Journal Ethnoscience and Educational Studies
Vol.1, No.2, August, 2025, Page 53-67

Review Article

Research Trend pharmacology Of *Ocimum Tenuiflorum* : A Systematic Review

Sephira Astrid Sureztia[1], Nurbaiti[1]*, Shofiy Syuja[1], Riski Syafha Melani[1], Hasya Rohima Putri[1], Salsabila Olivia[1], Gemmy Sarina[2]

[1]Department of Pharmacy, Faculty of Science and Health, University Muhammadiyah Riau
[2]Department of Pharmacy, Faculty of Health Science, Universitas Esa Unggul

Article Info

Received: 12-07-2025
Direvisi: 20-08-2025
Accepted: 31-08-2025

***Corresponding author:**
Nurbaiti
email: nurbaiti@umri.ac.id

ABSTRACT

Ocimum tenuiflorum has emerged as a compelling subject in pharmaceutical research due to its long history of use in traditional medicine. This study aims to identify the benefits and bioactive compounds present in ruku-ruku leaves (*Ocimum tenuiflorum*) and to explore its potential applications in the health sector. Recent studies have begun to uncover the molecular mechanisms underlying the therapeutic properties of this plant. A systematic review of 27 scientific articles using the PRISMA approach supports the claims regarding the pharmacological properties of *Ocimum tenuiflorum.* These findings reinforce the relevance of using this plant in traditional medicine and open up opportunities for the development of modern phytopharmaceuticals. Through various extraction methods and phytochemical analyses, a variety of bioactive compounds have been identified in ruku-ruku leaves that contribute to its broad range of pharmacological activities. The diversity of secondary metabolites in *Ocimum tenuiflorum* includes flavonoids, terpenoids, and phenols, which possess pharmacological properties such as antioxidant, anti-inflammatory, and antimicrobial activities. Ruku-ruku leaves hold great promise in the pharmaceutical and medical fields. This potential makes this plant an attractive candidate for the development of phytopharmaceuticals.

Keywords:
Ocimum tenuiflorum, Pharmacology, Bioactive compounds, Extraction, Phytopharmaceutical

INTRODUCTION

Ocimum tenuiflorum, commonly known as ruku-ruku, is an herbal species from the Lamiaceae family native to parts of India and Southeast Asia. In Indonesia, this species is often found growing wild or cultivated in Sumatra, Sumbawa, and surrounding areas. The vegetative morphology of *Ocimum tenuiflorum* is similar to that of *Ocimum basilicum* (basil), especially in its leaf characteristics and distinctive volatile aroma. As an herbal plant that has been used for generations, ruku-ruku has a long history in traditional medicine systems across various cultures (Fatimah, 2022)

Ocimum tenuiflorum, also known as ruku-ruku, is a plant species that has garnered increasing research interest due to its potential as a therapeutic agent (Ramadhan et al., 2023). Despite rapid advancements in modern pharmacology, public interest in traditional plant-based medicine continues to grow. This plant is a rich source of phytochemicals, particularly eugenol, rosmarinic acid, and flavonoids. These bioactive compounds have been identified to possess a wide range of pharmacological activities, including antioxidant, anti-inflammatory, and antimicrobial properties (VERA, 2021). The

therapeutic potential of *Ocimum tenuiflorum* has attracted the interest of researchers, making it a popular raw material for the development of pharmaceutical and nutraceutical products.

Contemporary pharmacological research is increasingly focused on exploring the potential of phytopharmaceuticals derived from various plant species that have long been used in traditional medicine systems. The primary focus of this research is on the identification, isolation, and characterization of bioactive plant compounds, as well as evaluating their toxicity and efficacy in modulating the immune system, treating various diseases, and improving quality of life. The isolation and identification of bioactive compounds, particularly alkaloids, flavonoids, and terpenoids, from different plant species are crucial steps in the development of new phytochemistry-based drugs. The application of chromatographic and spectroscopic techniques allows for the purification and characterization of these compounds. Subsequently, an evaluation of pharmacological activity, including antimicrobial, anti-inflammatory, and various other biological assays, is conducted to reveal the therapeutic potential of these compounds.

A literature review of *Ocimum tenuiflorum*, more commonly known as ruku-ruku, is a crucial first step in exploring the potential and characteristics of this species. As a member of the Lamiaceae family, ruku-ruku has attracted the interest of researchers due to its diverse, yet not fully understood, potential benefits. Through a comprehensive analysis of existing literature, this research aims to describe the morphological characteristics, geographical distribution, and ecological adaptations of this species. In addition, this literature review seeks to synthesize previous research findings on the pharmacological potential of *Ocimum tenuiflorum*. Several studies have shown that this plant holds promising prospects as a therapeutic agent, particularly in the management of chronic diseases such as diabetes mellitus and hypertension. Its diverse phytochemical content, including flavonoids and alkaloids, is believed to contribute to these biological activities. For example, the bioactive compounds found in this plant have potential as anti-inflammatory and anti-bacterial agents, opening up opportunities for the development of pharmaceutical or cosmetic products based on natural ingredients.

A comprehensive literature review also allows for the identification of challenges in the research and utilization of *Ocimum tenuiflorum*. These challenges can include aspects of cultivation, conservation, and sustainable resource management. On the other hand, this review can reveal the potential of *Ocimum tenuiflorum* in ecosystem restoration and climate change mitigation, given its physiological adaptations that allow it to grow in various habitats, including areas with extreme soil conditions. A literature review plays a crucial role in preventing research duplication and paving the way for further studies. By identifying knowledge gaps in previous studies, researchers can formulate new hypotheses and design innovative experiments to explore the potential of *Ocimum tenuiflorum* more deeply. Thus, a literature review serves as a scientific foundation that enriches our understanding of this species and provides direction for its future research and practical applications.

The ruku-ruku plant (*Ocimum tenuiflorum*) has long been known in traditional medicine for its various properties. Its rich phytochemical content, such as flavonoids, saponins, tannins, and essential oils, provides the scientific basis for its pharmacological activity. The mechanism of action of these compounds, particularly flavonoids, is thought to be related to their ability as potent antioxidants, neutralizing free radicals and reducing oxidative stress . Additionally, the anti-inflammatory properties of ruku-ruku are believed to contribute to its therapeutic effects in managing various inflammatory diseases.

The anticancer potential of this plant has also attracted attention, with active compounds capable of inducing cancer cell apoptosis and inhibiting angiogenesis (INDRIANI et al., 2024). These literature findings provide initial evidence regarding the therapeutic potential of ruku-ruku in wound treatment. However, further research is still needed to confirm the effectiveness and safety of ruku-ruku extracts in humans. Large-scale clinical trials with controlled designs are required to evaluate the effectiveness of ruku-ruku extracts in various types of wounds and to compare them with conventional therapies (SIREGAR, 2019). Furthermore, identifying the main active compounds and the molecular mechanisms involved in the healing process would be highly beneficial for developing more specific and effective products.

