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Review

Alangium Lamarckii: A Natural Remedy for Inflammation

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Abstract:

Alangium lamarckii, a medicinal plant indigenous to Balarampur, Uttar Pradesh, has long been used in traditional medicine for its potent anti-inflammatory properties. This study focuses on the formulation, development, and biological evaluation of an anti-inflammatory herbal dosage form derived from Alangium lamarckii. The extraction of active compounds was performed using standard phytochemical methods, followed by the formulation of various dosage forms, including tablets, capsules, and topical applications. The anti-inflammatory efficacy of these formulations was assessed through in vitro and in vivo models. Results demonstrated significant inhibition of inflammatory markers, including COX-2 and TNF-α, comparable to conventional non-steroidal anti-inflammatory drugs (NSAIDs). Additionally, the formulations exhibited minimal cytotoxicity and high biocompatibility, making them a promising alternative to synthetic drugs. The study concludes that Alangium lamarckii holds great potential as a natural anti-inflammatory remedy, offering an effective and safer therapeutic option for managing inflammation.

Keywords: *Alangium lamarckii, Anti-inflammatory, Herbal dosage form, Phytochemical extraction*

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1. Introduction

Inflammation is a complex physiological response to harmful stimuli such as pathogens, damaged cells, or irritants. It is a protective mechanism aimed at removing injurious stimuli and initiating the healing process. However, chronic inflammation is implicated in the pathogenesis of various diseases, including arthritis, cardiovascular diseases, and certain cancers[1-3]. The management of inflammation often involves the use of non-steroidal anti-inflammatory drugs (NSAIDs) and corticosteroids, which, despite their effectiveness, can cause significant side effects, such as gastrointestinal disturbances, renal impairment, and increased cardiovascular risk. Given the limitations of conventional anti-inflammatory drugs, there is a growing interest in exploring alternative remedies derived from natural sources. Medicinal plants have been used for centuries in traditional medicine to treat inflammation and other ailments, offering a rich source of bioactive compounds with therapeutic potential. Among these, Alangium lamarckii, a plant indigenous to Balarampur, Uttar Pradesh, stands out due to its historical use in traditional medicine and reported anti-inflammatory properties[4-9].

Alangium lamarckii, belonging to the family Alangiaceae, is a deciduous tree commonly found in India. Various parts of the plant, including the bark, leaves, and roots, have been traditionally used to treat a range of ailments, including fever, pain, and inflammation. Despite its long history of use, scientific studies on the anti-inflammatory properties of Alangium lamarckii are limited. This study aims to fill this gap by systematically evaluating the anti-inflammatory potential of Alangium lamarckii through the formulation and biological evaluation of herbal dosage forms[10-15].

The objectives of this study are threefold: firstly, to extract and identify the active phytochemical compounds in Alangium lamarckii; secondly, to develop stable and effective herbal dosage forms; and thirdly, to evaluate the anti-inflammatory efficacy of these formulations using in vitro and in vivo models. By achieving these objectives, this study seeks to establish Alangium lamarckii as a viable natural alternative to conventional anti-inflammatory drugs, offering a safer and potentially more effective option for managing inflammation[16-20].

2. Literature Review

a. **Previous Studies on Alangium Lamarckii:** Research on Alangium lamarckii has primarily focused on its traditional uses and preliminary phytochemical analyses. Studies have reported the presence of various bioactive compounds, including alkaloids, flavonoids, and saponins, which are known for their anti-inflammatory and analgesic properties. However, comprehensive studies investigating the specific anti-inflammatory mechanisms and therapeutic potential of Alangium lamarckii are scarce.

b. **Anti-inflammatory Properties of Medicinal Plants:** Medicinal plants have been extensively studied for their anti-inflammatory properties. Many plants contain bioactive compounds that modulate inflammatory pathways by inhibiting the production of pro-inflammatory mediators such as prostaglandins, cytokines, and nitric oxide. For instance, curcumin from turmeric, resveratrol from grapes, and quercetin from onions are well-documented for their anti-inflammatory effects. These compounds offer a promising alternative to synthetic drugs due to their lower toxicity and side effect profiles.

c. **Comparative Analysis of Natural vs. Synthetic Anti-inflammatory Agents:** Synthetic anti-inflammatory drugs, while effective, are often associated with adverse effects, leading to increased interest in natural remedies. Studies comparing the efficacy of natural and synthetic anti-inflammatory agents have shown that many plant-derived compounds can provide comparable relief with fewer side effects. The potential for drug-herb interactions, however, necessitates careful consideration when integrating natural remedies into clinical practice[21-23].

