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Standardization and Scientific Validation of Inflasap, An Ayurvedic Anti-Inflammatory Tablet

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ABSTRACT

Introduction: Inflasap, an Ayurvedic tablet with 17 herbal ingredients comprising of *Alpinia galanga* and *Boswellia serrata*, etc. targets inflammation using traditional principles. This study assesses its quality, safety, and efficacy as per Ayurvedic Pharmacopeia standards.

Materials and Methods: Herbal raw materials,were processed into tablets and evaluated for organoleptic, physicochemical, microbial, heavy metal, and GC-MS properties.

Results: Inflasap showed, stable physicochemical properties (1000 mg ± 5%, friability ≤1%), no pathogens, safe heavy metal levels (lead: 0.22 ppm, arsenic: 0.45 ppm), and 15 anti-inflammatory phytoconstituents (e.g., Oxirane: 69.844%).

Discussion: The results collectively validate Inflasap's quality, safety, and therapeutic potential. Its sensory and physicochemical properties ensure consumer acceptability and product stability, while microbial and heavy metal analyses confirm safety for oral administration. The GC-MS findings support the anti-inflammatory efficacy of its herbal ingredients, aligning with traditional Ayurvedic claims.**Conclusion**: Inflasap adheres to Ayurvedic Pharmacopeia standards, demonstrating robust quality, safety, and potential as an anti-inflammatory formulation. Its rich phytoconstituent profile underscores its therapeutic promise.

KEY WORDS: Inflasap, Ayurvedic tablet, anti-inflammatory, herbal formulation, GC-MS analysis, heavy metal toxicity, microbial limit test

INTRODUCTION

Ayurveda, one of the world's oldest holistic healing systems, originates from India and has been practiced for over 5,000 years. This traditional system of medicine emphasizes the balance of body, mind, and spirit to promote overall health and well-being.[1] Central to Ayurvedic practice is the use of herbal formulations, which harness the therapeutic properties of plants to address a wide range of ailments, including inflammatory disorders.[2] Inflammation, a natural immune response to injury or infection, can become chronic and contribute to various health conditions such as arthritis, autoimmune disorders, and cardiovascular diseases.

[3]Ayurveda offers a unique approach to managing inflammation by utilizing natural ingredients that are believed to possess anti-inflammatory, analgesic, and immunomodulatory properties, often with fewer side effects compared to synthetic drugs.[4]

Inflasap is an innovative Ayurvedic tablet developed to target inflammatory conditions using a synergistic blend of carefully selected herbal ingredients. These ingredients, rooted in centuries-old Ayurvedic texts, are combined in precise proportions to maximize therapeutic efficacy while adhering to traditional preparation methods.[5] The formulation of Inflasap is designed to provide a natural, holistic alternative for individuals seeking relief from inflammation-related symptoms. Each ingredient in the tablet has been chosen for its documented pharmacological properties, particularly its ability to reduce inflammation, alleviate pain, and support tissue repair, as described in classical Ayurvedic literature and supported by modern pharmacological studies.[6,7]

This study aims to detail the development and quality evaluation of Inflasap, focusing on the sourcing of raw materials, the preparation process, and rigorous analytical testing to ensure compliance with quality and safety standards. The raw materials, sourced from local markets in Thrissur, Kerala, were authenticated and processed following strict Ayurvedic protocols. Comprehensive analyses, including organoleptic, physicochemical, microbial limit, heavy metal toxicity, and gas chromatography-mass spectrometry (GC-MS), were conducted to assess the tablet's sensory characteristics, physical integrity, microbial safety, and chemical composition. These tests are critical to ensuring that Inflasap meets the standards set by the Ayurvedic Pharmacopeia of India, thereby guaranteeing its safety and efficacy for consumer use.

By combining traditional knowledge with modern scientific validation, this study seeks to establish Inflasap as a reliable and effective Ayurvedic formulation for managing inflammation. The results of these analyses provide insights into the tablet's composition, quality, and potential therapeutic benefits, paving the way for further clinical research to validate its efficacy in human subjects.

