I J C R M
International Journal of Contemporary Research In Multidisciplinary

Research Article

Comparative Study of the Therapeutic Potential and Antimicrobial Properties of Camphor and Hing (Asafoetida) In Different Lifestyle Disorders in Human Life

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DOI: https://doi.org/10.5281/zenodo.22794097

Abstract

Lifestyle disorders - Type 2 diabetes, hypertension, obesity, dyslipidemia, irritable bowel syndrome, and chronic musculoskeletal pain - now cause 71% of global deaths. Traditional Indian pharmacology offers two aromatic agents with contrasting routes: Camphor (Kapur, Cinnamomum camphora) and Hing (Asafoetida, Ferula asafoetida). Both are classified as Ushna Virya in Ayurveda but differ fundamentally: camphor is a bicyclic monoterpene ketone (C10H16O) approved only for topical use, while hing is an oleo-gum-resin containing sulfur compounds, ferulic acid, and sesquiterpene coumarins consumed as food.

This paper systematically compares their chemistry, antimicrobial mechanisms, and evidence in 8 major lifestyle disorders using PubMed, PMC, Molecules Journal and traditional texts. Findings show camphor is superior as a topical antimicrobial, counter-irritant and TRP-channel-mediated analgesic, while hing is superior as a systemic metabolic regulator with antidiabetic, antihypertensive, hypolipidemic and gut microbiome modulatory actions.

Manuscript Information

- **ISSN No:** 2583-7397
- **Received:** 08-09-2025
- **Accepted:** 26-10-2025
- **Published:** 30-10-2025
- **IJCRM:**4(5); 2025: 678-682

- **Plagiarism Checked:** Yes
- **Peer Review Process:** Yes

How to Cite this Article

Dutt A. Comparative Study of the Therapeutic Potential and Antimicrobial Properties of Camphor and Hing (Asafoetida) In Different Lifestyle Disorders in Human Life. Int J Contemp Res Multidiscip. 2025;4(5):678-682.

Access this Article Online

www.multiarticlesjournal.com

KEYWORDS: Cinnamomum camphora, Ferula asafoetida, metabolic syndrome, TRPV1, ferulic acid, antimicrobial, biofilm

1. INTRODUCTION

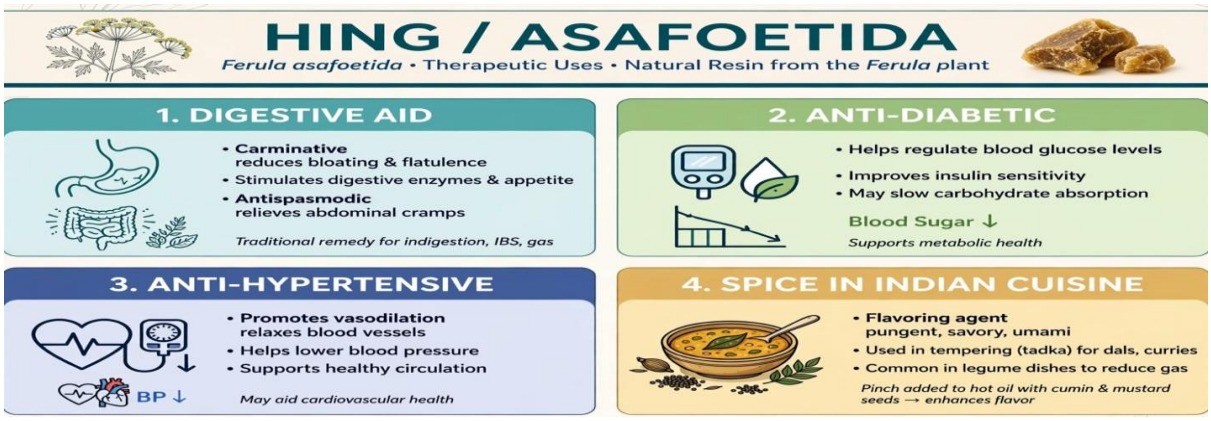
Camphor and hing share cultural space in Indian households - both used in puja and the kitchen - but their pharmacology is opposite.

