

REVIEW ARTICLE

Medicinal Properties of *Illicium Verum* Hook. F.

Asra Khan Pahore¹, Shagufta Khan², Nasim Karim³

- ^{1.} Department of Pharmacology, Altamash Institute of Dental Medicine, Karachi, Sindh-Pakistan.
- ^{2.} Department of Biological & Biomedical Sciences, Aga Khan University, Karachi, Sindh-Pakistan.
- ^{3.} Department of Pharmacology, Bahria University Medical & Dental College, Sailors Street, Adjacent PNS Shifa, DHA Phase II, Karachi, Sindh-Pakistan.

Correspondence:

Dr. Asra Khan Pahore

Senior Lecturer, Department of Pharmacology, Altamash Institute of Dental Medicine, Karachi, Pakistan.

Correspondence: asra.pahore@gmail.com

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ABSTRACT

Medicinal plants have active elements that can be used for cures or making drug precursors. According to the World Health Organization, 80% of the world's population depends on these plants as traditional treatments to meet their health care needs. *Illicium verum* Hook. F. (star anise) is an extensively used spice in traditional Chinese cuisine as a flavoring agent or a historical medicine for vomiting, stomachache, flatulence, and rheumatism and is included in the Chinese Pharmacopoeia. Some active components of star anise are essential oil, anethole, trans-anethole, sesquiterpenoids, shikimic acid, lignans, etc., which possess anxiolytic, neuro-protective, antibacterial, antifungal, anti-inflammatory, antiemetic, anti-flu, antidiarrheal, antispasmodic, anti-diabetic, antioxidant, anti-thrombotic, and anti-tumour effects that are discussed in this review article.

KEYWORDS: Medicinal, Flavoring agents, Flatulence, Vomiting, Pharmacopoeia, Antiemetic.

INTRODUCTION

Illicium verum (star anise) is a classic scented tree that grows in China and Vietnam^{1,2}. The star anise fruit is a regularly used spice in the Chinese Pharmacopoeia. It has been used as an old Chinese medicine for the treatment of emesis, toothache, depressed liver, flatulence, stomach pain, insomnia, inflammation of the skin, and rheumatic pain. Traditionally, its essential oil is topically applied as an antiseptic³⁻⁵. Different biological benefits of star anise are due to its chemical constituents, mainly polysaccharides, flavonoids, trans-anethole, sesquiterpenes, lactones, and shikimic acid. Many favorable functions of shikimic acid have been reported, including anticancer, antibacterial, anti-depressant, antioxidant, anti-inflammatory, anti-coagulant, and anti-thrombotic effects. Shikimic acid is also a vital chemical originator of the oseltamivir drug used to treat avian and swine flu⁶. Trans-anethole is another significant component of star anise, which also has many reported therapeutic effects like anti-thrombotic, anti-hypertensive, anti-inflammatory, antifungal, anti-cataract, and anti-obesity effects^{7,8}.

Medicinal plants

According to primitive records, it has been almost 60,000 years since humans used plants as medicines⁹. Medicinal plants have components that can be used for curative purposes or making drug precursors¹⁰. The World Health Organization estimates that more than 80% of the world's population uses plants as a traditional medicine to fulfil their primary healthcare needs¹¹. In traditional cultures, medicinal plants have played a significant role in reducing human suffering, and preference is usually given to them due to their efficacy in some diseases, easy accessibility, cost-effectiveness, and cultural acceptance¹². The different parts of medicinal plants that can be used are seeds, leaves, roots, fruits, flowers, skin, or a complete plant. Active compounds are present in the bodies of these plants, which are used as medicinal drugs and produce direct or indirect biological effects on living bodies¹³.

Illicium Verum

Illicium verum (*i.verum*) is an average-sized, timeless tree native to Asian tropical and subtropical areas¹⁴. Due to the similarity of the anise flavor from *Illicium verum* star-shaped pericarp fruit, it is also known as star anise, Chinese star anise, and badian. It is extensively cultivated commercially in China, India, and many other Asian countries. It is a commonly used spice in Chinese, Indian, Malay, and Indonesian cuisines. In the Indian subcontinent, star anise is a known spice to make biryani and masala chai. It is one of the significant constituents of traditional five-spice powder in China. In Vietnam, it is also an essential ingredient in noodle soup¹⁵.