2. MATERIALS AND METHODS

2.1 Collection of Raw materials

The raw materials for Inflasap were procured from the local market in Thrissur. Each herbal ingredient was identified and authenticated by the Pharmacognosy Division of Sitaram Ayurveda Pvt. Ltd. Subsequently, all materials were stored in the Quality Control Division of the company for future reference.

2.2 Preparation of Inflasap

Each Inflasap tablet is formulated using a Synergistic mix of therapeutic herbs, prepared in accordance with traditional Ayurvedic methods. The details of these ingredients—including their botanical names, parts used, and forms—are presented in Table 1.

Table 1: Composition of Inflasap Tablet

Sl. No	Ingredients	Botanical name	Parts used	Form
1.	Rasna	*Alpinia galanga*	Rhizome	Decoction
2.	Eranda	*Ricinus communis*	Root	Decoction
3.	Bala	*Sida rhombifolia*	Root	Decoction
4.	Sahacharam	*Nilgirianthus ciliatus*	Root	Decoction
5.	Satavari	*Asparagus racemosus*	Root tuber	Decoction
6.	Dusparsha	*Tragia involucrata*	Whole plant	Decoction
7.	Vasa	*Justicia beddomei*	Root	Decoction

8.	Guloochi	*Tinospora cordifolia*	Stem	Decoction
9.	Devadaru	*Cedrus deodara*	Heart wood	Decoction
10.	Athivisha	*Aconitum heterophyllum*	Root	Decoction
11.	Mustha	*Cyperus rotundus*	Rhizome	Decoction
12.	Ikshuram	*Asteracantha longifolia*	Root	Decoction
13.	Sati	*Kaemferia galangal*	Root	Decoction
14.	Viswam	*Zingiber officinale*	Rhizome	Decoction
15.	Guggulu	Commiphora mukul	Exudate	Powder
16.	Sallaki	*Boswellia serrata*	Exudate	Powder
17.	Crab	*Portunus pelagicus*	Shell powder	Powder

2.3 Preparation process

The preparation of Inflasap tablets involved combining the decoctions and powders listed in Table 1, followed by traditional Ayurvedic processing techniques to form tablets

2.4 Organoleptic Analysis

Organoleptic parameters such as color, odor, and taste of Inflasap tablets were analyzed to assess sensory characteristics.[8]

2.5 Physicochemical Analysis

The physicochemical parameters tested included average weight, friability, hardness, disintegration time (DT), and moisture content to evaluate the physical integrity of the tablets.[9]

2.6 Microbial Limit Test

The microbial limit test was carried out following the standard protocol prescribed in the Ayurvedic Pharmacopoeia of India. Samples were collected under aseptic conditions. Nutrient Agar (NA) and Sabouraud Dextrose Agar (SDA) media were prepared by dissolving the respective powders in double-distilled water, adjusting the pH with 1N NaOH and 1N HCl, followed by heating, autoclaving, and pouring into sterile Petri dishes. The media were allowed to solidify aseptically. For microbial analysis, 1 gram of each sample was serially diluted with 9 ml of sterile diluent. From suitable dilutions, 0.1 ml aliquots were inoculated on the media using the spread plate method. NA plates were incubated at 37°C for 24–48 hours, while SDA plates were incubated at room temperature for 3–5 days. The resulting microbial colonies were examined using microscopic and biochemical techniques. Colony counts were then compared with the microbial limit standards specified in the Ayurvedic Pharmacopoeia of India.[9]

