MEDFARM: Jurnal Farmasi dan Kesehatan, Vol. 15, No. 1, 2026, Page 152-168
e-ISSN : 2715-9957
p-ISSN: 2354-8487

Ethnomedicinal Plants for Anti-inflammatory and Analgesic in Osing Tribe, East Java, Indonesia: A Review

Firnanda Rayhan Syah Falaini[1], Arum Suproborini[2], Yaya Sulthon Aziz[3], Weka Sidha Bhagawan[4*]

[1,2,4)] Department of Pharmacy, Faculty of Health and Sciences, Universitas PGRI Madiun
[3)] Akademi Analis Farmasi dan Makanan Sunan Giri

e-mail:
*) **weka.sidha@unipma.ac.id**

ABSTRACT

The traditional medicinal knowledge of the Osing people in East Java, Indonesia, particularly concerning plants for inflammation and pain, is not systematically documented, hindering its scientific validation and potential integration into modern healthcare. This review aims to systematically document the ethnomedicinal plants used by the Osing community for anti-inflammatory and analgesic purposes, correlate this knowledge with existing scientific evidence, and perform taxonomic validation. A descriptive method was employed by collecting ethnomedicinal data from the RISTOJA (Riset Tumbuhan Obat dan Jamu) database. This was followed by a comprehensive literature review using scientific databases (PubMed, Google Scholar, ScienceDirect) to gather pharmacological evidence, and taxonomic verification was conducted using the World Flora Online (WFO) database. The study identified 40 plant species from 29 families traditionally used to treat various inflammatory and pain-related conditions, with *Curcuma longa* L. being the most frequently cited. The scientific validation revealed that 38 of these species (95%) have reported anti-inflammatory or analgesic activities, confirming the empirical knowledge of the Osing people. The findings highlight a strong correlation between traditional use and pharmacological evidence and identify *Tectaria subpedata* and *Ruellia napifera* as promising candidates for future research due to a lack of current scientific data. This research validates Osing ethnobotanical knowledge and provides a basis for developing novel phytopharmaceutical products.

Keywords: analgesic, anti-inflammatory, ethnomedicine, medicinal plants, Osing Tribe

Introduction

Inflammation is a vital immune process that defends the body against pathogens and helps repair tissue damage(Soliman & Barreda, 2023). However, when this response becomes dysregulated and turns chronic, it can cause many diseases,

including neurodegenerative, metabolic, cardiovascular, and cancer-related disorders(Chen et al., 2018; Furman et al., 2019). Diseases resulting from chronic inflammation affect hundreds of millions of people worldwide (Placha & Jampilek, 2021). Although Nonsteroidal Anti-Inflammatory Drugs (NSAIDs) are commonly used, their long-term use is limited by serious side effects such as gastrointestinal, kidney, and heart issues (Sohail et al., 2023). These challenges have increased interest in natural products, especially medicinal plants. With a long history in traditional medicine worldwide and extensive ethnomedicinal evidence, Indonesia is regarded as a potential source of safer, more sustainable anti-inflammatory agents (Mochtar et al., 2023).

As one of the world's major centers of megabiodiversity, Indonesia boasts an extraordinary wealth of flora, with tens of thousands of plant species, many of which have been empirically used in traditional medicine (Bhagawan et al., 2024). This richness makes Indonesia a highly promising but underexplored source of pharmacological resources (Bhagawan et al., 2022). The symbiotic relationship between biodiversity and cultural diversity in Indonesia has led to a well-established herbal medicine system, one of which is Jamu. This practice, rooted in ancient Javanese civilization, has strong historical evidence, as depicted in the reliefs of Borobudur Temple (Bhagawan et al., 2021). The evolution of Jamu from consumption by the royal elite to becoming part of the health practices of the general public, with formulations such as turmeric and tamarind widely recognized for their anti-inflammatory properties, highlights the value of this ethnopharmacological heritage (Bhagawan et al., 2025)

This research focuses on the Osing people, a unique ethnic group in Java that persistently preserves ancestral traditions, including medicinal knowledge, in a region rich in plant resources (Prasetyo et al., 2018). Although several ethnobotanical studies have documented plant use by the Osing people, a clear gap remains in the literature. Existing investigations are general in nature, and no systematic study has specifically focused on documenting and analyzing plant use for anti-inflammatory and analgesic purposes. This lack of focused documentation hinders further scientific validation and limits the potential integration of Osing people traditional knowledge into modern healthcare systems.

Based on the identified gaps, this study aims to (1) systematically document the ethnomedicinal knowledge and practices of the Osing people in the use of medicinal plants to treat inflammatory and pain conditions; (2) correlate these traditional uses with existing scientific evidence through a comprehensive literature review; (3) conducting taxonomic validation of these plants using scientific databases.

Methodology

Ethnomedicinal data collection

This ethnomedicinal review was conducted by collecting data on plants used through the RISTOJA (*Riset Tumbuhan Obat dan Jamu*) database

https://dashboard.kemkes.go.id. This database is a product of collaboration between the Indonesian Ministry of Health and various universities or academic institutions. To use it, filter each category: for example, in the province selection, choose East Java; in the regency or city selection, choose Banyuwangi; in the species selection, select (all); and in the efficacy selection (disease name), choose swelling, fever, goiter, mumps/parotitis, open wounds, internal heat, gout rheumatism, toothache/mouthache, headache, eye pain, stomachache, and earache.