Ruku-ruku (*Ocimum tenuiflorum*) has shown promising potential in the pharmaceutical field. In addition to its ability to accelerate wound healing, this plant also possesses strong antimicrobial activity against various pathogens, including antibiotic-resistant bacteria (Suriawati et al., 2018). Its content of bioactive compounds, such as flavonoids and polyphenols, provides powerful antioxidant properties, which can help prevent degenerative diseases. The broad pharmacological potential of ruku-ruku opens

up opportunities for the development of various pharmaceutical products, such as antimicrobial, anti-inflammatory, and antioxidant drugs. Further research is needed to uncover the molecular mechanisms underlying its pharmacological activities and to evaluate its potential in the treatment of various diseases.

This literature review aims to synthesize existing data on the phytochemical profile and therapeutic potential of Ocimum tenuiflorum, identify knowledge gaps regarding its mechanism of action and safety, evaluate its potential for natural pharmaceutical development, and recommend future research directions based on the goal of discovering novel bioactive compounds. this research is also directed at the pharmacological evaluation of these compounds to uncover their therapeutic potential in various disease indications. The long-term goal is to develop safe and effective herbal drug formulations based on these research findings. The results of this study are expected to serve as a basis for the development of innovative herbal pharmaceutical products, such as medicines, health supplements, or active ingredients in cosmetics.

METHODS

The method used for writing this article is based on data collection from online journals published over the last 15 years, from 2009-2024. Sources were obtained from both international and national journals. A systematic search was conducted using the Google Scholar database, which yielded a total of 323 articles, and other databases, which yielded 295 articles, published between 2019 and 2024. To ensure comprehensive coverage, a combination of keywords was used: "ruku-ruku leaves (*Ocimum tenuiflorum*)", "pharmacological effects of the ruku-ruku plant (*Ocimum tenuiflorum*)", "experiments on the ruku-ruku plant (*Ocimum tenuiflorum*)". Additionally, the search was limited to articles in the focus areas of health and pharmacological effect experiments. The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework was adopted to guide the article selection process. This process involved three main stages: identification, screening, eligibility, and inclusion. Relevant keywords were identified by consulting previous research, thesauri, and expert recommendations.

Table 1. Inclusion and Exclusion Criteria

Criteria	Inclusion	Exclusion
Language	Indonesian and English	Other than Indonesian and English
Article Type	Journal Article	Literature review, an overview, narrative review
Experimental Methods	Health, biology, chemistry, medical science, pharmacy	Agriculture, psychology, energy, social sciences, agriculture

Based on the established inclusion and exclusion criteria, detailed in Table 2, a total of 64 articles were deemed eligible for further review. These criteria related to the article type (journal article), language (Indonesian and English), and field of study (health sciences, biology, chemistry, and medical sciences). Full-text access was obtained for the 64 potentially relevant articles. After a review process guided by the inclusion and exclusion criteria, 27 articles were identified as suitable for a more in-depth analysis (Table 1).

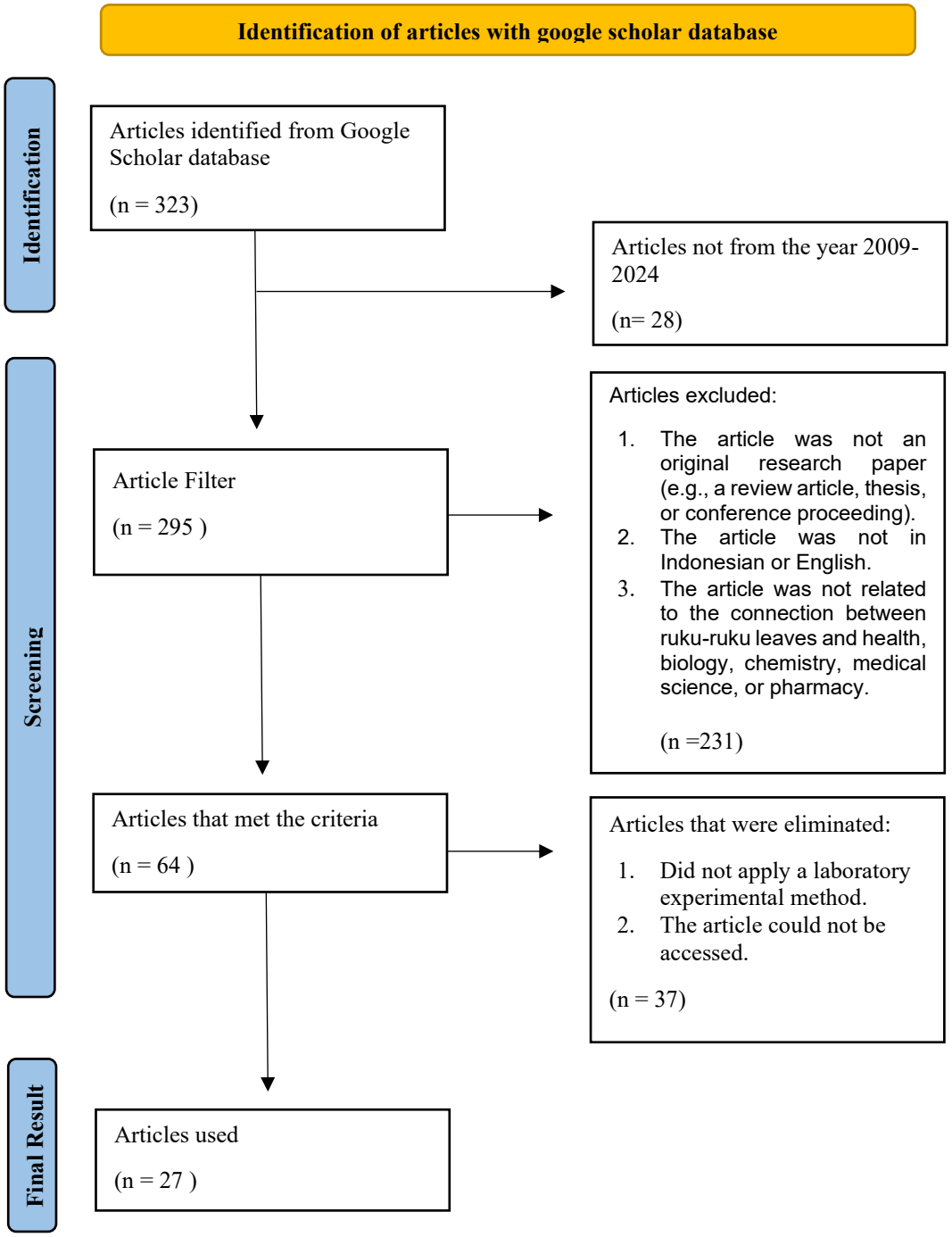

Figure 1. Literature Selection Process

RESULTS AND DISCUSSION

Based on this, the section presents an analysis of the 27 selected articles, with the results grouped by solvent, sample part, test animal, extraction method, and pharmacological effect (summarized in the Table and Diagram).