2.7 Heavy Metal Toxicity Analysis (HMT)

HMT analysis using ICP-MS involves detecting trace metals in a sample by ionizing it and measuring the mass-to-charge ratio of the resulting ions. A 1 ppm stock solution was prepared by pipetting 1 mL of a 9-element standard into a 100 mL volumetric flask and diluting it with SIEMENS water. Working standards of 0.5 ppb, 5 ppb, 50 ppb, 100 ppb, 200 ppb, and 250 ppb were then prepared by diluting the stock solution. For sample digestion, 0.2 g to 0.5 g of the sample was weighed into an MDS digestion tube, to which 5.0 mL of concentrated HNO_3, 0.5 mL of HCl, and 1.0 mL of H_2O_2 were added, followed by 15 minutes of self-digestion. After digestion, the contents were transferred to a 50 mL tube and diluted with extra pure water. The prepared sample was introduced into the ICP *via* a nebulizer, where ions were generated. These ions were directed into the mass spectrometer, where the detector recorded the number of ions detected, corresponding to the specific heavy metal concentration. [10]

2.8 GC-MS Analysis

The sample was prepared by methanol extraction, followed by filtration through a 0.2 µm Nylon syringe filter (13 mm) into a GC vial. GC-MS analysis was carried out using an Agilent Technologies 7890A GC system coupled with a 5975C triple axis detector. A DB-5MS column (30 m × 0.25 mm ID × 0.25 µm film thickness) was used, and 2 µL of the sample was injected in split less mode. Helium (99.9995%) served as the carrier gas at a constant flow rate of 1 mL/min. Electron ionization (EI) mode was employed at 70 eV ionization energy. The injector temperature was maintained at 300 °C. The oven temperature program was as follows: initial temperature 40 °C held for 5 minutes; ramped at 20 °C/min to 150 °C with no hold; then ramped at 5 °C/min to 300 °C and held for 10 minutes. Compounds were identified by comparing the resulting mass spectra with those in the NIST-08 mass spectral database.[11]

3. RESULTS

3.1 Organoleptic Analysis

The organoleptic analysis results for Inflasap tablets are presented in Table 2

Table No-2: organoleptic analysis of Inflasap.

Sl No	Test	Results
1	*E.coli*	Absent
2	*Staphylococcus sp.*	Absent
3	*Pseudomonas sp.*	Absent
4	*Salmonella sp.*	Absent
5	Total bacetrial count cfu/g or cfu/ml (100000)	10^5
6	Total yeast and mold cuf/g or cfu/ml(1000)	10^3

3.2 Physicochemical Analysis of Inflasap

The Inflasap tablet was subjected to standard quality control tests, including average weight, friability, hardness, and disintegration time, to assess its physical integrity and performance. Analysis was conducted on three batches, and the range of results is presented in Table 3. These parameters ensure the tablet's suitability for safe and effective oral administration.

Table No 3: Physicochemical analysis of Inflasap

Sl.No	Parameters	Result
1	Average Weight of Tablet	1000 mg ±5%
2	Friability	NMT 1%
3	Hardness	3-8 kg/cm²
4	Disintegration Time	NMT 90 min
5	Moisture	NMT 7%

3.3.Microbial Limit Analysis

The microbial analysis of Inflasap tablet is conducted to verify the product's safety by detecting harmful microorganisms such as *E. coli, Staphylococcus sp., and Salmonella sp*. The results of the microbial analysis are presented in Table no 4.

Table No 4: The Microbial analysis of Inflasap

Sl.No	Parameters	Result
1	Colour	Off white
2	Odour	Characteristic
3	Taste	Astringent

3.4 HMT Analysis

The heavy metal toxicity analysis of Inflasap detects harmful metals like lead, arsenic, cadmium, and mercury to ensure the product's safety. The results are presented in Table 5.

Table No 5: The HMT analysis of Inflasap

Sl. no.	Parameters Tested	Unit of Measurement	Result
1	Cadmium	ppm	BDL
2	Lead	ppm	0.22
3	Mercury	ppm	BDL
4	Arsenic	ppm	0.45

3.5.GC-MS analysis

GC-MS helps for identifying and quantifying bioactive volatile and semi-volatile compounds present in the Inflasap tablet, especially those derived from herbal ingredients. This analysis helps in standardizing the formulation, ensuring batch-to-batch consistency, detecting any contaminants or adulterants, and scientifically validating the presence of key phytoconstituents that contribute to the tablet's therapeutic efficacy. Figure 1& Table 6 shows the key phytoconstituents present in Inflasap.