Camphor is obtained from distillation of the wood of the Cinnamomum camphora (Lauraceae) tree native to East Asia. It was historically used as a cardiac stimulant, but modern FDA limits it to 3-11% in external preparations due to neurotoxicity on ingestion.

Hing is obtained by incising the taproot of Ferula asafoetida and allied species in Iran, Afghanistan and India. It is described in Charaka Samhita as Hingu - Deepaniya (digestive stimulant), Shoolaprashamana (antispasmodic) and Sanjnasthapana. British Pharmacopoeia lists it as expectorant and antispasmodic.

2. OBJECTIVES AND METHODOLOGY

Literature search 2000-2026 using keywords "camphor antimicrobial lifestyle", "Ferula asafoetida antidiabetic antihypertensive". Included: in vitro, in vivo, randomised controlled trials. Excluded: synthetic derivatives.



COMPARATIVE PHYTOCHEMISTRY

Feature.

CAMPHOR HING / ASAFOETIDA

Source ---- Essential oil of wood and leaves ----- Latex oleo-gum-resin from root

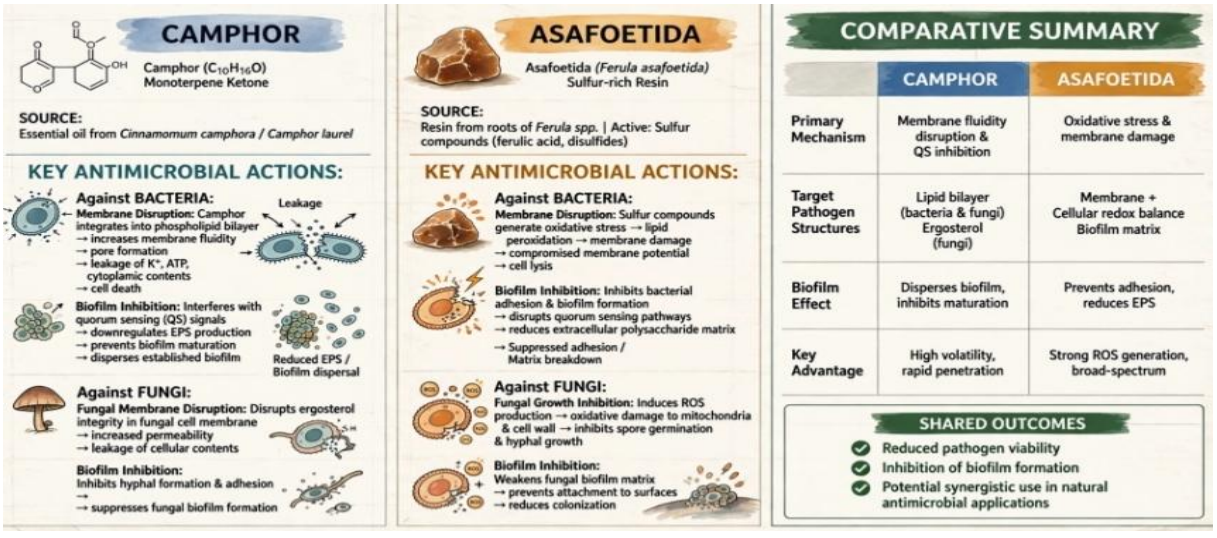
Chemistry - --d-camphor 84%,1,8-cineole, safrole, alpha-pinene ---- Resin 40-64%: ferulic acid, . assafoetidinol A/B, umbelliferone, farnesiferol B/C, galbanic acid. Gum 25% polysaccharides. Oil 10-17%: sec-butyl-propenyl disulfide (44%), dimethyl trisulfide