Table 2. Table of Selected Article Analysis

No	Author	Solvent	Sample Part	Test Animal / Microbes	Extraction Method	Pharmacological Effect
1	Sankhalkar & Vernekar, 2016	Methanol 80%	Leaf	None	Maceration	Antidiuretic, Antibacterial, Anti-inflammatory, Anti-ulcer
2	Lam et al., 2018	Methanol, Water	Leaf	None	Percolation, Maceration	Anticancer
3	Hanif Satria et al., 2023	Ethanol 70%	Leaf	*Salmonella enterica serovar typhi*	Maceration	Antibacterial
4	Yamani et al., 2016	Not specified	Leaves, Flowers, Oil	*Staphylococcus aureus, Escherichia coli, Pseudomonas aeruginosa*	Steam distillation	Antibacterial, Anti-asthmatic
5	Aulia & Rita, 2023	Ethanol 80%	Leaves	None	Maceration, Steam distillation	Anti-inflammatory, Antibacterial
6	Mousavi et al., 2016	Hexane, Chloroform, Ethyl acetate, Methanol, Water	Extract	Male rats	Maceration	Antidiabetic
7	Mohan Gowda et al., 2023	Water, Alcohol	Extract	Male rats	Maceration	Anti-stress, Antioxidant
8	Arenal et al., 2012	Water	Extract	Tilapia fish	Maceration	Antidiabetic
9	Sharma et al., 2022)	Acetone, Ethanol, Methanol, Water	Leaves	None	Ultrasound	Antidiabetic, Anti-inflammatory
10	Gunathilake & Somendrika, 2024	Water	Extract	Rats	Maceration	Antiseptic, Anti-allergic, Antispasmodic, Antiviral, Antibacterial, Antifungal, Anticancer, Anti-inflammatory, Analgesic
11	Humeirah et al., 2018	Water, Ethanol 95%	Leaf	*Staphylococcus aureus,*	Maceration	Antimicrobial

				Escherichia coli		
12	Dewitayani et al., 2019	Distilled water, Ethanol	Leaf	None	Not specified	Antioxidant
13	Gunathilake & Somendrika, 2024	Zinc nitrate solution, Distilled water	Extract	*Streptococcus mutans, Staphylococcus aureus, Enterococcus faecalis, Lactobacillus, Candida albicans*	Not specified	Antimicrobial, Anti-inflammatory, Antioxidant
14	Srinivas Naik et al., 2015	Methanol, Acetone, Water	Leaf	*Bacillus subtilis, Escherichia coli, Staphylococcus aureus*	Maceration, Soxhlet	Antibacterial
15	Andalia, 2021	Ethanol 70%	Leaf	*Escherichia coli*	Maceration	Antibacterial
16	Fitriyani et al., 2024	Distilled water	Leaf	*Aedes aegypti mosquito eggs*	Maceration	Antibacterial
17	Parbuntari et al., 2020	Hexane	Leaf	*Staphylococcus aureus, Enterococcus faecalis, Escherichia coli, Klebsiella pneumoniae, Acinetobacter baumannii*	Steam distillation	Antibacterial
18	Sirih et al., 2022	Ethanol	Extract	Mice	Extraction	Antibacterial, Antifungal, Antioxidant, Anticancer, Analgesic, Anti-aging, Anti-stress, Antiviral
19	Martiz et al., 2022	Water	Leaf	None	Not specified	Antidiabetic
20	Boonyanugomol et al., 2021	Ethanol 99%	Oil	None	Steam distillation	Anticancer
21	Ramadhan et al., 2023	Ethanol 70%	Leaf	*Shigella bacteria*	Maceration	Antibacterial
22	Srichok et al., 2022	Ethanol 70%, Dimethyl sulfoxide	Leaf	*Staphylococcus aureus, Escherichia coli*	Not specified	Antibacterial, Anti-inflammatory
23	Alabedi et al., 2021	Distilled water, Acetone	Leaf	Male rats	Not specified	Antioxidant, Anti-inflammatory
24	Sinaga et al., 2017	Methanol	Leaf, Stem	Rats	Sonication, Centrifugation	Antioxidant, Anticancer, Anti-

						inflammatory, Antibacterial
25	Lopresti et al., 2022	Methanol	Leaf	None	Hydro-alcohol	Anti-stress
26	Alaina et al., 2023	Ethanol 96%, Dimethyl sulfoxide	Leaf	*Staphylococcus epidermidis*	Not specified	Antibacterial
27	Upadhyay et al., 2015	Methanol	Leaf, Stem	Rats	Extraction	Anticancer, Antioxidant, Anti-inflammatory, Anti-infective

Solvent Profile

Based on the frequency distribution diagram of solvents used in ruku-ruku leaf research, it can be concluded that ethanol is the most frequently used solvent. This indicates that ethanol is considered an effective solvent for extracting active compounds from ruku-ruku leaves. The use of various ethanol concentrations, ranging from 70% to 99%, shows researchers' efforts to optimize the extraction process and obtain a maximum yield of compounds. Besides ethanol, methanol is also a popular choice, though its usage percentage is lower compared to ethanol