Pharmacological validation

To scientifically validate the traditional use of plant species most commonly treated for inflammatory and painful conditions according to the RISTOJA database, a comprehensive literature review was conducted to assess their pharmacological potential in managing inflammation and pain. The search utilized various scientific databases, including PubMed, ScienceDirect, Google Scholar, Scopus, and Web of Science. Keywords such as "activity test," "pain," "inflammation," "anti-inflammatory," "analgesic," "in vivo," "in vitro," and "cyclooxygenases" were combined with the scientific names of each plant species documented in the ethnomedicinal survey. This approach aimed to correlate traditional knowledge with available biomedical evidence to support the therapeutic relevance of the recorded species.

To ensure taxonomic precision and adherence to current botanical nomenclature, the scientific names and family classifications of all plant species identified in the ethnomedicinal survey were authenticated using the World Flora Online (WFO) database (www.wfoplantlist.org). The status of each plant name (e.g., accepted name, synonym) was verified and standardized accordingly for this publication. The database was last accessed in August 2025..

Result and Discussion

Osing People Ethnomedicinal Plants for Anti-inflammatory and Analgesic

The systematic analysis of the RISTOJA database reveals a rich and diverse pharmacopeia utilized by the Osing tribe of Banyuwangi, East Java, for the management of conditions associated with inflammation and pain. This review identified 40 plant species from 29 families that are traditionally used by the Osing people of East Java to treat conditions related to inflammation and pain (Table 1). The most prominently represented families were Zingiberaceae (4 species) and Asteraceae, Lamiaceae, Myrtaceae, and Fabaceae (3 species each). This prevalence suggests a deep-rooted understanding and reliance on these plant families within the local medicinal system. *Curcuma longa* L. was the most versatile species, cited for ten different ailments, including swelling, fever, and gout, underscoring its central role in Osing ethnomedicine. The frequent use of well-known species from the Zingiberaceae family, such as turmeric and ginger, aligns with their widespread application in Jamu,

Indonesia's traditional herbal medicine system, indicating a shared ethnopharmacological heritage across different Javanese cultures. The data reveals that the Osing community utilizes a diverse botanical repertoire, applying specific plants to a range of inflammatory symptoms from systemic conditions like fever to localized issues like toothaches and wounds.

Table 1. Medicinal Plants for Inflammation and Pain in Osing Tribe

Species	Family	Disease Treated
Curcuma longa L.	Zingiberaceae	Swelling, fever, goiter, mumps/ parotitis, gout rheumatism, toothache/mouthache, headache, eye pain, stomachache, earache
Allium cepa L.	Amaryllidaceae	Fever, mumps/parotitis, open wounds, gout rheumatism, eye pain
Andrographis paniculata (Burm. F.) Nees	Acanthaceae	Gout rheumatism, eye pain
Tectaria subpedata (Harr.) Ching	Tectariaceae	Fever, goiter, mumps/parotitis
Kaempferia galanga L.	Zingibereceae	Mumps/parotitis
Moringa oleifera Lam.	Moringaceae	Eye pain
Zingiber officinale Roscoe.	Zingibereceae	Internal heat, headache
Abrus precatorius L.	Fabaceae	Fever, internal heat
Acorus calamus L.	Acoraceae	Fever
Amomum compactum Soland. ex Malon	Zingibereceae	Fever
Cocos nucifera L.	Arecaceae	Internal heat. earache.
Elephantropus scaber L.	Asteraceae	Headache
Orthosiphon aristatus (Bl.) Miq.	Lamiaceae	Goiter, gout rheumatism
Psidium guajava L.	Myrtaceae	Fever
Anredera cordifolia (Ten.) Steenis	Basellaceae	Open wounds
Averrhoa bilimbi L.	Oxalidaceae	Toothache/ mouthache, eye pain
Centella asiatica (L.) Urb.	Apiaceae	Headache
Emilia sonchifolia (L.) Dc.	Asteraceae	Earache