Solubility --- Lipid soluble, volatile. ------ Both water- and lipid-soluble

Dose ---- Topical 3-11%, never >50 mg/kg oral ------ Culinary 200-500 mg/day, Therapeutic 250 mg BID encapsulated

Toxicity------ Convulsant >500 mg oral adult, fatal 4 gm; 70 mg/kg infant fatal --------Safe as GRAS; high dose: uterine stimulation, anticoagulant

3. ANTIMICROBIAL PROPERTIES - DETAILED COMPARISON



4. Camphor Mechanisms:

A. Membrane Disruption: Being lipophilic, camphor intercalates between phospholipids, increases fluidity, forms transient pores, causes leakage of K+ and ATP. Studies show MIC 0.5-4 mg/ml against Staphylococcus aureus and 1 mg/ml against Streptococcus mutans.

B. Biofilm Inhibition: Downregulates quorum sensing genes (lasI, rhlR in Pseudomonas), reduces EPS production by 70-80%. A 2023 MDPI paper - Is Camphor Future in Supporting Therapy for Skin Infections - reported 91-99% inhibition of Candida albicans biofilm at 2x MIC.

C. Anti-inflammatory synergy: Inhibits IL-1beta, IL-6, and TNF-alpha by 20- 70% in RAW264.7 macrophages at 100 ug/ml, and inhibits NO production by 65% and PGE2 by 70%, which helps in infected wounds where inflammation delays healing.

5. Hing Mechanisms:

A. Sulfur-induced oxidative stress: Polysulfides generate ROS and reactive sulfur species, oxidise membrane thiol groups, cause lipid peroxidation and loss of membrane potential, leading to lysis. Effective against Helicobacter pylori (MIC 125 ug/ml), Escherichia coli, Bacillus subtilis.

B. Coumarins action: Umbelliferone and ferulic acid inhibit bacterial DNA gyrase and efflux pumps. Sesquiterpene coumarins (galbanic acid) reverse antibiotic resistance.

C. Antifungal: Hydroalcoholic extract inhibited Aspergillus niger and Candida albicans with a zone of inhibition of 14- 19 mm at 100 mg/ml.

D. Antiviral and Anthelmintic: Documented against influenza virus, and traditional anthelmintic use confirmed against Ascaris.

Conclusion of Antimicrobial: Camphor is a rapid-contact killer for skin pathogens, ideal for topical antiseptic. Hing is a gut-selective antimicrobial that spares beneficial flora while suppressing pathogens and biofilms in the intestine.

6. ROLE IN LIFESTYLE DISORDERS

Type 2 Diabetes Mellitus (T2DM):

Hing shows strong evidence. In streptozotocin-induced diabetic rats, asafoetida extract 100 mg/kg reduced blood glucose by 40% in 4 weeks, increased insulin and protected beta cells via ferulic acid antioxidant action. Mechanism includes alpha-glucosidase inhibition (IC50 0.9 mg/ml), enhanced GLUT4 translocation in muscle, and stimulation of bile acid secretion, which activates the FXR receptor, improving glucose metabolism. Clinical observation: Asafin formulation (asafoetida + fenugreek fibre) improved postprandial glucose. Camphor has NO approved internal role. Oral ingestion causes hypoglycemia followed by seizures, not therapeutic.

Hypertension and Dyslipidemia:

Hing: Intravenous aqueous extract in anaesthetised rats reduced mean arterial blood pressure from 116 to 64 mmHg dose-dependently. Vasodilation via activation of NO-cGMP and blockade of voltage-gated Ca2+ channels. Also inhibits angiotensin-converting enzyme. In hyperlipidemic rats, 25 and 50 mg/kg for 8 weeks reduced total cholesterol 42%, LDL 60%, and triglycerides 44% by inhibiting HMG-CoA reductase and acyl-CoA cholesterol acyltransferase.

Camphor: Peripheral vasodilation and flushing reported historically; used in circulatory collapse. Today, only topical rubefacient effect increases local circulation to relieve pain associated with hypertension-related stiffness.

