



Short Communication

Doi: <https://doi.org/10.29244/jji.v11i1.413>

Evaluation of the Antibacterial Activity of *Muntingia calabura* L. Leaf Extract in Anti-Acne Serum and Gel Moisturizer Formulations

Evaluasi Aktivitas Antibakteri Ekstrak Daun Kersen (*Muntingia calabura* L.) dalam Formulasi Sediaan Serum dan Gel Pelembap Antijerawat

Andi Ulfah Magefirah Rasyid^{1*}, Nurfadilah², Fityatun Usman³, Zulkifli⁴, Zulham⁵, Asril Burhan⁶

¹Department of Pharmaceutical Microbiology, Faculty of Medicine and Health Sciences, Universitas Muhammadiyah Makassar, Makassar, 90222, Indonesia

²Department of Pharmaceutics and Pharmaceutical Technology, Faculty of Medicine and Health Sciences, Universitas Muhammadiyah Makassar, Makassar, 90222, Indonesia

³Department of Pharmaceutical Biology, Faculty of Medicine and Health Sciences, Universitas Muhammadiyah Makassar, Makassar, 90222, Indonesia

⁴Department of Pharmacology, Faculty of Medicine and Health Sciences, Universitas Muhammadiyah Makassar, Makassar, 90222, Indonesia

⁵Department of Pharmaceutics and Pharmaceutical Technology, Faculty of Health Sciences, Universitas Almarisah Madani, Makassar, 90245, Indonesia

⁶Department of Pharmaceutical Biology, Faculty of Health Sciences, Universitas Almarisah Madani, Makassar, 90245, Indonesia

ARTICLE INFO

Article history

Received on: 2025-06-04

Revised on: 2025-07-29

Accepted on: 2025-10-11

Keyword:

Anti-acne

Gel moisturizer

Muntingia calabura L.

Propionibacterium acnes

Serum

Kata kunci:

Antijerawat

Gel moisturizer

Muntingia calabura L.

Propionibacterium acnes

Serum

ABSTRACT

The cherry tree (*Muntingia calabura* L.) is known to contain bioactive compounds such as flavonoids, tannins, and saponins, which exhibit potential as natural antibacterial agents against acne-causing bacteria. This study aimed to evaluate and compare the antibacterial efficacy of serum and moisturizer gel formulations containing ethanol extract of *M. calabura* leaves against *Propionibacterium acnes*. Serum was selected due to its high concentration of active ingredients and superior skin penetration, while the gel moisturizer provides a light, non-greasy texture that is comfortable and easily absorbed. The results demonstrated that the serum formulation containing 18% extract (F3) exhibited the highest antibacterial activity against *P. acnes*, with a strong inhibition zone. Similarly, the gel formulation with 6% extract (F3) also showed a strong inhibitory effect. These findings highlight the potential of *M. calabura* leaf extract as an effective natural agent for the development of topical anti-acne skincare products.

ABSTRAK

Tanaman kersen (*Muntingia calabura* L.) diketahui mengandung senyawa bioaktif seperti flavonoid, tanin, dan saponin yang berpotensi sebagai agen antibakteri alami terhadap bakteri penyebab jerawat. Penelitian ini bertujuan untuk mengevaluasi dan membandingkan efektivitas antibakteri dari sediaan serum dan gel pelembap yang diformulasikan menggunakan ekstrak etanol daun *M. calabura* terhadap *Propionibacterium acnes*. Sediaan serum dipilih karena memiliki kandungan bahan aktif tinggi dan kemampuan penetrasi yang baik ke dalam kulit, sedangkan sediaan gel pelembap memberikan sensasi ringan dan nyaman tanpa meninggalkan rasa lengket. Hasil menunjukkan bahwa formulasi serum dengan konsentrasi ekstrak 18% (F3) menghasilkan diameter zona hambat terbesar terhadap *P. acnes*, termasuk dalam kategori kuat. Formulasi gel pelembap dengan konsentrasi ekstrak 6% (F3)



juga menunjukkan efektivitas antibakteri tinggi dengan klasifikasi daya hambat kuat. Studi ini mendukung potensi *M. calabura* sebagai bahan aktif alami dalam pengembangan produk perawatan kulit topikal antijerawat.