Species	Family	Disease Treated
Persea americana Mill.	Lauraceae	Gout rheumatism, headache
Plantago major L.	Plantaginaceae	Gout rheumatism
Sechium edule (Jacq.) Sw.	Cucurbitaceae	Fever
Syzygium aromaticum (L.) Merr. & L.M.Perry	Myrtaceae	Swelling
Tamarindus indica L.	Fabaceae	Goiter, toothache/ mouthache
Tinospora crispa (L.) Hook. F & Tomson	Menispermaceae	Gout rheumatism
Urena lobata L.	Malvaceae	Headache
Ananas comosus (L.) Merr.	Bromeliaceae	Toothache/mouthache
Annona muricata L.	Annonaceae	Fever
Arenga pinnata (Wurmb) Merr.	Arecaceae	Gout rheumatism
Camellia sinensis (L.) Kuntze	Theaceae	Toothache/mouthache.
Citrus aurantifolia (Christm.) Swingle	Rutaceae	Internal heat
Eugenia uniflora L.	Myrtaceae	Gout rheumatism
Imperata cylindrica (L.) Raeusch.	Poaceae	Internal heat
Lannea coromandelica (Houtt.) Merr.	Anacardiaceae	Open wounds
Merremia umbelata (L) Hallier F.	Convolvulaceae	Goiter
Paederia foetida L.	Rubiaceae	Stomachache
Phaleria macrocarpa (Scheff.) Boerl.	Thymelaeaceae	Gout rheumatism
Plectranthus scutellarioides (L.) R.Br.	Lamiaceae	Internal heat
Pluchea indica (L.) Less	Asteraceae	Goiter
Ruellia napifera Zoll. & Moritzi	Acanthaceae	Eye pain
Tallinum paniculatum (Jacq.) Gaertn.	Talinaceae	Stomachache

Scientific Confirmation of Osing People Medicinal Plants Used in Inflammation and Pain

A comprehensive literature search confirmed that a significant majority of the plants identified have been scientifically investigated for their anti-inflammatory and analgesic properties (Table 2). Of the 40 species documented, 38 have published

evidence supporting their traditional use, validating the empirical knowledge of the Osing people. The pharmacological activities are substantiated through various *in vivo* and *in vitro* models. For instance, extracts from *Moringa oleifera* Lam., *Annona muricata* L., and *Orthosiphon aristatus* (Bl.) Miq. demonstrated potent anti-inflammatory effects, with edema inhibition rates of 94.4%, 80.85%, and 78%, respectively, in carrageenan-induced paw edema assays —a standard model for acute inflammation (Hajar et al., 2025; Ishola et al., 2014; Tabana et al., 2016).

The mechanisms underlying these effects are often linked to the modulation of key inflammatory pathways. Studies on *Amomum compactum* Soland. ex Maton and *Merremia umbellata* (L.) Hallier f. showed inhibition of pro-inflammatory mediators such as nitric oxide (NO), prostaglandins (PGE_2), interleukins (IL-6), and tumor necrosis factor-alpha (TNF-α), as well as suppression of enzymes like cyclooxygenase-2 (COX-2) (J. A. Lee et al., 2012; S. C. Lee et al., 2023). Similarly, the analgesic effects of plants like *Andrographis paniculata* (Burm. f.) Nees and *Lannea coromandelica* (Houtt.) Merr. were confirmed through significant reductions in acetic acid-induced writhing in mice, a model for peripheral pain (D. Lee et al., 2020; Rahman et al., 2016).

Table 2. Scientific Confirmation of Osing People Medicinal Plants Used in Inflammation and Pain

Species	Extracts and Plant Parts	Assay used/ method	Anti-inflammatory or Analgesic Activity	References
Abrus precatorius L.	Water extract of leaves	Croton oil-induced ear edema in rats	67.10% reduction of inflammatory response	(Georgewill & Georgewill, 2009)
Acorus calamus L.	Hydroalcoholic extract of rhizome	Chronic constriction injury-induced heat hyperalgesia in rats	74.54% inhibition of thermal hyperalgesia at 200 mg/kg	(Muthuraman & Singh, 2011)
Allium cepa L.	Methanol extract of bulbs	Carrageenan-induced paw edema in rats	62.5% inhibition of paw edema at 200 mg/kg	(Oyewusi et al., 2021)
Amomum compactum Soland. ex Malon	Ethanolic extract	Lipopolysaccharide (LPS)-induced RAW 264.7 cells	Prominently inhibited production of NO, PGE_2, IL-6, and TNF-α	(J. A. Lee et al., 2012)
Ananas comosus (L.) Merr.	Peel extract	Carrageenan-induced air pouch in rats	Reducing exudates formation, inflammatory cell counts, and nitrite, tumor necrosis factor-alpha and	(Ajayi et al., 2022)

Species	Extracts and Plant Parts	Assay used/ method	Anti-inflammatory or Analgesic Activity	References
			interleukin-6 levels	
Andrographis paniculata (Burm. F.) Nees	Ethanol extract of leaves	Acetic acid-induced writhing test in mice	67.22% reduction in writhing at 1000 mg/kg	(D. Lee et al., 2020)
Annona muricata L.	Lyophilized extract of unripe fruit	Carrageenan-induced paw edema in rats	80.85% inhibition of edema at 200 mg/kg	(Ishola et al., 2014)
Anredera cordifolia (Ten.) Steenis	Extract of leaves	Carrageenan-induced paw edema in rats	10.12% inhibition of paw edema at 50.4 mg/200 g BW	(Kurniawan et al., 2014)
Arenga pinnata (Wurmb) Merr.	Ethanol extract of fruit	Acetic acid-induced writhing test in rats	Exhibited analgesic effect at 50 and 100 mg/kg	(Sovia & Anggraeny, 2019)
Averrhoa bilimbi L.	Methanolic extract of leaves	Acetic acid-induced writhing test in mice	67.51% inhibition of writhing at 400 mg/kg	(Amin, 2019)
Camellia sinensis (L.) Kuntze	Methanolic extract of fresh leaves	*In vitro* 5-lipoxygenase (5-LOX) inhibition assay	Showed concentration-dependent inhibition of 5-LOX with an IC50 of 30.60 ± 0.40 µg/mL.	(Thitimuta et al., 2017)
Centella asiatica (L.) Urb.	Asiatic acid isolated from the plant	Carrageenan-induced paw edema in mice	Significantly inhibited paw edema at 10 mg/kg (P<.001)	(Huang et al., 2011)
Citrus aurantifolia (Christm.) Swingle	Ethanolic extract of peels	Carrageenan-induced paw edema in rats	54.7% inhibition of paw edema at 500 mg/kg	(Malleshappa et al., 2018)
Cocos nucifera L.	Acetone extract of inflorescence	Carrageenan-induced paw edema in mice	59.81% inhibition of paw edema at 400 mg/kg	(Chithra et al., 2020)
Curcuma longa L.	Essential oil from rhizome	Carrageenan-induced paw edema in mice	61.1% reduction in paw thickness at 1000 mg/kg	(Liju et al., 2011)