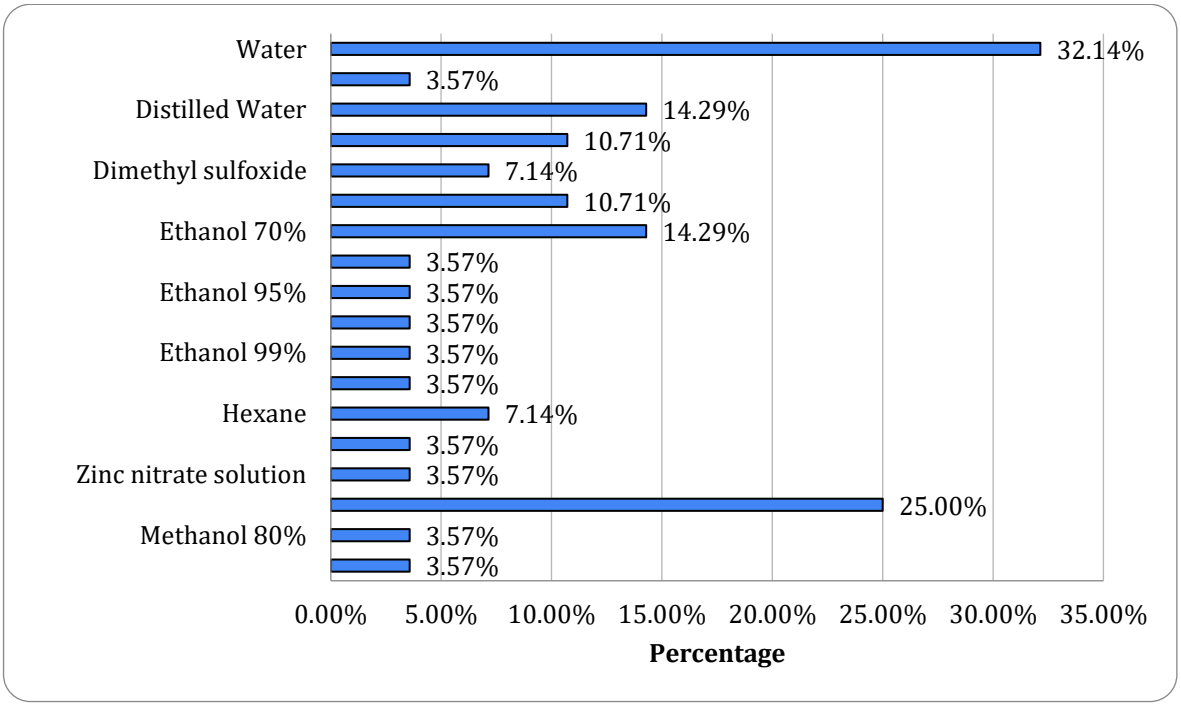

Figure 2. Solvents

These research findings indicate a diversity of bioactive compounds in ruku-ruku leaves (*Ocimum tenuiflorum*) (Maryam et al., 2018), which is evidenced by the variety of effective solvents used for their extraction. The preference for polar solvents like methanol and ethanol suggests a dominance of polar compounds within the plant matrix. The use of various ethanol concentrations indicates an effort to optimize the extraction of compounds across a wide range of polarities. The use of nonpolar solvents like hexane and specialized solvents such as DMSO and zinc nitrate solutions implies the presence of compounds with diverse polarity characteristics, including nonpolar compounds and those requiring specific dissolution conditions. Nonpolar organic solvents like hexane and chloroform were also documented in some studies, typically used to extract the nonpolar compounds found in ruku-ruku

leaves. The sequential use of both polar and nonpolar solvents is often performed to maximize the extraction of compounds with different polarities. The use of other solvents like ethyl acetate, acetone, and dimethyl sulfoxide (DMSO) was also noted, but with a lower frequency.

The use of water as a solvent, documented in several studies, is a key component of the extraction strategy for ruku-ruku leaves, particularly for its inherent safety and low cost. As a highly polar solvent, water is well-suited for extracting water-soluble compounds such as flavonoids and phenols. However, its effectiveness is often limited when used as a single solvent because it cannot efficiently dissolve the full spectrum of bioactive compounds, especially those with moderate to non-polar characteristics. This limitation is frequently overcome through the use of mixed solvents, such as a common ethanol-water mixture. By combining water with an organic solvent, researchers can create a solvent system with a tunable polarity. This allows for a more efficient and selective extraction process, enabling the dissolution of a wider range of compounds and significantly increasing the overall extraction yield and quality. Therefore, while water alone is a simple and green option, its strategic combination with organic solvents is crucial for a comprehensive approach to unlocking the full phytochemical potential of ruku-ruku leaves.

Sample Part Profile

Data analysis shows that ruku-ruku leaves (*Ocimum tenuiflorum*) are the most-researched part of the plant, accounting for about 71.43% of studies (Fatimah, 2022). This indicates a richness of active phytoconstituents in this part and suggests that the leaves have great potential as a source of bioactive compounds. Nevertheless, the stem (7.14%) and essential oil (7.14%) have also been research targets, opening up opportunities for further exploration into the plant's more complete phytochemical profile. The significant use of extracts (21.43%) indicates intensive efforts to isolate and characterize the active compounds from the plant, with the aim of developing natural products such as medicines, cosmetics, and food.

An analysis of the frequency distribution diagram for sample parts in ruku-ruku leaf research shows that the leaf is the most frequently used part of the plant as a research subject. The dominant use of the leaves indicates that they are believed to have the highest concentration of bioactive compounds compared to other parts of the plant. This finding is consistent with various previous studies that also made the leaves the main focus in medicinal plant research.

An analysis of the frequency distribution diagram for sample parts in ruku-ruku leaf research shows that the leaf is the most frequently used part of the plant as a research subject. The dominant use of the leaves indicates they are believed to have the highest concentration of bioactive compounds compared to other parts of the plant, a finding that is consistent with various previous medicinal plant studies. In addition to the leaves, the stem, flowers, and essential oils were also subjects of research, though with a lower frequency. The use of the stem and flowers indicates the potential for bioactive compounds to also be present in those parts, while the use of essential oils allows researchers to study the potential of the plant's volatile compounds. The use of extracts, which was also documented, shows researchers' efforts to obtain active compounds in a purer and more concentrated form.

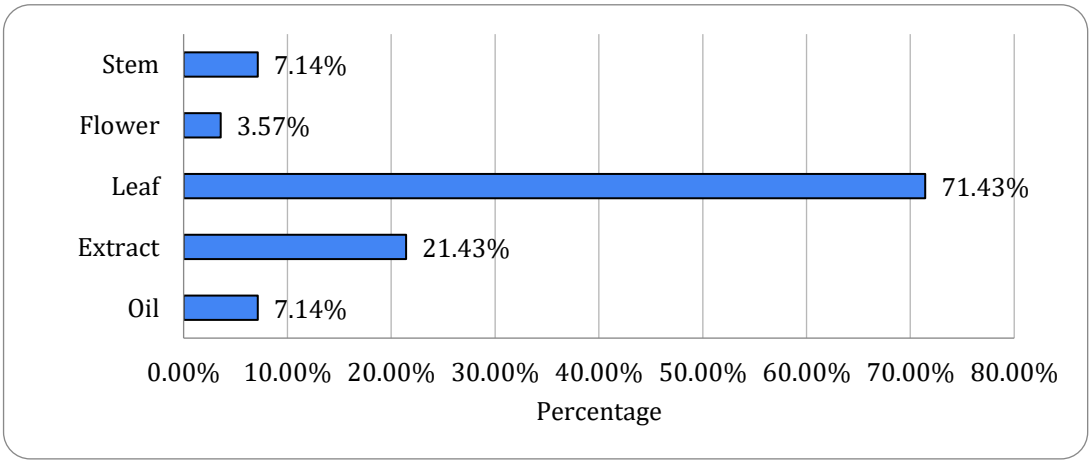

Figure 3. Sample Parts

Profile of Test Animals Or Microbes

Based on the diagram (Figure.4), the frequency distribution of test animals and subjects in the reviewed studies shows a diverse research focus. The largest category, at 28.57%, is "None," indicating that a significant portion of the research did not involve a living subject. Among the biological subjects, bacteria are the most frequently used, with Staphylococcus aureus accounting for 25.00% and Escherichia coli for 21.43%, highlighting a strong emphasis on antibacterial activity. The use of mammalian subjects is also prominent, with male rats and rats each at 10.71%. A wide range of other subjects, including various bacteria, fungi (Candida albicans), and even more specific models like tilapia fish and Aedes aegypti mosquito eggs, were also used, each making up 3.57% of the total.