*Corresponding author:

Andi Ulfah Magefirah Rasyid (andiulfahmagefirahasyid@unismuh.ac.id)

Citation: Rasyid, A. U. M., Nurfadilah, Usman, F., Zulkifli, Zulham, & Burhan, A. (2026). Evaluation of the Antibacterial Activity of *Muntingia calabura* L. Leaf Extract in Anti-Acne Serum and Gel Moisturizer Formulations. *Jurnal Jamu Indonesia*, 11(1), 12–17. <https://doi.org/10.29244/jji.v11i1.413>

1. INTRODUCTION

Topical antibiotics are widely used to treat skin infections, including acne vulgaris. However, their prolonged use can lead to adverse effects such as local irritation and the development of antibiotic resistance (Novaryatiin, 2016). These concerns underscore the need for alternative therapies, particularly those derived from natural sources with proven antimicrobial properties.

Muntingia calabura L., commonly known as the cherry tree, is a tropical plant traditionally used in folk medicine. Its leaves are rich in bioactive compounds including flavonoids, saponins, tannins, and terpenoids, which exhibit significant antibacterial activity (Azzahra et al., 2021; Zebua et al., 2019). The exploration of plant-based antimicrobials is increasingly relevant in the context of cosmeceutical development, where the integration of pharmacological efficacy with cosmetic appeal is emphasized.

The incorporation of natural extracts such as *M. calabura* into topical formulations, including gels, creams, and serums, represents a promising strategy in dermatological and cosmetic applications. Recent trends indicate a growing consumer preference for natural skincare products with minimal side effects and enhanced skin compatibility (Ulfah et al., 2020). Several studies have reported the antimicrobial potential of plant-based topical formulations in managing acne and related skin conditions (Fitriani et al., 2021; Sholaekah et al., 2025).

Among these formulations, serums are particularly valued for their high concentration of active compounds, rapid absorption, and non-greasy finish, making them suitable for oily or acne-prone skin (Fitriani et al., 2021). On the other hand, gel formulations offer a cooling effect, lightweight texture, and enhanced comfort, especially for sensitive skin (Sholaekah et al., 2025). Both formulation types have distinct advantages, yet a comparative evaluation of their antibacterial effectiveness using *M. calabura* extract remains limited.

This study aims to evaluate and compare the antibacterial activity of serum and gel moisturizer formulations containing ethanol extract of *M. calabura* leaves against *Propionibacterium acnes*, a major causative agent of acne. The findings are expected to contribute to the development of safer, more effective, and environmentally friendly topical treatments derived from natural ingredients.

2. METHODS

2.1. Preparation of Plant Material (Simplicia)

Fresh leaves of *M. calabura* were collected, washed thoroughly, and air-dried in a shaded area to minimize moisture content. The dried leaves were then ground into a fine powder using a mechanical grinder to obtain simplicia material suitable for extraction (Ulfah et al., 2020).

2.2. Extraction Procedure

A total of 350 grams of *M. calabura* leaf powder was subjected to maceration using 70% ethanol. The maceration was performed at room temperature over five 24-hour cycles. The resulting mixture was filtered, and the remaining residue was re-macerated under the same conditions. The combined filtrates were then evaporated using a rotary evaporator to yield a viscous ethanolic extract (Zulham et al., 2025).

2.3. Phytochemical Screening

Qualitative phytochemical screening was carried out to detect the presence of major secondary metabolites, including alkaloids, flavonoids, tannins, and saponins, following the method described by Ulfah et al. (2020). Alkaloids were identified using Bouchardat, Mayer, and Dragendorff reagents. Flavonoids were detected through the magnesium powder and concentrated hydrochloric acid test (Mg + HCl test). Tannins were determined by the formation of a color complex upon the addition of ferric chloride (FeCl₃) reagent. The presence of saponins was evaluated using the foam test involving distilled water and 2N hydrochloric acid.

2.4. Formulation of Topical Preparations

The concentrated extract was formulated into two types of topical preparations, namely serum and gel moisturizer formulations. The serum formulations contained extract concentrations of 6% w/v (F1), 12% w/v (F2), and 18% w/v (F3) (Hikmah et al., 2024). Meanwhile, the gel moisturizer formulations incorporated extract concentrations of 3% w/v (F1), 4.5% w/v (F2), and 6% w/v (F3) (Rosi et al., 2024). Each formulation was prepared using standard pharmaceutical procedures, and the base components were adjusted to ensure uniformity and stability.