3. Materials and Methods

a. **Collection and Identification of Alangium Lamarckii:** Alangium lamarckii specimens were collected from Balarampur, Uttar Pradesh. The plant material was authenticated by a botanist and a voucher specimen was deposited in the herbarium of the local research institution for future reference.

b. **Phytochemical Extraction Process:** The extraction of active compounds from Alangium lamarckii was carried out using standard phytochemical extraction methods. The collected plant material was washed, dried, and ground into a fine powder. The powdered material was then subjected to solvent extraction using solvents of varying polarities to ensure the comprehensive extraction of phytochemicals. The extracts were concentrated under reduced pressure and stored at 4°C until further use.

c. **Formulation of Herbal Dosage Forms:** Various dosage forms, including tablets, capsules, and topical applications, were formulated using the concentrated extracts of Alangium lamarckii. The formulation process involved the selection of appropriate excipients to ensure stability, bioavailability, and patient compliance. The formulations were subjected to preliminary stability testing to assess their shelf life and storage conditions.

d. **Experimental Design for Biological Evaluation**: The anti-inflammatory efficacy of the formulated dosage forms was evaluated using both in vitro and in vivo models. In vitro assays included the measurement of inhibition of key inflammatory mediators such as cyclooxygenase-2 (COX-2) and tumor necrosis factor-alpha (TNF-α). In vivo studies were conducted using animal models of inflammation to assess the therapeutic potential and safety profile of the formulations[24-27].

4. Phytochemical Analysis

a. **Methods of Phytochemical Screening:** Phytochemical screening of Alangium lamarckii extracts was conducted to identify the presence of various bioactive compounds. Standard qualitative tests were performed to detect alkaloids, flavonoids, saponins, tannins, phenolics, and glycosides. These tests provided preliminary insights into the phytochemical composition of the plant extracts.

b. **Identification of Active Compounds:** The active compounds in Alangium lamarckii extracts were identified using advanced analytical techniques such as High-Performance Liquid Chromatography (HPLC), Gas Chromatography-Mass Spectrometry (GC-MS), and Nuclear Magnetic Resonance (NMR) spectroscopy. These techniques enabled the precise identification and quantification of bioactive constituents responsible for the plant's anti-inflammatory properties.

c. **Quantitative Analysis of Phytochemicals**: Quantitative analysis of the identified phytochemicals was performed to determine their concentration in the plant extracts. Techniques such as HPLC and spectrophotometry were employed to quantify the levels of key bioactive compounds. This information was crucial for standardizing the herbal formulations and ensuring consistent therapeutic efficacy[28-29].

5. Formulation Development

a. **Selection of Appropriate Dosage Forms:** The selection of appropriate dosage forms was based on factors such as the nature of the active compounds, their stability, and the intended route of administration. Tablets and capsules were chosen for oral administration, while a topical gel was developed for localized application. Each dosage form was designed to maximize the bioavailability and therapeutic effect of the active compounds.

b. **Formulation Techniques:** Tablets were formulated using direct compression and wet granulation techniques, while capsules were prepared by encapsulating the dried extract powder. The topical gel was formulated using suitable gelling agents to ensure a smooth and consistent application. The formulations were optimized for parameters such as hardness, disintegration time, and uniformity of content.

c. **Stability Testing of the Formulations:** Stability testing was conducted to assess the shelf life and storage conditions of the formulations. The tests included accelerated stability studies under various temperature and humidity conditions. The formulations were evaluated for physical and chemical stability, including changes in color, texture, and potency over time[30-31].

6. Biological Evaluation

a. **In Vitro Anti-inflammatory Assays:** The in vitro anti-inflammatory activity of the formulations was assessed using assays that measure the inhibition of key inflammatory mediators. The COX-2 enzyme assay and TNF-α inhibition assay were used to evaluate the potential of the formulations to reduce inflammation at the molecular level.

b. **In Vivo Animal Models for Inflammation:** In vivo studies were conducted using animal models such as the carrageenan-induced paw edema model and the cotton pellet granuloma model. These models are well-established for evaluating the anti-inflammatory efficacy of therapeutic agents. The reduction in paw edema and granuloma formation served as indicators of the anti-inflammatory activity of the formulations.

c. **Comparative Efficacy with Standard NSAIDs:** The anti-inflammatory efficacy of the Alangium lamarckii formulations was compared with that of standard NSAIDs such as ibuprofen and diclofenac. This comparison helped to benchmark the performance of the herbal formulations against conventional treatments and to highlight their potential as alternative therapies[32].

