F, Fitrya F, Eliza E, Yohandini H, Cenora C. Uji Toksisitas Subkronik Ekstrak Etanol Daun Sungkai (Paronema canescens Jack.) Terhadap Tikus Putih Rattus noverticus (Wistar strain). J Sains Farm Klin. 2023;10(2):211. https://doi.org/10.25077/jsfk.10.2.211-217.2023.