2.5. Antibacterial Activity Assay

The antibacterial activity of the prepared formulations was evaluated against *Propionibacterium acnes* using two different methods. For serum formulations, the disc diffusion method was used, in which sterile discs impregnated with the samples were placed onto Mueller-Hinton agar plates previously inoculated with *P. acnes* (Gerung et al., 2021). For gel formulations, the well

diffusion method was applied, whereby the samples were introduced into wells punched into agar that had been inoculated with the test bacteria (Ulfah et al., 2020). After incubation, the diameter of inhibition zones around the discs or wells was measured in millimeters. Clindamycin (1%) was used as a positive control, while base formulations without extract served as negative controls. All tests were conducted in triplicate (Estikomah et al., 2021a).

3. RESULTS AND DISCUSSION

3.1. Extraction Yield

The maceration of *M. calabura* leaves with 70% ethanol yielded a concentrated extract weighing 40.86 grams from 350 grams of dried simplicia, resulting in a yield of 11.67%. As shown in **Table 1**, this yield falls within the optimal extraction range of 10–20% for herbal materials, indicating an efficient process under the applied conditions (Depkes RI, 2017).

3.2. Phytochemical Composition

Phytochemical screening (**Table 2**) revealed that the extract contained flavonoids, tannins, saponins, and terpenoids, consistent with earlier studies (Azzahra et al., 2021; Estikomah et al., 2021b). These compounds are recognized for their distinct antibacterial properties. Flavonoids disrupt bacterial membrane integrity and increase permeability (Yuan et al., 2021), tannins denature membrane proteins and inhibit essential enzymes (Wang et al., 2015), while saponins act as natural surfactants causing cell lysis (Hayon et al., 2023).

3.3. Antibacterial Activity of Serum and Gel Moisturizer Formulations

The antibacterial activity of the serum formulations was assessed against *P. acnes* using the disc diffusion method. The results demonstrated a concentration-dependent pattern, in which higher extract concentrations resulted in larger inhibition zones. As shown in **Figure 1a**, the serum formulation containing 18% extract (F3) exhibited the highest inhibitory effect, with a mean inhibition zone of 18.17 mm, which was classified as strong antibacterial activity. In contrast, the control group without extract (F0) showed no inhibition zone. When compared to the positive control (clindamycin 50 ppm), which produced an inhibition zone exceeding 20 mm, the F3 formulation demonstrated considerable, though slightly lower, effectiveness. These results suggested that the high concentration of active

compounds in the extract contributed significantly to bacterial growth inhibition, although not surpassing the conventional antibiotic. This observation was visually supported by the inhibition zones observed in the disc diffusion assay, as shown in **Figure 2b**.

The gel moisturizer formulations were evaluated using the well diffusion method. All gel samples containing the extract showed measurable zones of inhibition. The F3 formulation (6% extract) produced the largest inhibition zone, measuring 18.38 mm, which was also categorized as strong antibacterial activity. As illustrated in **Figure 1b**, the inhibition zone diameter increased proportionally with the extract concentration. Interestingly, although the gel formulation contained a lower extract concentration than the serum (6% vs. 18%), it exhibited a comparable antibacterial effect. This phenomenon could be attributed to the gel base's superior diffusion capacity and its ability to enhance skin contact and facilitate compound penetration. The inhibition zones observed in the well diffusion assay further confirmed these findings, as depicted in **Figure 2a**.

3.4. Comparative Analysis and Mechanistic Insights

A comparative evaluation between the two dosage forms indicates that *M. calabura* extract exhibits potent antibacterial activity in both serum and gel forms. The slightly enhanced performance of the gel at a lower concentration suggests that formulation type plays a key role in modulating drug release and bioavailability. This is consistent with literature reporting that hydrophilic gel matrices can enhance penetration and sustained delivery of phytochemicals (Fitriani et al., 2021; Sholaekah et al., 2025).

Mechanistically, the antibacterial activity is likely the result of multi-target actions by the phytoconstituents. For example, saponins interact with bacterial porins and compromise nutrient transport, while flavonoids and tannins further damage membrane and enzymatic functions (Hayon et al., 2023; Wang et al., 2015). The combined actions of these compounds may explain the strong inhibition observed in both formulations.

Taken together, the data suggest that *M. calabura* leaf extract is a viable candidate for development into anti-acne skincare products, providing both efficacy and formulation versatility. The gel moisturizer, in particular, appears promising due to its efficacy at lower extract concentrations and its favorable sensory attributes for acne-prone skin.