Fig No 1: The GC-MS chromatogram of Inflasap

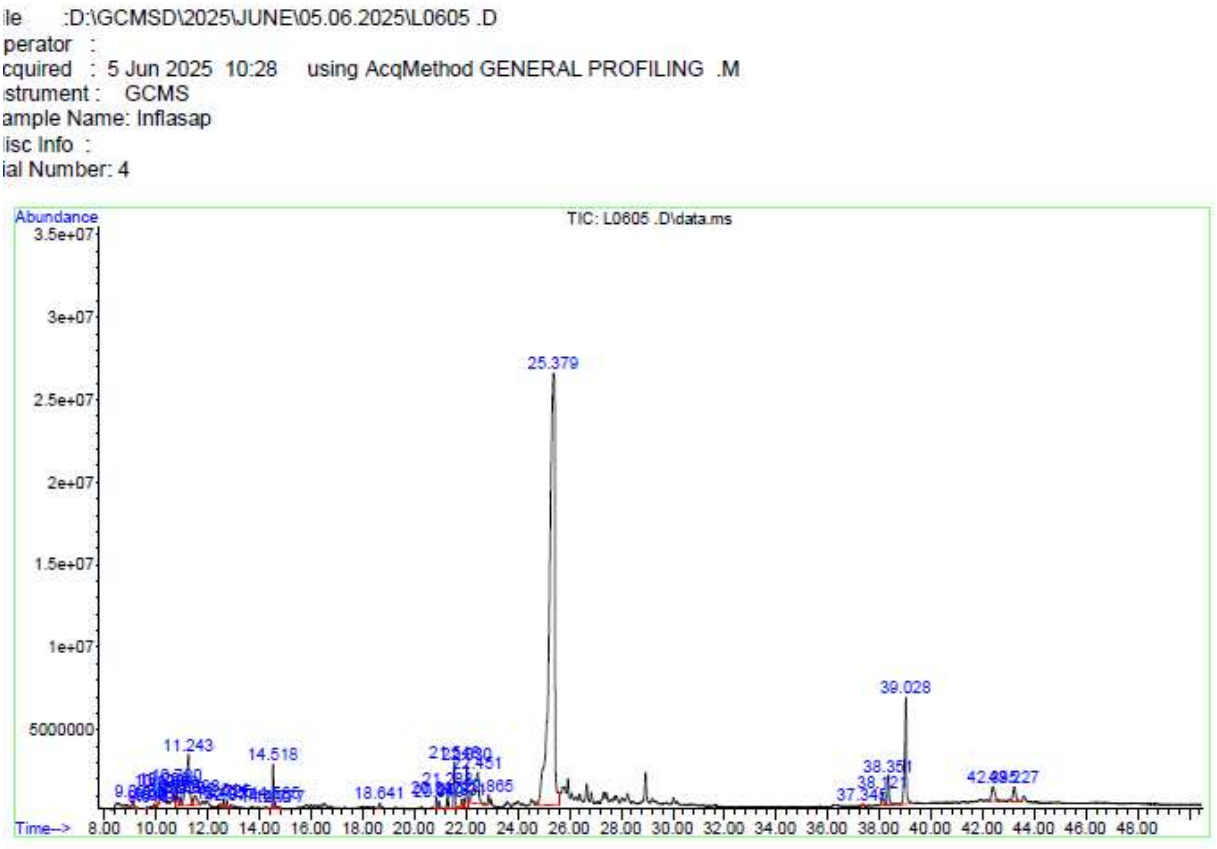

Table No 6: The GC-MS analysis of Inflasap

Sl No	Constituent	Chemical formula	Area %	Action
1	Oxirane, 2,2-dimethyl-3-(3,7,12,16,20-pentamethyl-3,7,11,15,19-heneicosapentaenyl),(all-E)-	$C_{30}H_{50}O$	69.844	Anti-Inflammatory[12]
2	n-Hexadecanoic Acid	$C_{16}H_{32}O_2$	4.321	Anti-Inflammatory[13]
3	α-Amyrin	$C_{30}H_{50}O$	1.263	Anti-Inflammatory[14]
4	Epiglobulol	$C_{15}H_{26}O$	1.097	Anti-Inflammatory[15]
5	Methyl palmitate	$C_{17}H_{34}O_2$	0.375	Anti-Inflammatory[16]
6	Perillyl alcohol	$C_{10}H_{16}O$	0.253	Anti-Inflammatory[17]
7	α-Phellandrene	$C_{10}H_{16}$	0.22	Anti-Inflammatory[18]
8	Methyleugenol	$C_{11}H_{14}O_2$	0.188	Anti-Inflammatory &Antinociceptive Effect [19]
9	Verbenone	$C_{10}H_{14}O$	0.165	Anti-Inflammatory & Antinociceptive Effect[20]
10	Terpinenol-4-ol	$C_{10}H_{18}O$	0.156	Anti-Inflammatory[21]
11	β-Stigmasterol	$C_{29}H_{48}O$	0.086	Anti-Inflammatory[22]
12	α-copaene	$C_{15}H_{24}$	0.081	Anti-Inflammatory &Antinociceptive Effect [23]
13	δ-Cadinene	$C_{15}H_{24}$	0.078	Anti-Inflammatory & Antinociceptive Effect[24]
14	Linalool	$C_{10}H_{18}O$	0.064	Anti-Inflammatory[25]
15	β-Thujone	$C_{10}H_{16}O$	0.022	Anti-Inflammatory[26]

4. DISCUSSION

The comprehensive analyses conducted on Inflasap tablets provide a robust evaluation of its quality, safety, and potential therapeutic efficacy as an Ayurvedic anti-inflammatory formulation. Each test—organoleptic, physicochemical, microbial limit, heavy metal toxicity (HMT), and gas chromatography-mass spectrometry (GC-MS)—contributes critical insights into the tablet's characteristics and compliance with the standards outlined in the Ayurvedic Pharmacopeia of India.

The organoleptic analysis revealed that Inflasap tablets exhibit an off-white color, a characteristic odor, and an astringent taste. These organoleptic characteristics ensure consumer acceptability and provide a preliminary indication of the tablet's authenticity and quality, as sensory attributes are often the first point of quality assessment in herbal products.