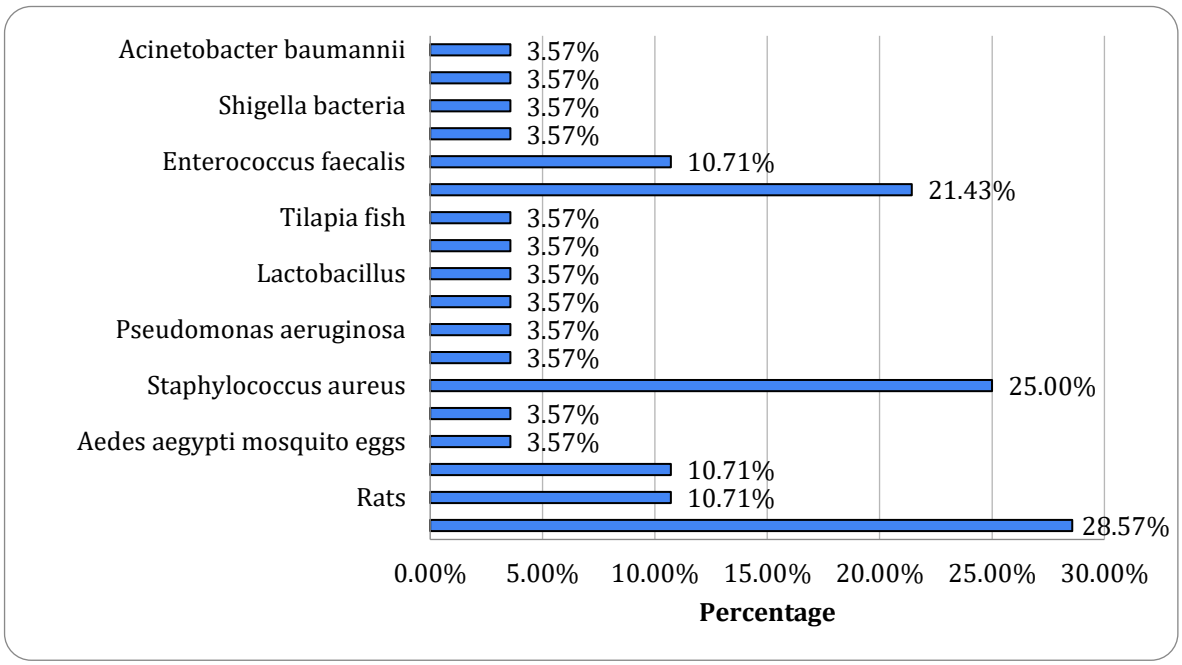

Figure 4. Test Animals Or Microbes

Research on the biological activity of ruku-ruku leaves has largely focused on its antimicrobial potential, particularly against the bacteria Staphylococcus aureus and Escherichia coli. The use of various pathogenic and non-pathogenic bacteria indicates an effort to map the broad antibacterial spectrum of the ruku-ruku leaf extract. Additionally, research has explored its antifungal potential, with Candida albicans as the primary model. The use of higher-level test animals such as mice and rats shows an interest in evaluating pharmacological effects and in vivo toxicity (Putra et al., 2024). The use of more specific models like mosquito eggs, tilapia fish, and Lactobacillus indicates a targeted approach to evaluate the extract's potential in addressing various health issues, including malaria, parasitic diseases, and digestive disorders.

An analysis of the frequency distribution diagram for test animals in ruku-ruku leaf research shows that rats are the most frequently used test animals. This indicates that rats are considered the most relevant animal model for evaluating the pharmacological effects of ruku-ruku leaf extract. The use of rats as test animals in pharmaceutical research is a standard practice due to their physiological similarities to humans.

The diversity of test animals and subjects used in ruku-ruku leaf research is a testament to the broad scope and multifaceted nature of the studies. The research ranges from in-depth evaluations of systemic pharmacological effects in mammalian models, such as rats and mice, to targeted antimicrobial activity against a wide array of pathogens, including common bacteria like Staphylococcus aureus and

Escherichia coli and fungi like Candida albicans. Furthermore, the inclusion of more specific models, such as tilapia fish and Aedes aegypti mosquito eggs, highlights a focused approach aimed at addressing particular health challenges like parasitic diseases. This comprehensive testing, spanning from basic microbial studies to complex in vivo animal models, provides strong evidence for the plant's potential as a source of bioactive compounds with a wide range of pharmacological activities. As a result, this body of research lays a solid foundation for the development of ruku-ruku leaves as a versatile and promising active ingredient for various pharmaceutical products.

Profile Of Extraction Method

The frequency of extraction methods used in the reviewed studies is shown in Figure 5. Maceration is by far the most widely used method, accounting for a substantial portion of the research at over 45%. The second most frequent category is "Not specified," with over 20% of studies not detailing their method of extraction. Steam distillation is the third most common method, used in approximately 14% of the studies. Other methods, including Extraction, Hydro-alcohol, Percolation, Centrifugation, Sonication, Soxhlet, and Ultrasound, were all used with a much lower frequency, each representing less than 10% of the total studies.

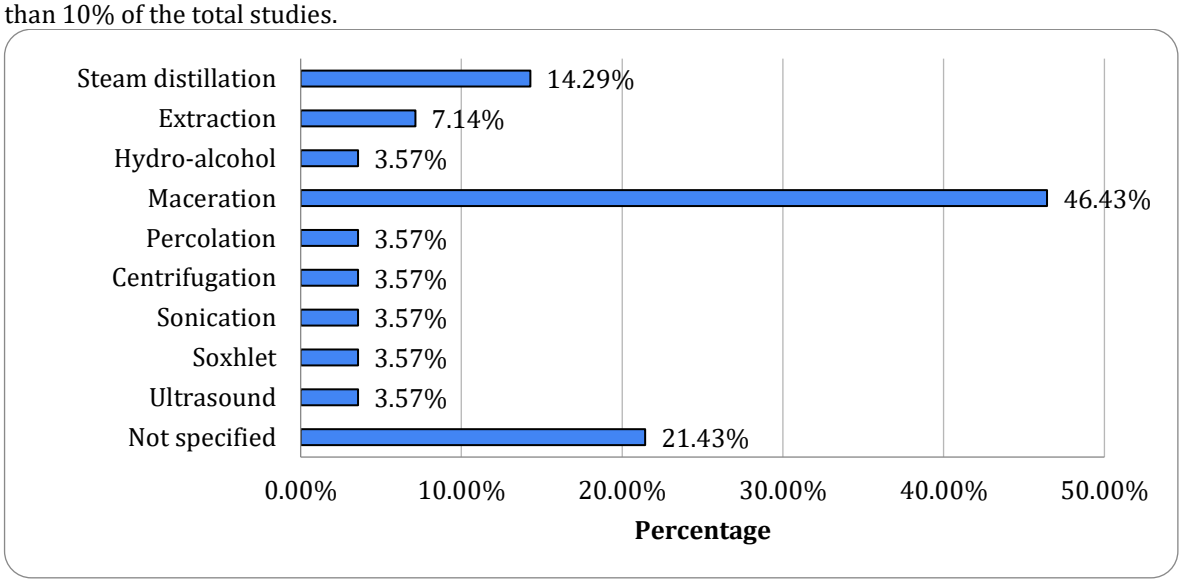

Figure 5. Extraction Methods

The maceration method is the most frequently used extraction technique in ruku-ruku leaf research (Putri, 2021), indicating its simplicity and effectiveness in extracting phytoconstituents. The use of various other extraction methods shows efforts to optimize the process in terms of both efficiency and selectivity. The application of modern methods such as sonication and ultrasonication reflects a current trend in plant extraction research, with the goal of increasing the yield and quality of the extract.