Species	Extracts and Plant Parts	Assay used/ method	Anti-inflammatory or Analgesic Activity	References
Elephantropus scaber L.	Hydroalcoholic extract of aerial parts	Carrageenan-induced paw edema in rats	57% reduction in pedal edema at 60 mg/kg	(Sankar et al., 2001)
Emilia sonchifolia (L.) Dc.	Methanolic extract of leaves	Carrageenan-induced paw edema in mice	72.1% inhibition of paw edema at 862.2 mg/kg	(Essien et al., 2009.)
Eugenia uniflora L.	Crude extract of leaves	Carrageenan-induced peritonitis model in mice	Significant inhibition of leukocyte migration at 50, 100, and 200 mg/kg	(Falcão et al., 2018)
Imperata cylindrica (L.) Raeusch.	Methanolic extract of aerial parts	Carrageenan-induced paw edema in rats	Dose-dependent inhibition of inflammation at the 1st and 3rd hour post-induction	(Razafindrakoto et al., 2021)
Kaempferia galanga L.	Ethyl-p-methoxycinnamate (EPMC) isolated from rhizome	Carrageenan-induced paw edema in rats	53.7% inhibition of inflammation at 100 mg/kg	(Umar et al., 2012)
Lannea coromandelica (Houtt.) Merr.	Ethanol extract of stem bark	Acetic acid-induced writhing test in mice	92.92% inhibition of writhing at 250 mg/kg	(Rahman et al., 2016)
Merremia umbelata (L) Hallier F.	Methanol extract of dried leaves and shoots	LPS-stimulated RAW264.7 macrophage model (*in vitro*)	Suppressed the gene expression of inducible NO synthase (NOS2) and cyclooxygenase-2 (COX-2).	(S. C. Lee et al., 2023)
Moringa oleifera Lam.	Aqueous extract of leaves	Carrageenan-induced paw edema in rats	94.4% inhibition of paw edema at 350 mg/kg	(Hajar et al., 2025)
Orthosiphon aristatus (Bl.) Miq.	50% ethanol extract of leaves	Carrageenan-induced paw edema in rats	78% inhibition of inflammation at 400 mg/kg	(Tabana et al., 2016)
Paederia foetida L.	Ethanolic extract of root	Acetic acid-induced writhing test in mice	60.2% inhibition of writhing at 200 mg/kg	(Sruthi & Gnaneshwari, 2015)

Species	Extracts and Plant Parts	Assay used/ method	Anti-inflammatory or Analgesic Activity	References
Persea americana Mill.	Aqueous extract of leaves	Carrageenan-induced paw edema in rats	Significant inhibition of swelling at 800 mg/kg, similar to indomethacin	(Yasir et al., 2010)
Phaleria macrocarpa (Scheff.) Boerl.	Fruit extract	Excision wound model in rats	Significantly decreased TNF-α level in granulation tissue	(Abood et al., 2015)
Plantago major L.	Methanol extract of seeds	Carrageenan-induced paw edema in rats	49.76% inhibition of paw edema at 25 mg/kg	(Türel et al., 2009)
Plectranthus scutellarioides (L.) R.Br.	Ethanol extract of leaves	*In vitro* nitric oxide (NO) inhibitory assay on lipopolysaccharide (LPS)-induced macrophage cells.	Inhibited nitric oxide production with an IC50 value of 79.46 µg/mL.	(Ghiza Fakhriati et al., 2018)
Pluchea indica (L.) Less	Ethyl acetate fraction of ethanol extract of leaves	Carrageenan-induced paw edema in rats	Exhibited anti-inflammatory activity in a dose-dependent manner	(Buapool et al., 2013)
Psidium guajava L.	Hydroethanolic extract of fruit pomace (peel, seed, pulp)	Carrageenan-induced paw edema in mice	56% inhibition of paw edema at 300 mg/kg (i.p.)	(Denny et al., 2013)
Ruellia napifera Zoll. & Moritzi	Not available	Not available	Not available	Not available
Sechium edule (Jacq.) Sw.	Methanol extract of fruit	Cytokine level measurement in mice	Reduced TNF-α level from 255.7 pg/mL to 92.46 pg/mL at 1000 mg/kg	(Aguiñiga-Sánchez et al., 2020)
Syzygium aromaticum (L.) Merr. & L.M.Perry	Eugenol oil from buds	Carrageenan-induced paw edema in mice	51.8% reduction in paw edema at 33 mg/kg	(Rasool et al., 2025)
Tallinum paniculatum (Jacq.) Gaertn.	Ethyl acetate extract of leaves	Complete Freund's Adjuvant (CFA)-induced arthritis in rats	Significant reduction in foot volume and arthritis index	(Emelda et al., 2020)