Table 1. Yield of Ethanolic Extract from *Muntingia calabura* L. Leaves

| Sample Weight (g) | Extract Weight (g) | Yield (%) |
|-------------------|--------------------|-----------|
| 350 | 40.86 | 11.67 |

Table 2. Phytochemical Screening Results of *Muntingia calabura* L. Leaf Extract

| Compound | Reagent Used | Observation | Result |
|------------|--------------------------------|---------------------------|--------|
| Alkaloids | Bouchardat, Mayer, Dragendorff | Precipitate color changes | - |
| Flavonoids | Mg ²⁺ + HCl | Brick red coloration | + |
| Tannins | FeCl ₃ | Dark blue coloration | + |
| Saponins | Foam test | Stable foam formation | + |

Note: (+) Present; (-) Absent;

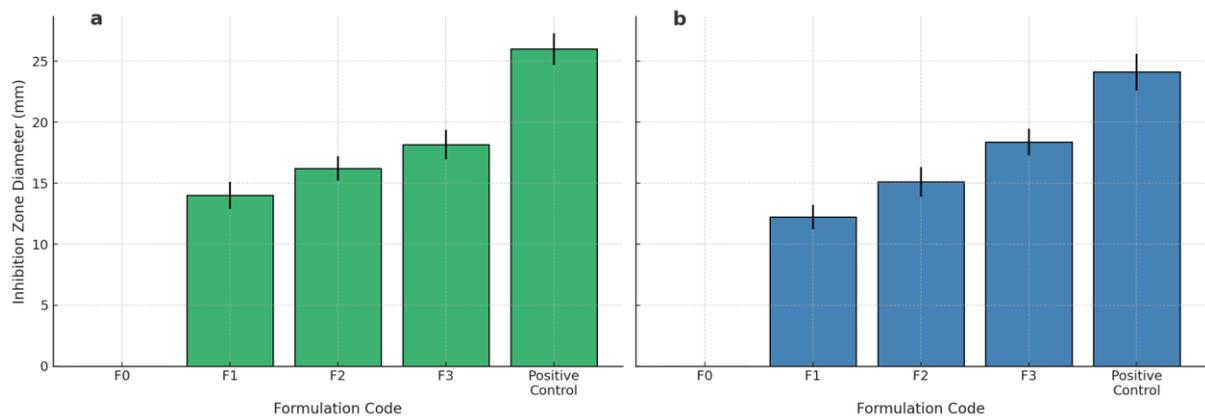


Figure 1. Antibacterial activity of *M. calabura* leaf extract: (a) serum formulations evaluated using the disc diffusion method, and (b) gel moisturizer formulations evaluated using the well diffusion method, against *P. acnes* after 24-hour incubation. Clindamycin 1% was used as the positive control, and base formulations without extract served as negative controls. Data represent mean inhibition zone diameters \pm standard deviation ($n = 3$).