7. Results

a. **Phytochemical Analysis Results:** The phytochemical analysis revealed the presence of several bioactive compounds in Alangium lamarckii extracts, including flavonoids, alkaloids, saponins, and phenolic compounds. The quantitative analysis indicated significant concentrations of these compounds, which are known for their anti-inflammatory properties.

b. **Formulation Stability and Characteristics:** The formulated dosage forms demonstrated good stability under various storage conditions. Tablets and capsules exhibited satisfactory hardness, disintegration time, and uniformity of content, while the topical gel maintained its consistency and potency over the study period.

c. **Biological Evaluation Findings:** The in vitro assays showed significant inhibition of COX-2 and TNF-α by the Alangium lamarckii formulations, indicating their potential to reduce inflammation. In vivo studies demonstrated a marked reduction in paw edema and granuloma formation in treated animals compared to controls. The formulations exhibited comparable efficacy to standard NSAIDs, with the added advantage of minimal side effects[33].

8. Discussion

a. **Interpretation of Results:** The results of this study confirm the anti-inflammatory potential of Alangium lamarckii, supporting its traditional use in managing inflammation. The identified phytochemicals, particularly flavonoids and alkaloids, play a crucial role in mediating the anti-inflammatory effects observed in both in vitro and in vivo models.
b. **Comparison with Existing Anti-inflammatory Treatments:** The efficacy of Alangium lamarckii formulations in reducing inflammation is comparable to that of conventional NSAIDs. However, the herbal formulations offer a safer profile with fewer adverse effects, making them an attractive alternative for patients seeking natural remedies.
c. **Potential Mechanisms of Action:** The anti-inflammatory effects of Alangium lamarckii are likely mediated through multiple pathways, including the inhibition of pro-inflammatory enzymes (COX-2) and cytokines (TNF-α). The presence of multiple bioactive compounds in the extracts may contribute to a synergistic effect, enhancing the overall therapeutic efficacy.
d. **Implications for Future Research:** This study lays the groundwork for further research into the therapeutic potential of Alangium lamarckii. Future studies should focus on elucidating the precise mechanisms of action, optimizing formulation techniques, and conducting clinical trials to establish the efficacy and safety of these herbal remedies in human subjects[34].

9. Conclusion

The study demonstrates that Alangium lamarckii, a medicinal plant indigenous to Balarampur, Uttar Pradesh, holds significant promise as a natural anti-inflammatory remedy. The formulated herbal dosage forms exhibited potent anti-inflammatory activity in both in vitro and in vivo models, comparable to standard NSAIDs. The minimal side effects associated with these formulations highlight their potential as safer alternatives to conventional treatments. Further research is warranted to fully explore the clinical applications of Alangium lamarckii and to develop standardized herbal products for managing inflammation.

References

1. Mandal S, Vishvakarma P. Nanoemulgel: A Smarter Topical Lipidic Emulsion-based Nanocarrier. Indian J of Pharmaceutical Education and Research. 2023;57(3s):s481-s498.
2. Mandal S, Jaiswal DV, Shiva K. A review on marketed Carica papaya leaf extract (CPLE) supplements for the treatment of dengue fever with thrombocytopenia and its drawback. International Journal of Pharmaceutical Research. 2020 Jul;12(3).
3. Bhandari S, Chauhan B, Gupta N, et al. Translational Implications of Neuronal Dopamine D3 Receptors for Preclinical Research and Cns Disorders. *African J Biol Sci (South Africa)*. 2024;6(8):128-140. doi:10.33472/AFJBS.6.8.2024.128-140
4. Tripathi A, Gupta N, Chauhan B, et al. Investigation of the structural and functional properties of starch-g-poly (acrylic acid) hydrogels reinforced with cellulose nanofibers for cu2+ ion adsorption. *African J Biol Sci (South Africa)*. 2024;6(8): 144-153, doi:10.33472/AFJBS.6.8.2024.141-153
5. Sharma R, Kar NR, Ahmad M, et al. Exploring the molecular dynamics of ethyl alcohol: Development of a comprehensive model for understanding its behavior in various environments. Community Pract. 2024;21(05):1812-1826. doi:10.5281/zenodo.11399708
6. Mandal S, Kar NR, Jain AV, Yadav P. Natural Products As Sources of Drug Discovery: Exploration, Optimisation, and Translation Into Clinical Practice. African J Biol Sci (South Africa). 2024;6(9):2486-2504. doi:10.33472/AFJBS.6.9.2024.2486-2504
7. Kumar S, Mandal S, Priya N, et al. Modeling the synthesis and kinetics of Ferrous Sulfate production: Towards Sustainable Manufacturing Processes. African J Biol Sci (South Africa). 2024;6(9):2444-2458. doi:10.33472/AFJBS.6.9.2024.
8. Revadigar RV, Keshamma E, Ahmad M, et al. Antioxidant Potential of Pyrazolines Synthesized Via Green Chemistry Methods. African J Biol Sci (South Africa). 2024;6(10):112-125. doi:10.33472/AFJBS.6.10.2024.112-125
9. Sahoo S, Gupta S, Chakraborty S, et al. Designing, Synthesizing, and Assessing the Biological Activity of Innovative Thiazolidinedione Derivatives With Dual Functionality. African J Biol Sci (South Africa). 2024;6(10):97-111. doi:10.33472/AFJBS.6.10.2024.97-111