Species	Extracts and Plant Parts	Assay used/ method	Anti-inflammatory or Analgesic Activity	References
Tamarindus indica L.	Methanolic extract of seeds	Carrageenan-induced paw edema in rats	Significant reduction of paw edema at 100, 200, and 400 mg/kg	(Suralkar et al., 2012)
Tectaria subpedata (Harr.) Ching	Not available	Not available	Not available	Not available
Tinospora crispa (L.) Hook. F & Tomson	Aqueous extract of dried stem	Carrageenan-induced paw edema in rats	Significant inhibition of paw swelling at 50, 100, and 150 mg/kg, comparable to ibuprofen	Hipol et al., 2012)
Urena lobata L.	Aqueous extract of leaves	Carrageenan-induced paw edema in rats	4% reduction in paw edema at 500 mg/kg	(Purnomo & Tilaqza, 2022)
Zingiber officinale Roscoe.	Juice from rhizome (in formulation with *Citrus limon*)	Carrageenan-induced paw edema in rats	44.05% inhibition of paw edema at 20 mg/kg	(Bekkouch et al., 2023)

This strong correlation between traditional claims and modern scientific findings highlights the value of ethnobotanical research as a strategy for drug discovery. Notably, two species, *Tectaria subpedata* (Harr.) Ching and *Ruellia napifera* Zoll. & Moritzi, lacked specific pharmacological studies related to inflammation or pain in the reviewed literature. This identifies a critical knowledge gap and positions these plants as high-priority candidates for future phytochemical and pharmacological investigation.

Conclusion

This review systematically documents 40 medicinal plants used by the Osing tribe for anti-inflammatory and analgesic purposes and confirms that the traditional application of the vast majority is supported by modern scientific evidence. The findings validate the ethnopharmacological knowledge of the Osing community as a scientifically sound and valuable resource. This research underscores the importance of preserving this cultural heritage and provides a strong basis for further investigation into understudied species, potentially leading to the development of novel, plant-derived therapeutic agents for treating inflammation and pain.

Declaration of Competing Interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Reference

Abood, W. N., Al-Henhena, N. A., Abood, A. N., Jamil Al-Obaidi, M. M., Ismail, S., Abdulla, M. A., & Al Batran, R. (2015). Wound-healing potential of the fruit extract of phaleria macrocarpa. *Bosnian Journal of Basic Medical Sciences*, *15*(2), 25–30. https://doi.org/10.17305/bjbms.2015.39

Aguiñiga-Sánchez, I., Soto-Hernández, M., Cadena-Iñiguez, J., Suwalsky, M., Colina, J. R., Castillo, I., Rosado-Pérez, J., Mendoza-Núñez, V. M., & Santiago-Osorio, E. (2020). Phytochemical analysis and antioxidant and anti-inflammatory capacity of the extracts of fruits of the sechium hybrid. *Molecules*, *25*(20). https://doi.org/10.3390/molecules25204637

Ajayi, A. M., Coker, A. I., Oyebanjo, O. T., Adebanjo, I. M., & Ademowo, O. G. (2022). Ananas comosus (L) Merrill (pineapple) fruit peel extract demonstrates antimalarial, anti-nociceptive and anti-inflammatory activities in experimental models. *Journal of Ethnopharmacology*, *282*, 114576. https://doi.org/https://doi.org/10.1016/j.jep.2021.114576

Amin, M. N. (2019). Evaluation of the analgesic and anti-inflammatory activities of methanolic extracts of the leaves of Averrhoa bilimbi leaves. *Discovery Phytomedicine*, *6*(1), 12. https://doi.org/10.15562/phytomedicine.2019.77

Bekkouch, O., Zengin, G., Harnafi, M., Touiss, I., Khoulati, A., Saalaoui, E., Harnafi, H., Abdellattif, M. H., & Amrani, S. (2023). Anti-Inflammatory Study and Phytochemical Characterization of Zingiber officinale Roscoe and Citrus limon L. Juices and Their Formulation. *ACS Omega*, *8*(30), 26715–26724. https://doi.org/10.1021/acsomega.2c04263

Bhagawan, W. S., Ekasari, W., & Agil, M. (2024). Ethnobotanical survey of herbal steam baths among the Tenggerese community in Bromo Tengger Semeru National Park, Indonesia. *IOP Conference Series: Earth and Environmental Science*, *1352*(1). https://doi.org/10.1088/1755-1315/1352/1/012103