Obesity:

Hing aids weight management indirectly - improves fat digestion via enhanced pancreatic lipase and bile flow, reduces bloating, and improves gut motility, preventing overeating due to dyspepsia. Prebiotic galactomannans in the formulation improve satiety.

Camphor-menthol equimolar combination shows synergistic anti-obesity in vitro: IC50 10.3 ug/ml DPPH antioxidant, inhibition of adipogenesis, but no safe oral translation.

IBS, Functional Dyspepsia, GERD:

Hing is the drug of choice in Ayurveda. RCT: 43 patients with functional dyspepsia, 250 mg BID Asafin for 30 days vs placebo - significant improvement in bloating score ($p<0.001$), early satiety, GSRS score. Mechanism: dual action - antispasmodic by blocking muscarinic and histamine receptors, and prokinetic by enhancing acetylcholine-mediated contraction via ferulic acid. Antimicrobial against H. pylori and SIBO.Camphor is limited to abdominal massage oil; the cooling effect reduces visceral pain sensation via TRPA1.

Musculoskeletal Pain, Arthritis, Sedentary Lifestyle Pain:

Camphor is superior. Mechanism: Activates TRPV3 (warm sensation) and desensitises TRPV1 and inhibits TRPA1, providing analgesia without intense burning. Increases local blood flow by 40- 50%, measured by laser Doppler. In osteoarthritis, 3.1% camphor + menthol balm reduced pain scores by 40% within 2 hours. Anti-inflammatory action confirmed.

Hing role: Antispasmodic for menstrual cramps, low back pain related to gut distension.

Stress, Anxiety, Sleep:

Hing contains coumarins with mild sedative and GABAergic activity, traditionally used for hysteria and anxiety. Camphor aroma in low concentration (olfactory) reduces stress via limbic system activation, used in aromatherapy, but high concentration is neurotoxic.

Respiratory disorders linked to pollution lifestyle:
Camphor: Antitussive in guinea pig citric acid model reduces cough frequency by 50-60%, expectorant at low dose. Used in Vicks VapoRub.
Hing: Bronchodilator, anti-asthmatic, inhibits histamine-induced bronchospasm.

7. INTEGRATED PROTOCOL FOR LIFESTYLE MANAGEMENT

A proposed integrative use under medical supervision:

1. **Morning:** Warm water + hing 250 mg capsule for metabolic and gut health + low glycemic diet
2. **Daytime:** Physical activity; for joint pain, camphor 5% + menthol 5% topical balm before exercise
3. **Evening:** Aromatherapy with 1% camphor in diffuser for 10 min for respiratory clearance (keep room ventilated, not for children <2 years)
4. **Diet:** Hing tempering (tadka) in legumes to reduce flatulence and glycemic load, improving compliance with a high-fibre diet crucial for lifestyle disorders.

8. SAFETY AND REGULATORY CONSIDERATIONS

Camphor: FDA banned >11%. EU restricts camphor in food. Keep away from children. Over 10,000 accidental exposures per year in the US. Treatment: activated charcoal, benzodiazepine for seizures.
Hing: EMA herbal monograph safe. Avoid in pregnancy (uterine stimulant), bleeding disorders, infants <1 year.

9. CONCLUSION

Both camphor and hing validate traditional wisdom but with distinct domains. Camphor is best understood as a topical antimicrobial and analgesic adjuvant that helps overcome the pain barrier to exercise and prevents skin infections common in diabetes and obesity. Hing is a systemic functional food with pleiotropic effects on the gut-brain-metabolism axis, directly targeting root causes of lifestyle disorders: insulin resistance, dyslipidemia, hypertension, dysbiosis and chronic low-grade inflammation.
Future research should focus on double-blind trials of standardised Asafin 250 mg BID for metabolic syndrome, and low-dose camphor-menthol transdermal patches for chronic pain in diabetic neuropathy. A combination nutraceutical + topical approach could reduce polypharmacy.

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