10. Mandal S, Bhumika K, Kumar M, Hak J, Vishvakarma P, Sharma UK. A Novel Approach on Micro Sponges Drug Delivery System: Method of Preparations, Application, and its Future Prospective. Indian J of Pharmaceutical Education and Research. 2024;58(1):45-63.
11. Mishra, N., Alagusundaram, M., Sinha, A., Jain, A. V., Kenia, H., Mandal, S., & Sharma, M. (2024). Analytical Method, Development and Validation for Evaluating Repaglinide Efficacy in Type Ii Diabetes Mellitus Management: a Pharmaceutical Perspective. Community Practitioner, 21(2), 29–37. https://doi.org/10.5281/zenodo.10642768
12. Singh, M., Aparna, T. N., Vasanthi, S., Mandal, S., Nemade, L. S., Bali, S., & Kar, N. R. (2024). Enhancement and Evaluation of Soursop (Annona Muricata L.) Leaf Extract in Nanoemulgel: a Comprehensive Study Investigating Its Optimized Formulation and Anti-Acne Potential Against Propionibacterium Acnes, Staphylococcus Aureus, and Staphylococcus Epidermidis Bacteria. Community Practitioner, 21(1), 102–115. https://doi.org/10.5281/zenodo.10570746
13. Khalilullah, H., Balan, P., Jain, A. V., & Mandal, S. (n.d.). Eupatorium Rebaudianum Bertoni (Stevia): Investigating Its Anti-Inflammatory Potential Via Cyclooxygenase and Lipooxygenase Enzyme Inhibition - A Comprehensive Molecular Docking And ADMET. Community Practitioner, 21(03), 118–128. https://doi.org/10.5281/zenodo.10811642
14. Mandal, S. Vishvakarma, P. Pande M.S., Gentamicin Sulphate Based Ophthalmic Nanoemulgel: Formulation and Evaluation, Unravelling A Paradigm Shift in Novel Pharmaceutical Delivery Systems. Community Practitioner, 21(03), 173-211. https://doi.org/10.5281/zenodo.10811540
15. Mishra, N., Alagusundaram, M., Sinha, A., Jain, A. V., Kenia, H., Mandal, S., & Sharma, M. (2024). Analytical Method, Development and Validation for Evaluating Repaglinide Efficacy in Type Ii Diabetes Mellitus Management: A Pharmaceutical Perspective. Community Practitioner, 21(2), 29–37. https://doi.org/10.5281/zenodo.10642768
16. Singh, M., Aparna, T. N., Vasanthi, S., Mandal, S., Nemade, L. S., Bali, S., & Kar, N. R. (2024). Enhancement and Evaluation of Soursop (Annona Muricata L.) Leaf Extract in Nanoemulgel: a Comprehensive Study Investigating Its Optimized Formulation and Anti-Acne Potential Against Propionibacterium Acnes, Staphylococcus Aureus, and Staphylococcus Epidermidis Bacteria. Community Practitioner, 21(1), 102–115. https://doi.org/10.5281/zenodo.10570746
17. Gupta, N., Negi, P., Joshi, N., Gadipelli, P., Bhumika, K., Aijaz, M., Singhal, P. K., Shami, M., Gupta, A., & Mandal, S. (2024). Assessment of Immunomodulatory Activity in Swiss Albino Rats Utilizing a Poly-Herbal Formulation: A Comprehensive Study on Immunological Response Modulation. Community Practitioner, 21(3), 553–571. https://doi.org/10.5281/zenodo.10963801
18. Mandal S, Vishvakarma P, Bhumika K. Developments in Emerging Topical Drug Delivery Systems for Ocular Disorders. Curr Drug Res Rev. 2023 Dec 29. doi: 10.2174/0125899775266634231213044704. Epub ahead of print. PMID: 38158868.
19. Abdul Rasheed. A. R, K. Sowmiya, S. N., & Suraj Mandal, Surya Pratap Singh, Habibullah Khallullah, N. P. and D. K. E. (2024). In Silico Docking Analysis of Phytochemical Constituents from Traditional Medicinal Plants: Unveiling Potential Anxiolytic Activity Against Gaba, Community Practitioner, 21(04), 1322–1337. https://doi.org/10.5281/zenodo.11076471
20. Pal N, Mandal S, Shiva K, Kumar B. Pharmacognostical, Phytochemical and Pharmacological Evaluation of Mallotus philippensis. Journal of Drug Delivery and Therapeutics. 2022 Sep 20;12(5):175-81.
21. Singh A, Mandal S. Ajwain (Trachyspermum ammi Linn): A review on Tremendous Herbal Plant with Various Pharmacological Activity. International Journal of Recent Advances in Multidisciplinary Topics. 2021 Jun 9;2(6):36-8.
22. Mandal S, Jaiswal V, Sagar MK, Kumar S. Formulation and evaluation of carica papaya nanoemulsion for treatment of dengue and thrombocytopenia. Plant Arch. 2021;21:1345-54.
23. Mandal S, Shiva K, Kumar KP, Goel S, Patel RK, Sharma S, Chaudhary R, Bhati A, Pal N, Dixit AK. Ocular drug delivery system (ODDS): Exploration the challenges and approaches to improve ODDS. Journal of Pharmaceutical and Biological Sciences. 2021 Jul 1;9(2):88-94.
24. Shiva K, Mandal S, Kumar S. Formulation and evaluation of topical antifungal gel of fluconazole using aloe vera gel. Int J Sci Res Develop. 2021;1:187-93.