Bhagawan, W. S., Ekasari, W., & Agil, M. (2025). Ethnomedicinal survey and scientific validation of inflammation-healing plants used by the Tengger community in East Java, Indonesia. *Biodiversitas*, *26*(7), 3160–3173. https://doi.org/10.13057/biodiv/d260707

Bhagawan, W. S., Suproborini, A., Prastya Putri, D. L., Nurfatma, A., & Putra, R. T. (2022). Ethnomedicinal study, phytochemical characterization, and pharmacological confirmation of selected medicinal plant on the northern slope of Mount Wilis, East Java, Indonesia. *Biodiversitas*, *23*(8), 4303–4313. https://doi.org/10.13057/biodiv/d230855

Buapool, D., Mongkol, N., Chantimal, J., Roytrakul, S., Srisook, E., & Srisook, K. (2013). Molecular mechanism of anti-inflammatory activity of Pluchea indica leaves in macrophages RAW 264.7 and its action in animal models ofinflammation. *Journal of Ethnopharmacology*, *146*(2), 495–504. https://doi.org/10.1016/j.jep.2013.01.014

Chen, L., Deng, H., Cui, H., Fang, J., Zuo, Z., Deng, J., Li, Y., Wang, X., & Zhao, L. (2018). Inflammatory responses and inflammation-associated diseases in organs. *Oncotarget,* 9(6).

Chithra, M. A., Ijinu, T. P., Kharkwal, H., Sharma, R. K., Pushpangadan, P., & George, V. (2020). Phenolic rich Cocos nucifera inflorescence extract ameliorates inflammatory responses in LPS-stimulated RAW264.7 macrophages and toxin-induced murine models. *Inflammopharmacology*, *28*(4), 1073–1089. https://doi.org/10.1007/s10787-019-00620-6

Denny, C., Melo, P. S., Franchin, M., Massarioli, A. P., Bergamaschi, K. B., De Alencar, S. M., & Rosalen, P. L. (2013). Guava pomace: A new source of anti-inflammatory and analgesic bioactives. *BMC Complementary and Alternative Medicine*, *13*. https://doi.org/10.1186/1472-6882-13-235

Emelda, A., Wati, A., Taufik, M., Kurniawaty, R., & Author, C. (2020). Journal of Global Pharma Technology Immunomodulator Activity and Antirheumatoid Arthritis Extract of Ethyl Acetate Ginseng Bugis Talinum Paniculatum (jacq.) Gaertn). *Journal of Global Pharma Technology*, 12(02), 246-251.

Essien, G., Nwidu, L. L., & Nwafor, P. A. (2009). *Anti-Inflammatory and Analgesic Potential of Methanolic Extract of Emilia Sonchifolia (Compositae) Leaves in Rodents*. *African Journal of Biomedical Research,* 12(3).

Falcão, T. R., de Araújo, A. A., Soares, L. A. L., de Moraes Ramos, R. T., Bezerra, I. C. F., Ferreira, M. R. A., de Souza Neto, M. A., Melo, M. C. N., de Araújo, R. F., de Aguiar Guerra, A. C. V., de Medeiros, J. S., & Guerra, G. C. B. (2018). Crude extract and fractions from Eugenia uniflora Linn leaves showed anti-inflammatory, antioxidant, and antibacterial activities. *BMC Complementary and Alternative Medicine*, *18*(1). https://doi.org/10.1186/s12906-018-2144-6

Furman, D., Campisi, J., Verdin, E., Carrera-Bastos, P., Targ, S., Franceschi, C., Ferrucci, L., Gilroy, D. W., Fasano, A., Miller, G. W., Miller, A. H., Mantovani, A., Weyand, C. M., Barzilai, N., Goronzy, J. J., Rando, T. A., Effros, R. B., Lucia, A., Kleinstreuer, N., & Slavich, G. M. (2019). Chronic inflammation in the etiology of disease across the life span. *Nature Medicine*, *25*(12), 1822–1832. https://doi.org/10.1038/s41591-019-0675-0

Georgewill, O. A., & Georgewill, U. O. (2009). Evaluation of the anti-inflammatory activity of extract of Abrus precatorious. *Eastern Journal of Medicine*, *14*(1), 23–25. https://doi.org/10.4314/jophas.v5i2.48477

Ghiza Fakhriati, S., Ida, M., & Citra Ayu, A. (2018) Res. J. Chem. Environ. The 2 nd International Seminar and Expo on Jamu. In *Research Journal of Chemistry and Environment,* 22.

Hajar, A., Kabdy, H., Abdelmounaim, B., Badaoui, M., Karima, R., Chafik, T., Oufquir, S., Soad, M., Elyazouli, L., Aboufatima, R., Mohamed, L., Garzoli, S., & Abderrahman, C. (2025). Phytochemical analysis, anti-inflammatory property, wound-healing, and anti-granuloma effect of Moroccan aqueous leave extract of Moringa oleifera. *Journal of Pharmacy and Pharmacology*, rgaf056. https://doi.org/10.1093/jpp/rgaf056

Hipol, R. L. B., Cariaga, M. F. N. M., & Hipol, R. M. (2012). Anti-inflammatory activities of the aqueous extract of the stem of Tinospora crispa (Family Menispermaceae). J Nat Stud, 11(1&2), 88-95.