The physicochemical analysis demonstrated that Inflasap tablets meet stringent quality control standards for physical integrity and stability. The average weight of 1000 mg ± 5% indicates uniformity across batches, which is crucial for ensuring consistent dosing. The friability of not more than 1% reflects the tablet's ability to withstand mechanical stress during handling and transportation, ensuring it remains intact until

consumption. The hardness range of 3–8 kg/cm^2 suggests adequate mechanical strength, balancing ease of swallowing with durability. The disintegration time of not more than 90 minutes ensures that the tablet breaks down appropriately in the gastrointestinal tract, facilitating the release and absorption of active compounds. Finally, the moisture content of not more than 7% indicates effective control of moisture during manufacturing and storage, reducing the risk of microbial growth and chemical degradation. These physicochemical parameters collectively confirm that Inflasap is a stable and reliable formulation, suitable for long-term storage and safe oral administration.

The microbial limit analysis confirmed the absence of harmful pathogens such as *E. coli*, *Staphylococcus sp.*, *Pseudomonas sp.*, and *Salmonella sp.*, ensuring the microbiological safety of Inflasap. The total bacterial count (10^5 cfu/g or cfu/ml) and total yeast and mold count (10^3 cfu/g or cfu/ml) are well within the permissible limits specified by the Ayurvedic Pharmacopeia of India. The low microbial load further supports the physicochemical finding of low moisture content, as moisture is a primary factor in microbial proliferation. This analysis underscores the safety of Inflasap for consumer use and highlights the effectiveness of the quality control measures implemented during its production.