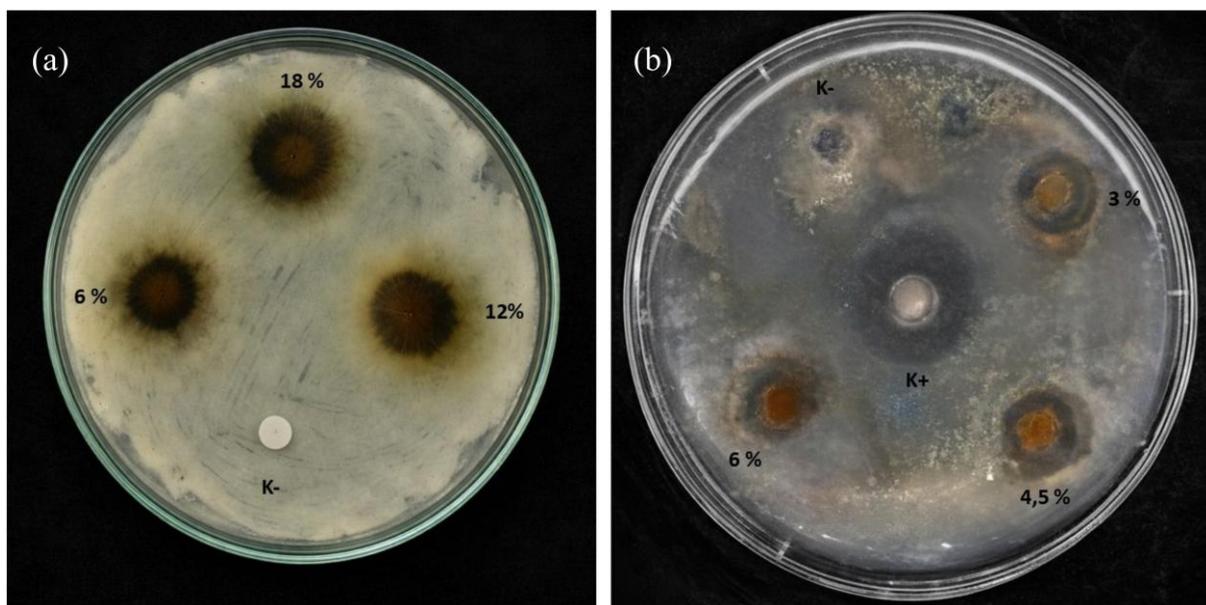


Figure 2. Representative images of inhibition zones from antibacterial activity tests against *P. acnes*: (a) gel moisturizer formulations with 3%, 4.5%, and 6% extract, alongside the positive control (K+ = clindamycin 1%) and negative control (K- = gel base without extract), evaluated using the well diffusion method; (b) serum formulations with 6%, 12%, and 18% extract, and a negative control (K- = serum base without extract), tested using the disc diffusion method.

4. CONCLUSION

This study demonstrated that the ethanolic extract of *Muntingia calabura* L. leaves possesses significant antibacterial activity against *Propionibacterium acnes*, supporting its potential as a natural anti-acne agent. Among the tested formulations, the serum containing 18% extract exhibited strong antibacterial efficacy with an inhibition zone of 18.17 mm, while the gel moisturizer with 6% extract showed comparable effectiveness, achieving an inhibition zone of 18.38 mm. These findings highlight that both serum and gel formulations can serve as effective topical delivery systems for *M. calabura* extract, with the gel offering comparable bioactivity at a lower extract concentration. The results support the further development of *M. calabura*-based topical preparations as safe, natural alternatives to synthetic antimicrobials in acne treatment. Future studies may explore formulation optimization, long-term stability, and clinical evaluation to validate the therapeutic potential of these products.

AUTHOR CONTRIBUTIONS

Conceptualization, A.U.M. and N.; methodology, A.U.M.; validation, A.U.M., Zk., and F.; formal analysis, A.U.M.; investigation, A.U.M. and F.; resources, A.U.M.; data curation, N. and Zh.; writing—original draft preparation, A.U.M.; writing—review and editing, A.U.M. and A.B.; visualization, Zk.; supervision, A.B.; project administration, A.U.M. All authors have read and agreed to the published version of the manuscript.

INSTITUTIONAL REVIEW BOARD STATEMENT

Not applicable. This study did not involve human participants or animal subjects.

INFORMED CONSENT STATEMENT

Not applicable.

DATA AVAILABILITY STATEMENT

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

FUNDING

This research received no external funding.

ACKNOWLEDGMENT

The authors would like to express their gratitude to the academic staff of the Pharmacy Undergraduate Program, Faculty of Medicine and Health Sciences, Universitas Muhammadiyah Makassar, for providing facilities and a supportive academic environment. Special thanks are extended to the research team and laboratory staff for their technical assistance throughout the study.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

DECLARATION OF GENERATIVE ARTIFICIAL INTELLIGENCE (AI) USE

During the preparation of this manuscript, the authors used ChatGPT (OpenAI) to assist in improving the clarity, structure, and readability of the text. After using this tool, the authors thoroughly reviewed, edited, and verified the entire content to ensure it accurately represents their own ideas and interpretations. The authors take full responsibility for the integrity and originality of the published work.