Huang, G. J., Huang, S. S., Chiu, C. S., Chen, H. J., Hou, W. C., Sheu, M. J., Lin, Y. C., & Shie, P. H. (2011). Antinociceptive activities and the mechanisms of anti-inflammation of asiatic acid in mice. *Evidence-Based Complementary and Alternative Medicine*, 2011. https://doi.org/10.1155/2011/895857

Ishola, I. O., Awodele, O., Olusayero, A. M., & Ochieng, C. O. (2014). Mechanisms of analgesic and anti-inflammatory properties of annona muricata linn. (Annonaceae)

fruit extract in rodents. *Journal of Medicinal Food*, *17*(12), 1375–1382. https://doi.org/10.1089/jmf.2013.0088

Kurniawan, B., Carolia, N., & Pheilia, A. (2014). The effectiveness of binahong leaf extract (Anredera cordifolia (Ten.) Steenis) and mefenamic acid as anti inflamation to white male rat induced by karagenin. *JuKe Unila*, 4(8).

Lee, D., Baek, C. Y., Hwang, J. H., & Kim, M. Y. (2020). Andrographis paniculata extract relieves pain and inflammation in monosodium iodoacetate-induced osteoarthritis and acetic acid-inducedwrithing in animal models. *Processes*, *8*(7). https://doi.org/10.3390/pr8070873

Lee, J. A., Lee, M. Y., Shin, I. S., Seo, C. S., Ha, H., & Shin, H. K. (2012). Anti-inflammatory effects of amomum compactum on RAW 264.7 cells via induction of heme oxygenase-1. *Archives of Pharmacal Research*, *35*(4), 739–746. https://doi.org/10.1007/s12272-012-0419-x

Lee, S. C., Ahn, J., Kim, J., Lee, J. Y., Kim, J., Uddin, M. S., Lee, S. W., & Kim, C. Y. (2023). The Antioxidant and Anti-Inflammatory Properties of Merremia umbellata Extract. *Antioxidants*, *12*(12). https://doi.org/10.3390/antiox12122037

Liju, V. B., Jeena, K., & Kuttan, R. (2011). An evaluation of antioxidant, anti-inflammatory, and antinociceptive activities of essential oil from Curcuma longa. L. *Indian Journal of Pharmacology*, *43*(5), 526–531. https://doi.org/10.4103/0253-7613.84961

Malleshappa, P., Kumaran, R. C., Venkatarangaiah, K., & Parveen, S. (2018). Peels of Citrus fruits: A potential source of anti-inflammatory and anti-nociceptive agents. *Pharmacognosy Journal*, *10*(6), S172–S178. https://doi.org/10.5530/pj.2018.6s.30

Mochtar, N. Nizmah. F., Mugiyanto, E., Wirasti, W., Maharani, V., Umarella, N., Wulandari, H. F., Rahmatullah, St., Handayani, W., Pambudi, D. B., Oktaviani, R. K., Nur, A. V., Permadi, Y. W., Muthoharoh, A., Vo, T.-H., & Wihadi, Muh. N. K. (2023). Indonesian anti-inflammation herbs mechanism: mini review. *Jurnal Ilmiah Kesehatan*, *16*(2), 64–75. https://doi.org/10.48144/jiks.v16i2.1453

Muthuraman, A., & Singh, N. (2011). Attenuating effect of Acorus calamus extract in chronic constriction injury induced neuropathic pain in rats: An evidence of anti-oxidative, anti-inflammatory, neuroprotective and calcium inhibitory effects. *BMC*

Complementary and Alternative Medicine, 11. https://doi.org/10.1186/1472-6882-11-24

Oyewusi, A. J., Oridupa, O. A., Saba, A. B., Oyewusi, I. K., & Olukunle, J. O. (2021). Anti-inflammatory and analgesic effects of methanol extract of red cultivar Allium cepa bulbs in rats and mice. *Journal of Basic and Clinical Physiology and Pharmacology*, *32*(6), 1087–1092. https://doi.org/10.1515/jbcpp-2020-0080

Placha, D., & Jampilek, J. (2021). Chronic inflammatory diseases, anti-inflammatory agents and their delivery nanosystems. *Pharmaceutics*, 13(1), 1–27. https://doi.org/10.3390/pharmaceutics13010064

Prasetyo, B., Chikmawati, T., Walujo, E. B., & Amzu, E. (2018). Ethnoecology: The traditional landscape of osing tribe in Banyuwangi, Indonesia. *Biodiversitas*, *19*(6), 2003–2009. https://doi.org/10.13057/biodiv/d190604

Purnomo, Y., & Tilaqza, A. (2022). Analgesic and Anti-inflammatory Activities of Urena lobata L. Leaf Extracts. *Indonesian Journal of Pharmacy,* 33(4).