The heavy metal toxicity analysis revealed that Inflasap contains safe levels of heavy metals, with cadmium and mercury below detectable limits (BDL), lead at 0.22 ppm, and arsenic at 0.45 ppm. These values are well below the permissible limits set by the Ayurvedic Pharmacopeia of India and international regulatory standards for herbal medicines. This analysis confirms that Inflasap poses no risk of heavy metal toxicity, making it safe for long-term use in managing chronic inflammatory conditions.

The GC-MS analysis identified 20 phytoconstituents in Inflasap, of which 15 exhibit anti-inflammatory properties, with several also showing antinociceptive activity. The dominant compound, Oxirane, 2,2-dimethyl-3-(3,7,12,16,20-pentamethyl-3,7,11,15,19-heneicosapentaenyl), (all-E)- (69.844% area), is a terpenoid derivative. Terpenoids are well-documented for their ability to modulate inflammatory pathways, such as the inhibition of nuclear factor-kappa B (NF-κB) and cyclooxygenase (COX) enzymes.[27] Other significant compounds, such as n-Hexadecanoic acid (4.321%) and α-Amyrin (1.263%), are fatty acids and triterpenoids, respectively, which contribute to anti-inflammatory effects by reducing prostaglandin synthesis and stabilizing cell membranes.[28] Compounds like Methyleugenol (0.188%), Verbenone (0.165%), α-copaene (0.081%), and δ-Cadinene (0.078%) also exhibit antinociceptive properties, suggesting that Inflasap may provide pain relief in addition to reducing inflammation. These findings provide a scientific basis for Inflasap's therapeutic claims and highlight the synergistic effects of its herbal ingredients, which likely enhance its efficacy compared to single-compound drugs. The anti-inflammatory and antinociceptive compounds identified in the GC-MS analysis align with the traditional indications of the ingredients, such as *Alpinia galanga* (Rasna) for joint pain and *Tinospora cordifolia* (Guloochi) for immunomodulation. This synergy is a hallmark of Ayurvedic formulations, where multiple ingredients work together to address complex conditions like chronic inflammation.

The results of these tests, when correlated, confirm that Inflasap is a well-formulated product suitable for oral administration, with a strong scientific basis supporting its traditional use in managing inflammatory conditions. Together, these findings suggest that Inflasap is a well-crafted Ayurvedic tablet that adheres to traditional principles while meeting modern quality standards.

5. CONCLUSION

Inflasap, an Ayurvedic tablet crafted with 17 herbal ingredients such as *Alpinia galanga* and *Boswellia serrata*, demonstrates exceptional quality and safety as an anti-inflammatory formulation, meeting the rigorous standards of the Ayurvedic Pharmacopeia of India. Comprehensive analyses—organoleptic, physicochemical, microbial, heavy metal toxicity, and GC-MS—confirm its sensory acceptability, physical stability,

microbiological safety, minimal heavy metal content, and potent anti-inflammatory phytoconstituents like terpenoids and triterpenoids. These findings validate its traditional use and highlight its potential as a safe, natural alternative to synthetic drugs for managing chronic inflammation.