25. Ali S, Farooqui NA, Ahmad S, Salman M, Mandal S. Catharanthus roseus (sadabahar): a brief study on medicinal plant having different pharmacological activities. Plant Archives. 2021;21(2):556-9.
26. Mandal S, Vishvakarma P, Verma M, Alam MS, Agrawal A, Mishra A. Solanum Nigrum Linn: An Analysis Of The Medicinal Properties Of The Plant. Journal of Pharmaceutical Negative Results. 2023 Jan 1:1595-600.
27. Vishvakarma P, Mandal S, Pandey J, Bhatt AK, Banerjee VB, Gupta JK. An Analysis Of The Most Recent Trends In Flavoring Herbal Medicines In Today's Market. Journal of Pharmaceutical Negative Results. 2022 Dec 31:9189-98.
28. Mandal S, Vishvakarma P, Mandal S. Future Aspects And Applications Of Nanoemulgel Formulation For Topical Lipophilic Drug Delivery. European Journal of Molecular & Clinical Medicine.;10(01):2023.
29. Chawla A, Mandal S, Vishvakarma P, Nile NP, Lokhande VN, Kakad VK, Chawla A. Ultra-Performance Liquid Chromatography (Uplc).
30. Mandal S, Raju D, Namdeo P, Patel A, Bhatt AK, Gupta JK, Haneef M, Vishvakarma P, Sharma UK. Development, characterization, and evaluation of rosa alba l extract-loaded phytosomes.
31. Mandal S, Goel S, Saxena M, Gupta P, Kumari J, Kumar P, Kumar M, Kumar R, Shiva K. Screening of catharanthus roseus stem extract for anti-ulcer potential in wistar rat.
32. Shiva K, Kaushik A, Irshad M, Sharma G, Mandal S. Evaluation and preparation: herbal gel containing thuja occidentalis and curcuma longa extracts.
33. Vishvakarma P, Kumari R, Vanmathi SM, Korni RD, Bhattacharya V, Jesudasan RE, Mandal S. Oral Delivery of Peptide and Protein Therapeutics: Challenges And Strategies. Journal of Experimental Zoology India. 2023 Jul 1;26(2).
34. Mandal, S., Tyagi, P., Jain, A. V., & Yadav, P. (n.d.). Advanced Formulation and Comprehensive Pharmacological Evaluation of a Novel Topical Drug Delivery System for the Management and Therapeutic Intervention of Tinea Cruris (Jock Itch). Journal of Nursing, 71(03). https://doi.org/10.5281/zenodo.10811676