Besides maceration, the steam distillation method is also quite frequently used, especially for extracting essential oils from ruku-ruku leaves. Other extraction methods such as percolation, sonication, and Soxhlet are also used, but with a lower frequency. Each method has its own advantages for extracting compounds with different solubility properties. The variation in extraction methods used shows an effort to optimize the process and obtain a maximum yield of active compounds. This reflects the chemical complexity of the compounds in ruku-ruku leaves and researchers' efforts to obtain high-quality extracts. The selection of the appropriate extraction method is highly dependent on the type of compound to be obtained and the physicochemical properties of the plant material.

The use of diverse extraction methods in ruku-ruku leaf research is a clear indication that researchers are employing various approaches to systematically optimize the process and maximize the yield of active compounds. Methods ranging from traditional maceration to modern techniques like sonication and steam distillation are utilized to selectively target compounds with different chemical properties, from polar flavonoids to non-polar essential oils. This intentional variation in method selection directly reflects the inherent chemical complexity of the compounds present in ruku-ruku

leaves. By exploring multiple techniques, researchers are not just trying to obtain a large quantity of extract, but are actively striving to obtain a high-quality extract with the most potent pharmacological profile. Ultimately, this comprehensive approach underscores the diligent effort to fully unlock the plant's therapeutic potential, ensuring the final extract is effective and suitable for specific applications in natural medicine and other industries.

Profile of Pharmacological Effects

The majority of research focuses on the potential of ruku-ruku leaves as an antibacterial, anti-inflammatory, and antioxidant agent (Figure 6). This indicates that the active compounds in the leaves have a strong ability to fight bacterial infections, reduce inflammation, and counteract cell damage caused by free radicals (REFI, 2022). Based on the frequency distribution diagram of the pharmacological effects of ruku-ruku leaves, it can be concluded that the leaves have very strong potential as an antibacterial agent, as shown by the very high percentage (50%) in this category. This indicates that many studies have confirmed the effectiveness of ruku-ruku leaves in inhibiting the growth of various types of pathogenic bacteria. Ruku-ruku leaves also show significant potential as an anti-inflammatory agent (32.14%), suggesting that their active compounds can help reduce inflammation. Furthermore, the pharmacological potential of ruku-ruku leaves as an antioxidant agent cannot be ignored. The bioactive compounds within have shown significant effectiveness (25%) in neutralizing free radicals, thus playing a crucial role in preventing various degenerative diseases.

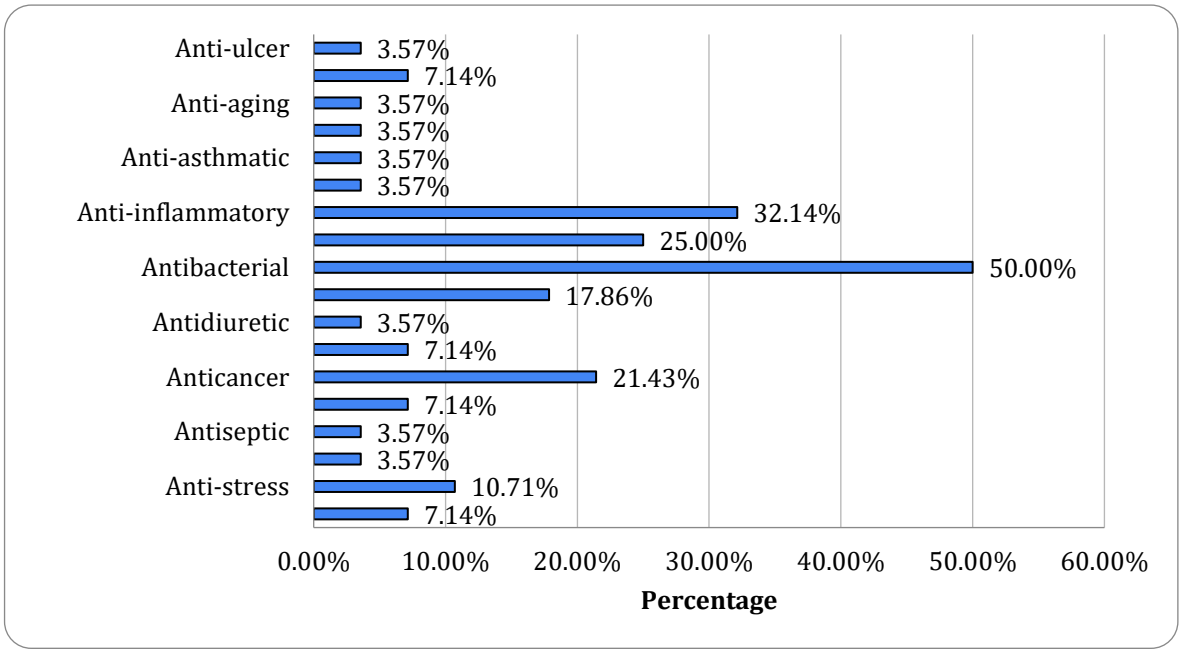

Figure 6. Pharmacological Effects

In addition to antibacterial, anti-inflammatory, and antioxidant effects, ruku-ruku leaves also show potential as other antimicrobial agents, such as antifungal (7.14%) and antiviral (7.14%), indicating a broad spectrum of antimicrobial activity. Another interesting potential is its significant antidiabetic activity (17.86%), which suggests that ruku-ruku leaves may have a role in the management of diabetes. The anticancer potential of ruku-ruku leaves is also a focus for researchers, indicating that its active compounds may be able to inhibit the growth of cancer cells. Furthermore, the leaves demonstrate potential as an analgesic and anti-stress agent. Various studies have thus revealed the great potential of ruku-ruku leaves as a source of bioactive compounds with a wide range of pharmacological activities.

The research findings showing the various pharmacological effects of ruku-ruku leaves convincingly indicate the plant's immense potential as a source of bioactive compounds for developing

natural medicines. For instance, the leaves' potent antibacterial activity, which has been confirmed against common pathogens like Staphylococcus aureus and Escherichia coli, can be utilized to develop new alternative medicines. This is particularly relevant in the current era of rising antibiotic resistance, where new solutions are urgently needed. Furthermore, the plant's significant anti-inflammatory and antioxidant activities are crucial for developing therapeutics. The compounds can help manage chronic inflammatory conditions and, by neutralizing free radicals, play a vital role in preventing cell damage linked to various degenerative diseases, including heart disease and cancer. Beyond these primary effects, studies have also highlighted the leaves' promising anticancer, antidiabetic, antifungal, and antiviral properties, cementing ruku-ruku as a versatile resource with a broad range of therapeutic applications.