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REFERENCES

1. Sharma PV. *History of Medicine in India: From Antiquity to 1000 A.D.* New Delhi: Indian National Science Academy; 1992.
2. Chopra A, Doiphode VV. Ayurvedic medicine: core concept, therapeutic principles, and current relevance. *Med Clin North Am.* 2002;86(1):75-89.
3. Medzhitov R. Inflammation 2010: new adventures of an old flame. *Cell.* 2010;140(6):771-776.
4. Aggarwal BB, Prasad S, Reuter S, Kannappan R, Rane N, Sethi G, et al. Identification of novel anti-inflammatory agents from Ayurvedic medicine for prevention of chronic diseases. *Curr Drug Targets.* 2011;12(11):1595-1653.
5. Charaka. *Charaka Samhita.* Varanasi: Chaukhambha Sanskrit Sansthan; 2003.
6. Siddiqui MZ. *Boswellia serrata*, a potential anti-inflammatory agent: an overview. *Indian J Pharm Sci.* 2011;73(3):255-261.
7. Upadhyay RK. *Tinospora cordifolia*: a review of its immunomodulatory properties. *J Nat Remedies.* 2017;17(2):47-55.
8. Anonymous. The Ayurvedic Pharmacopoeia of India. Government of India, Ministry of Health and Family Welfare, New Delhi. 2008;1(6).
9. Anonymous. The Ayurvedic Pharmacopoeia of India. Government of India, Ministry of Health and Family Welfare, New Delhi. 2010;2(3).
10. Association of Official Analytical Chemists International. *Official Methods of Analysis of AOAC International*. 20th ed. Gaithersburg (MD): AOAC International; 2016.
11. Jalali A, Hatamie A, Saferpour T, Khajeamiri A, Safa T, Buazar F. Impact of Pharmaceutical Impurities in Ecstasy Tablets: Gas Chromatography-Mass Spectrometry Study. Iran J Pharm Res. 2016 Winter;15(1):221-9. PMID: 27610162; PMCID: PMC4986105.
12. Majumder, S., Ghosh, A. & Bhattacharya, M. Natural anti-inflammatory terpenoids in *Camellia japonica* leaf and probable biosynthesis pathways of the metabolome. *Bull Natl Res Cent* 44, 141 (2020).
13. Aparna V, Dileep KV, Mandal PK, Karthe P, Sadasivan C, Haridas M. Anti-inflammatory property of n-hexadecanoic acid: structural evidence and kinetic assessment. Chemical biology & drug design. 2012 Sep;80(3):434-9.
14. Alsaedi HKA, Alwan NA, Al-Masoudi EA. Physiological and biochemical effect of α-Amyrin: A review. *J Med Life Sci*. 2024;6(3):443–52. doi:10.21608/jmals.2024.383360.