REFERENCES

- Azzahra, B. N., Rahmi, D., & Setyaningsih, R. (2021). Pengaruh ekstrak daun kersen (*Muntingia calabura* L.) sebagai disinfektan alami terhadap daya hambat dan penurunan total bakteri di ruang penampungan susu. *Jurnal Teknologi Hasil Peternakan*, 2(2), 39–55. <https://doi.org/10.24198/jthp.v2i2.36013>
- Depkes RI. (2017). *Farmakope Herbal Indonesia* (Edisi II). Departemen Kesehatan Republik Indonesia.
- Estikomah, S. A., Amal, A. S. S., & Safaatsih, S. F. (2021a). Uji daya hambat terhadap bakteri *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Propionibacterium acnes* gel semprot ekstrak etanol daun kersen (*Muntingia calabura* L.) Karbopol 940. *Pharmaceutical Journal of Islamic Pharmacy*, 5(1), 36–53.
- Estikomah, S., Yuniastuti, E., & Lestari, R. (2021b). Uji fitokimia dan aktivitas antibakteri ekstrak daun kersen (*Muntingia calabura* L.) terhadap *Propionibacterium acnes*. *Jurnal Fitofarmaka Indonesia*, 8(2), 100–108.
- Fitriani, A., Wulandari, D., & Sari, M. (2021). Efektivitas krim ekstrak daun binahong (*Anredera cordifolia*) terhadap penyembuhan luka pada kulit tikus. *Jurnal Farmasi dan Ilmu Kefarmasian Indonesia*, 8(2), 124–130.
- Gerung, W., Antasionasti, I., & Fatmawali. (2021). Uji Aktivitas Antibakteri Ekstrak Daun Belimbing Botol (*Averrhoa bilimbi* L.) Terhadap Pertumbuhan Bakteri *Propionibacterium acne* Penyebab Jerawat. *Pharmacon*, 10(4), 1087–1093.
- Hayon, M. F. K., Supriningrum, R., & Fatimah, N. (2023). Identifikasi jenis saponin dan uji aktivitas antibakteri ekstrak metanol kulit batang sekilang (*Embelia borneensis* Scheff.) terhadap bakteri *Pseudomonas aeruginosa* ATCC 9027 dan *Streptococcus mutans* ATCC 25175. *Jurnal Riset Kefarmasian Indonesia*, 5(2), 258–272.
- Hikmah, F. N., Malahayati, S., & Nugraha, D. F. (2024). Formulasi Dan Evaluasi Sediaan Serum Gel Ekstrak Bunga Melati (*Jasminum sambac* L.). *Sains Medisina*, 2(3), 110–120. <https://doi.org/10.63004/snsmed.v2i3.29>
- Novaryatiin, S. (2016). Identifikasi bakteri dan resistensinya terhadap antibiotik di Poli Gigi RSUD dr. Doris Sylvanus Palangkaraya. *Jurnal Surya Medika*, 1(2), 17–25.
- Rosi, D. H. R., Kirana Efmisa, A., Fernandi, R., Amar, K., & Deswati. (2024). Formulasi Sediaan Gel Moisturizer Ekstrak Etanol Daun Bayam Merah (*Amarantus tricolor* L.). *Journal of Midwifery and Healthcare Sciences*, 1(1). Retrieved from <https://journal.umnyarsi.ac.id/index.php/JMHS/article/view/59>
- Sholaekah, A., Zakaria, M., Sari, N. K., & Wahyuni, S. (2025). Uji aktivitas antibakteri sediaan emulgel ekstrak belimbing wuluh

- (*Averrhoa bilimbi* L.) terhadap bakteri *Propionibacterium acnes*. *Jurnal Riset Kefarmasian Indonesia*, 7(1). <https://doi.org/10.33759/jrki.v7i1.581>
- Ulfah, A., Rasyid, M., & Amody, Z. (2020). Pengujian Efektifitas Formula Gel Ekstrak Daun Beluntas (*Pluchea indica* (L.) Less) Dengan Variasi Konsentrasi Gelling Agent Sebagai Kandidat Sediaan Anti Jerawat. *Jurnal Ilmiah Manuntung*, 6(2), 312–322.
- Wang, Y., Hambly, B. D., & Bao, S. (2015). Tannin as a potential antibacterial agent and its mechanism. *Journal of Natural Products*, 78(3), 123–129.
- Yuan, Y., Wu, Q., & Wang, J. (2021). Flavonoids as membrane-active agents to combat bacterial infections. *International Journal of Molecular Sciences*, 22(17), 9362. <https://doi.org/10.3390/ijms22179362>
- Zebua, H. P., Manalu, R. D., & Sitanggang, S. A. (2019). Efektivitas antibakteri ekstrak daun kersen terhadap bakteri patogen. *Jurnal Penelitian Biologi dan Farmasi*, 3(1), 34–41.
- Zulham, Z., Rasyid, A. U. M., & Burhan, A. (2025). Hepatoprotective Potential of *Schleichera oleosa* Leaf Extract Against Paracetamol-Induced Liver Injury in Rats. *Jurnal Jamu Indonesia*, 10(3), 152–157. <https://doi.org/10.29244/jji.v10i3.407>

Publisher's Note & Disclaimer

All statements, opinions, and data in this publication were solely the responsibility of the individual authors or contributors and did not necessarily reflect the views of the publisher or editors. The publisher and editors did not guarantee the accuracy, completeness, or reliability of the content, and were not legally responsible for any errors, omissions, or consequences arising from its use. The publisher and editors also disclaimed any liability for injury, damage, or loss to persons or property resulting from the application of ideas, methods, or products mentioned herein. Readers were advised to independently verify all information before relying on it. The publisher accepted no responsibility for any consequences arising from the use of this publication's materials.