CONCLUSION

Intensive research has firmly established the promising potential of ruku-ruku leaves within the fields of pharmacy and medicine. This is primarily due to the rich diversity of bioactive compounds they contain, which, through their wide range of polar and non-polar properties, gives rise to a broad spectrum of biological activities. The leaves have been definitively shown to be effective in fighting various types of microorganisms, reducing inflammation, and even inhibiting the growth of cancer cells, positioning them as a strong candidate for novel therapeutic development. Beyond these primary effects, studies have also identified their potential as an analgesic for pain management, an antidiabetic agent for blood sugar regulation, and an adaptogen to help the body manage stress. Consequently, these multifaceted properties open up broad opportunities for the development of a new generation of natural products, ranging from pharmaceuticals and herbal supplements to cosmetics and functional foods. To fully realize this potential, a systematic and rigorous approach is essential, requiring further in-depth research to not only identify the main active compounds but also to meticulously understand their mechanisms of action. The final and most crucial step will be to conduct comprehensive clinical trials to scientifically validate their safety, optimal dosage, and overall efficacy in humans, paving the way for their formal use in medical applications.

REFERENCE

Aclabedi, T. G. S., AL-Baghdady, H. F., Alahmer, M. A., Bustani, G. S., & Al-Dhalimy, A. M. B. (2021). Effects of Ocimum tenuiflorum on Induced Testicular Degeneration by Filgrastim in Wistar Rats. Archives of Razi Institute, 76(5), 1211–1215. https://doi.org/10.22092/ari.2021.356079.1772

Alaina, N., Mambang, D. E. P., & Nasution, M. P. (2023). Aktivitas Antibakteri Ekstrak Etanol Daun Ruku-Ruku (Ocimum tenuiflorum L.) TerhadapBakteri Staphylococcus epidermidis. BEST JOURNAL (Biology Education, Science & Technology), 6(2), 647–653.

Andalia, R. (2021). Efektivitas Ekstrak Etanol Daun Ruku-Ruku (Ocimum Tenuiflorum L) Terhadap Daya Hambat Bakteri Escherichia Coli. Serambi Saintia: Jurnal Sains Dan Aplikasi, 9(1), 71–76.

Arenal, A., Martín, L., Castillo, N. M., de la Torre, D., Torres, U., & González, R. (2012). Aqueous extract of Ocimum tenuiflorum decreases levels of blood glucose in induced hyperglycemic tilapia (Oreochromis niloticus). Asian Pacific Journal of Tropical Medicine, 5(8), 634–637. https://doi.org/10.1016/S1995-7645(12)60130-8

Aulia, R., & Rita, R. S. (2023). Tinjauan Pustaka Potensi Ekstrak Daun Ruku-Ruku. 46(2), 474–482.

Boonyanugomol, W., Rukseree, K., Prapatpong, P., Reamtong, O., Baik, S. C., Jung, M., Shin, M. K., Kang, H. L., & Lee, W. K. (2021). An in vitro anti-cancer activity of ocimum tenuiflorum essential oil by inducing apoptosis in human gastric cancer cell line. Medicina (Lithuania), 57(8). https://doi.org/10.3390/medicina57080784

Dewitayani, D., Sulaiman, M. I., & Widayat, H. P. (2019). Studi Pembuatan Teh Celup Daun Ruku-Ruku (Ocimum tenuiflorum L.) dengan Penambahan Bubuk Jahe sebagai Minuman Penyegar. Jurnal Ilmiah Mahasiswa Pertanian, 4(1), 510–516. https://doi.org/10.17969/jimfp.v4i1.10355

Fatimah, S. (2022). Pengembangan Kawasan Wisata Mandeh melalui rekonstruksi kearifan lokal perempuan pesisir, Kabupaten Pesisir Selatan, Sumatera Barat. Diakronika, 22(2), 166–183.

Fitriyani, D., Razak, A., Satria, R., & Pratama, S. F. (2024). Effectiveness of Ruku-ruku Leaf Infusion (Ocimum tenuiflorum L .) Nano Technology as a Natural Larvicide against Larval Mortality Mosquito (Aedes aegypti L .) Efektivitas Infusa Daun Ruku-ruku (Ocimum tenuiflorum L .) Teknologi Nano sebagai Larvasida A. Serambi Biologi, 9(2), 221–228.

Gunathilake, I. A. D. S. R., & Somendrika, M. A. D. (2024). Development of a biodegradable packaging with antimicrobial properties from cassava starch by incorporating Ocimum tenuiflorum extract. Food Chemistry Advances, 4(June 2023), 100658. https://doi.org/10.1016/j.focha.2024.100658

Hanif Satria, I., Intan Keumala Dewi, D., Hj Titiek Djannatun, D., & Arsyad, M. (2023). Efektivitas Ekstrak Daun Ruku-Ruku (Ocimum Tenuiflorum Linne) Dalam Menghambat Pertumbuhan Bakteri Salmonella Enterica Sevoar Typhi Dan Tinjauan Nya Menurut Pandangan Islam. *Jurnal Ilmiah Indonesia, Februari*, *3*(2), 168–176. https://doi.org/10.36418/cerdika.xxx

Humeirah, N. S., Putra, R. K., & Helmiawati, Y. (2018). Pembuatan pilus daun ruku-ruku (*ocimum tenuiflorum*) yang berkhasiat membantu menurunkan kadar gula darah pada journal of holistic and health sciences. J o u r n a l o f h o l i s t i c a n d H e a l t h S c i e n c e S, 62–68.

Indriani, R., Sendra, E. N. Y., & Firdayanti, I. V. A. (2024). Hubungan fortifikasi moringa oleifera meningkatkan imunitas anggota keluarga yang mempunyai riwayat kanker literatur riview. Healthy: jurnal inovasi riset ilmu kesehatan, 3(2), 100–114.

Lam, S. N., Neda, G. D., & Rabeta, M. S. (2018). The anticancer effect of ocimum tenuiflorum leaves. Food Research, 2(2), 154–162. https://doi.org/10.26656/fr.2017.2(2).251

Lopresti, A. L., Smith, S. J., Metse, A. P., & Drummond, P. D. (2022). A randomized, double-blind, placebo-controlled trial investigating the effects of an Ocimum tenuiflorum (Holy Basil) extract (HolixerTM) on stress, mood, and sleep in adults experiencing stress. Frontiers in Nutrition, 9. https://doi.org/10.3389/fnut.2022.965130

Martiz, R. M., Patil, S. M., Abdulaziz, M., Babalghith, A., Al-Areefi, M., Al-Ghorbani, M., Kumar, J. M., Prasad, A., Nagalingaswamy, N. P. M., & Ramu, R. (2022). Defining the Role of Isoeugenol from Ocimum tenuiflorum against Diabetes Mellitus-Linked Alzheimer's Disease through Network Pharmacology and Computational Methods. Molecules, 27(8). https://doi.org/10.3390/molecules27082398

Maryam, F., Taebe, B., & Hasanah, U. (2018). Isolasi dan karakterisasi senyawa steroid ekstrak etil asetat teripang batu (Actinopyga lecanora Jaeger). Jurnal Farmasi Dan Bahan Alam: FARBAL, 6(1), 14–19.