15. Jayaprakash A, Johns AE, Haneef FK, Radhamany PM. GC-MS analysis and in silico molecular docking studies of anti-inflammatory compounds from Thottea barberi (gamble) ding Hou root. Medicinal Plants-International Journal of Phytomedicines and Related Industries. 2019;11(3):286-91.
16. El-Demerdash E. Anti-inflammatory and antifibrotic effects of methyl palmitate. Toxicol Appl Pharmacol. 2011 Aug 1;254(3):238-44. doi: 10.1016/j.taap.2011.04.016. Epub 2011 Apr 30. PMID: 21575650.
17. Puppala ER, Aochenlar SL, Shantanu PA, Ahmed S, Jannu AK, Jala A, Yalamarthi SS, Borkar RM, Tripathi DM, Naidu VGM. Perillyl alcohol attenuates chronic restraint stress aggravated dextran sulfate sodium-induced ulcerative colitis by modulating TLR4/NF-κB and JAK2/STAT3 signaling pathways. *Phytomedicine*. 2022 Nov;106:154415.
18. Siqueira HDS, Neto BS, Sousa DP, Gomes BS, da Silva FV, Cunha FVM, Wanderley CWS, Pinheiro G, Cândido AGF, Wong DVT, Ribeiro RA, Lima-Júnior RCP, Oliveira FA. α-Phellandrene, a cyclic monoterpene, attenuates inflammatory response through neutrophil migration inhibition and mast cell degranulation. Life Sci. 2016 Sep 1;160:27-33. doi: 10.1016/j.lfs.2016.07.008. Epub 2016 Jul 20. PMID: 27449945.
19. Souza-Junior FJC, Luz-Moraes D, Pereira FS, Barros MA, Fernandes LMP, Queiroz LY, Maia CF, Maia JGS, Fontes-Junior EA. *Aniba canelilla* (Kunth) Mez (Lauraceae): A Review of Ethnobotany, Phytochemical, Antioxidant, Anti-Inflammatory, Cardiovascular, and Neurological Properties. Front Pharmacol. 2020 May 26;11:699. doi: 10.3389/fphar.2020.00699. PMID: 32528283; PMCID: PMC7264103.
20. González-Velasco HE, Pérez-Gutiérrez MS, Alonso-Castro ÁJ, Zapata-Morales JR, Niño-Moreno PDC, Campos-Xolalpa N, González-Chávez MM. Anti-Inflammatory and Antinociceptive Activities of the Essential Oil of *Tagetes parryi* A. Gray (Asteraceae) and Verbenone. Molecules. 2022 Apr 19;27(9):2612. doi: 10.3390/molecules27092612. PMID: 35565963; PMCID: PMC9103156.
21. Hart PH, Brand C, Carson CF, Riley TV, Prager RH, Finlay-Jones JJ. Terpinen-4-ol, the main component of the essential oil of Melaleuca alternifolia (tea tree oil), suppresses inflammatory mediator production by activated human monocytes. Inflamm Res. 2000 Nov;49(11):619-26. doi: 10.1007/s000110050639. PMID: 11131302.
22. Bakrim S, Benkhaira N, Bourais I, Benali T, Lee LH, El Omari N, Sheikh RA, Goh KW, Ming LC, Bouyahya A. Health benefits and pharmacological properties of stigmasterol. *Antioxidants*. 2022;11(10):1912. doi:10.3390/antiox11101912.
23. Queiroz JC, Antoniolli AR, Quintans-Júnior LJ, Brito RG, Barreto RS, Costa EV, da Silva TB, Prata AP, de Lucca W Jr, Almeida JR, Lima JT, Quintans JS. Evaluation of the anti-inflammatory and antinociceptive effects of the essential oil from leaves of Xylopia laevigata in experimental models. ScientificWorldJournal. 2014;2014:816450. doi: 10.1155/2014/816450. Epub 2014 Jul 3. PMID: 25097889; PMCID: PMC4109226.
24. Queiroz JC, Antoniolli AR, Quintans-Júnior LJ, Brito RG, Barreto RS, Costa EV, da Silva TB, Prata AP, de Lucca W Jr, Almeida JR, Lima JT, Quintans JS. Evaluation of the anti-inflammatory and antinociceptive effects of the essential oil from leaves of Xylopia laevigata in experimental models. ScientificWorldJournal. 2014;2014:816450. doi: 10.1155/2014/816450. Epub 2014 Jul 3. PMID: 25097889; PMCID: PMC4109226.
25. Chutia P, Chetia P, Mustaque AS, Thakuria R, Bora A, Patowary L. Linalool alleviates oxidative stress and inflammatory markers in rats with CFA-induced rheumatoid arthritis. *Braz Arch Biol Technol*. 2025;68:e25240161. doi:10.1590/1678-4324-2025240161.

26. Miguel MG. Antioxidant and anti-inflammatory activities of essential oils: a short review. Molecules. 2010 Dec 15;15(12):9252-87. doi: 10.3390/molecules15129252. PMID: 21160452; PMCID: PMC6259136.
27. Li P, Yang CQ, Jin J, Wang Y, Liu WZ, Ding WW. [Correlations between HBCD and thyroid hormone concentrations in human serum from production source area]. Huan Jing Ke Xue. 2014 Oct;35(10):3970-6. Chinese. PMID: 25693409.
28. Haveman JW, Gansevoort RT, Bongaerts AH, Nijsten MW. Low incidence of nephropathy in surgical ICU patients receiving intravenous contrast: a retrospective analysis. Intensive Care Med. 2006 Aug;32(8):1199-205. doi: 10.1007/s00134-006-0198-2. Epub 2006 Jun 2. PMID: 16741701.