Rahman, M., Khatun, A., Uddin, S. J., & Shilpi, J. A. (2016). Comparative effect of Lannea coromandelica (Houtt.) Merr. leaves and stem barks on acetic acid induced pain model in mice and chromogenic reagents: exploring the analgesic potential and phytochemical groups. *Pharmacologyonline*, 147, 146-152.

Rasool, E. M. A., Saleh, A. N. A., Al-Khafaji, M., Akool, A. S. K., & Kadum, H. (2025). Evaluation of antinociceptive and anti-inflammatory activities of clove (Syzygium aromaticum) in vivo. *International Journal of Innovative Research and Scientific Studies*, *8*(2), 2834–2841. https://doi.org/10.53894/ijirss.v8i2.5822

Razafindrakoto, Z. R., Tombozara, N., Donno, D., Gamba, G., Nalimanana, N. R., Rakotondramanana, D. A., Andrianjara, C., Beccaro, G. L., & Ramanitrahasimbola, D. (2021). Antioxidant, analgesic, anti-inflammatory and antipyretic properties, and toxicity studies of the aerial parts of Imperata cylindrica (L.) Beauv. *South African Journal of Botany*, *142*, 222–229. https://doi.org/10.1016/j.sajb.2021.07.004

Sankar, V., Kalirajan, R., Sales, F. S. V., & Raghuraman, S. (2001). Antiinflammatory activity of Elephantopus scaber in albino rats. *Indian journal of pharmaceutical sciences*, *63*(6), 523-525.

Sidha Bhagawan, W., Barsyaif, A., & Hidayat, A. (2021). *Ethnobotanical Study of Tengger Tribe Sexual Medicinal Plant in Argosari Village, Lumajang, Indonesia*. *14*(2), 99–110. https://doi.org/10.22435/jtoi.v14i2

Sohail, R., Mathew, M., Patel, K. K., Reddy, S. A., Haider, Z., Naria, M., Habib, A., Abdin, Z. U., Razzaq Chaudhry, W., & Akbar, A. (2023). Effects of Non-steroidal Anti-inflammatory Drugs (NSAIDs) and Gastroprotective NSAIDs on the Gastrointestinal Tract: A Narrative Review. *Cureus*. https://doi.org/10.7759/cureus.37080

Soliman, A. M., & Barreda, D. R. (2023). Acute Inflammation in Tissue Healing. In *International Journal of Molecular Sciences,* 24, (1). https://doi.org/10.3390/ijms24010641

Sovia, E., & Anggraeny, D. (2019). Sugar Palm Fruits (Arenga pinnata) as Potential Analgesics and Anti-Inflammatory Agent. *Molecular and Cellular Biomedical Sciences*, *3*(2), 107. https://doi.org/10.21705/mcbs.v3i2.63

Sruthi, K., & Gnaneshwari, K. (2015). Biological evaluation of in-vivo analgesic and anti-inflammatory effects of paederia foetida root extract. *World Journal of Advance Healthcare Research,* 6.

Suralkar, A. A., Rodge, K. N., Kamble, R. D., & Maske, K. S. (2012). Evaluation of Anti-inflammatory and Analgesic Activities of Tamarindus indica Seeds. In *International Journal of Pharmaceutical Sciences and Drug Research*, 4(3).

Tabana, Y. M., Al-Suede, F. S. R., Ahamed, M. B. K., Dahham, S. S., Hassan, L. E. A., Khalilpour, S., Taleb-Agha, M., Sandai, D., Majid, A. S. A., & Majid, A. M. S. A. (2016). Cat's whiskers (Orthosiphon stamineus) tea modulates arthritis pathogenesis via the angiogenesis and inflammatory cascade. *BMC Complementary and Alternative Medicine*, *16* (1). https://doi.org/10.1186/s12906-016-1467-4

Thitimuta, S., Pithayanukul, P., Nithitanakool, S., Bavovada, R., Leanpolchareanchai, J., & Saparpakorn, P. (2017). Camellia sinensis L. Extract and its potential beneficial effects in antioxidant, anti-inflammatory, anti-hepatotoxic, and anti-tyrosinase activities. *Molecules*, *22*(3). https://doi.org/10.3390/molecules22030401

Türel, I., Özbek, H., Erten, R., Öner, A. C., Cengiz, N., & Yilmaz, O. (2009). Hepatoprotective and anti-inflammatory activities of Plantago major L. *Indian Journal of Pharmacology*, *41*(3), 120–124. https://doi.org/10.4103/0253-7613.55211

Umar, M. I., Asmawi, M. Z., Sadikun, A., Atangwho, I. J., Yam, M. F., Altaf, R., & Ahmed, A. (2012). Bioactivity-guided isolation of ethyl-p-methoxycinnamate, an anti-inflammatory constituent, from Kaempferia galanga L. extracts. In *Molecules* (Vol. 17, Issue 7, pp. 8720–8734). https://doi.org/10.3390/molecules17078720

Yasir, M., Das, S., & Kharya, M. (2010). The phytochemical and pharmacological profile of persea americana Mill. In *Pharmacognosy Reviews* (Vol. 4, Issue 7, pp. 77–84). https://doi.org/10.4103/0973-7847.65332