Mohan Gowda, C. M., Murugan, S. K., Bethapudi, B., Purusothaman, D., Mundkinajeddu, D., & D'Souza, P. (2023). Ocimum tenuiflorum extract (HOLIXERTM): Possible effects on hypothalamic-pituitary-adrenal (HPA) axis in modulating stress. PLoS ONE, 18(5 May), 1–12. https://doi.org/10.1371/journal.pone.0285012

Mousavi, L., Salleh, R. M., Murugaiyah, V., & Asmawi, M. Z. (2016). Hypoglycemic and anti-hyperglycemic study of Ocimum tenuiflorum L. leaves extract in normal and streptozotocin-induced diabetic rats. Asian Pacific Journal of Tropical Biomedicine, 6(12), 1029–1036. https://doi.org/10.1016/j.apjtb.2016.10.002

Ocimum, L., Ocimum, L., Harma, A. R. U. N. D. E. V. S., Aur, I. N. K., Ngish, S. O. A., Hakur, A. L. T., Ania, S. A.

S., & Ingh, A. M. S. (2022). and Anti-Inflammatory Activities of Traditionally Used.

Parbuntari, H., Etika, S. B., & Mulia, M. (2020). Identification and Prediction of Potential Drug-like Compounds From Ruku-Ruku Leaves (Ocimum tenuiflorum Linnen) in West Sumatera. 10(ICoBioSE 2019), 248–252. https://doi.org/10.2991/absr.k.200807.050

Putra, R. F., Umar, S., Aldi, Y., & Afriwardi, A. (2024). Potensi senyawa bromelin dalam beberapa pengujian toksisitas farmakologi. Forte Journal, 4(2), 268–276.

Putri, R. (2021). Penentuan Kandungan Antioksidan Dan Fenolik Total Dari Infusa Daun Tanaman Famili Lamiaceae Secara Spektrofotometri. Universitas Andalas.

Ramadhan, F. R., Dewi, I. K., Djannatun, T., & Arsyad, M. (2023). Efektivitas Ekstrak Daun Ruku-Ruku (Ocimum Tenuiflorum Linne) Dalam Menghambat Pertumbuhan Bakteri Shigella Dysenteriae Dan Tinjauannya Menurut Pandangan Islam. Cerdika: Jurnal Ilmiah Indonesia, 3(2), 144–152.

Refi, M. (2022). Pengaruh ekstrak daun kemangi (*Ocimum basilicum*) terhadap kerusakan hati mencit (*Mus musculus*) yang diberi minuman tuak. Uin raden intan lampung.

Sankhalkar, S., & Vernekar, V. (2016). Quantitative and Qualitative analysis of Phenolic and Flavonoid content in Moringa oleifera Lam and Ocimum tenuiflorum L. Pharmacognosy Research, 8(1), 16–21. https://doi.org/10.4103/0974-8490.171095

Sharma, A. D., Kaur, I., Angish, S., Thakur, A., Sania, S., & Singh, A. (2022). Comparative phytochemistry, antioxidant, antidiabetic, and anti-inflammatory activities of traditionally used Ocimum basilicum L. Ocimum gratissimum L., and Ocimum tenuiflorum L. *BioTechnologia Journal of Biotechnology, Computational Biology and Bionanotechnology*, *103(3)*, 131–142. https://doi.org/http://doi.org/10.5114/bta.2022.116206

Sinaga, C. N. L., Tobing, M. C., & Pinem, M. I. (2017). Uji Efikasi Rodentisida Nabati Daun Ruku-ruku (Ocimum sanctum L.) terhadap Mortalitas Tikus Sawah (Rattus argentiventer Robb & Kloss) di Laboratorium: Efficacy Test Botanical Rodenticide Ruku-ruku's Leaves (Ocimum sanctum L.) onMortality of Rice Field Rat (Rattus argentiventer Robb & Kloss.) in Laboratory. Jurnal Online Agroekoteknologi, 5(2), 434–443.

Siregar, T. (2019). Pengaruh air rebusan daun kemangi terhadap kadar asam urat darah pada penderita hiperurisemia.

Sirih, D., Piper, M., Ruiz, C., Dengan, P., Sirih, D., Piper, H., Terhadap, A. L., Mutans, S., Abeiasa, M. S., Humaira, V., & Ferdian, H. (2022). Artikel penelitian jurnal medisains kesehatan. 3(1), 14–20.

Srichok, J., Yingbun, N., Kowawisetsut, T., Kornmatitsuk, S., Suttisansanee, U., Temviriyanukul, P., & Chantong, B. (2022). Synergistic Antibacterial and Anti-inflammatory Activities of Ocimum tenuiflorum Ethanolic Extract against Major Bacterial Mastitis Pathogens. Antibiotics, 11(4). https://doi.org/10.3390/antibiotics11040510

Srinivas Naik, L., Shyam, P., Paul Marx, K., Baskari, S., & Devi, C. V. R. (2015). Antimicrobial activity and phytochemical analysis of Ocimum tenuiflorum leaf extract. International Journal of PharmTech Research, 8(1), 88–95.

Suriawati, J., Patimah, P., & Rachmawati, S. R. (2018). Antibacterial activities test of combination of ethanolic extract of betel leaves (Piper betle L.) and basil leaves (Ocimum basilicum L.) against Staphylococcus aureus. Sanitas, 9(2), 118–126.

Upadhyay, A. K., Chacko, A. R., Gandhimathi, A., Ghosh, P., Harini, K., Joseph, A. P., Joshi, A. G., Karpe, S. D., Kaushik, S., Kuravadi, N., Lingu, C. S., Mahita, J., Malarini, R., Malhotra, S., Malini, M., Mathew, O. K.,

Mutt, E., Naika, M., Nitish, S., … Sowdhamini, R. (2015). Genome sequencing of herb Tulsi (Ocimum tenuiflorum) unravels key genes behind its strong medicinal properties. BMC Plant Biology, 15(1), 1–20. https://doi.org/10.1186/s12870-015-0562-x

Varghese, R. M., S, A. K., & Shanmugam, R. (2024). Antimicrobial Activity of Zinc Oxide Nanoparticles Synthesized Using Ocimum Tenuiflorum and Ocimum Gratissimum Herbal Formulation Against Oral Pathogens. *Cureus*, *16*(2), 1–10. https://doi.org/10.7759/cureus.53562

Vera, M. (2021). Formulasi Cairan Antiseptik Dengan Bahan Dasar Ekstrak Daun Kemangi (Ocimum Basilicum L.) Untuk Penyembuhan Luka Sayat. Uin Raden Intan Lampung.

Yamani, H. A., Pang, E. C., Mantri, N., & Deighton, M. A. (2016). Antimicrobial activity of Tulsi (Ocimum tenuiflorum) essential oil and their major constituents against three species of bacteria. Frontiers in Microbiology, 7(MAY), 1–10. https://doi.org/10.3389/fmicb.2016.00681