Botanicals

I.verum is categorized in the class Magnoliopsida and the family Illiciaceae. Its plant is an average-sized shrub, 8 to 15 meters high and 30 centimetres deep. The bay is either white or silver. Leaflets are simple, glossy, leathery, alternative, and 6 to 12 centimetres long. Flowers are oversized, 1 to 1.5 centimetres in diameter, bisexual, pinkish white to red or yellow with a hint of green, solitary, and axillary. Fruit is capsule type and forms clusters in a star shape (**Figure I**). Each arm is a seed pod. The picking of fruit occurs before it is fully grown and dries. Seeds are sparkly coffee-coloured or red with a significant amount of oil. The flowers

of star anise mature from March to May, while the fruits are full-flavoured from September to October^{16,17}.

Figure I: Morphology of the dried fruit of *Illicium verum*. Hook. F.



Dried fruit of *Illicium Verum*

Illicium verum dried fruit contains alkaloids, essential oils, tannins (9–10%), cis-anethole, trans-anethole (85–90%), Limone, α -pinene, α -terpineol, β -phellandrene and farnesol^{18,19}. Out of these, anethole and fatty oil are the primary components of star anise. Anethole is an organic bioactive compound with many medicinal effects like anti-inflammatory, antioxidant, antibacterial, anticancer, anti-spasmodic, anti-thrombotic, anti-diabetic, hypotensive, neuro-protective, and immuno-modulatory. Star anise oil is topically used for rheumatic pain, earache, fever, scabies, insomnia, and constipation and as an antiseptic^{20,21}. Star anise can be used internally and externally in many preparations. Its most common internal use is dyspepsia, while its external use is topical inhalation for respiratory tract congestion. It is also a significant component of anti-tussive drugs and is currently used as a medicine for the flu (Table I)²².

Table I: Components of *Illicium verum* and their pharmacological actions²²

Components	Pharmacological actions
α - Pinene	Anti-inflammatory and anti-cholinestrase activity
α - Terpeneol	Anti-tumor, anti-convulsant and antioxidant activity
β -Phellandrene	Flavoring agent
Anethole	Antibacterial and antifungal activity
Lignans	Anti-inflammatory and anti-tumor activity
Phenylpropanoids	Protective activity against pathogens
P-coumaric acid	Anti-tumor and antioxidant activity
Quercetin	Maintenance of cardiac and mental health
Quercetin-3-o-alpha-d-xyloside	Antioxidant activity
Sesquiterpenoids	Protective agents
Trans-anethole	Antibacterial and antifungal activity
Shikimic acid	Anti-coagulant and anti-thrombotic activity
Terpinen-4-ol gamma-terpinene	Antibacterial and antifungal activity

Medicinal Uses of *Illicium Verum*

Antifungal effect

The crucial oil of *I.verum* comprises monoterpenes that result in antifungal activity by causing degradation of the fungi's cell wall, injury to the cytoplasmic membrane, and ultimately, protein destruction²³. It has been reported that an absolute and 50% methanol extract of *I.verum* have shown significant zone inhibition of *Aspergillus fumigatus* with 14.3mm and 10 mm diameters, respectively²⁴.

Antioxidant effect

The star anise fruit essential oil has shown its antioxidant activity through DPPH (1,1-diphenyl-2-picrylhydrazyl) and ABTS (2, 2-azino-bis(3-ethylbenzothiazoline-6-sulfonic acid)) assays with an IC₅₀ value of 47µg/ml and 75.9µg/ml, respectively²⁵. Another study has shown the antioxidant activity of a methanolic extract of star anise using DPPH with an IC₅₀ value of 61µg/ml²⁶.

Anti-diabetic effect

The seed extract of star anise has anti-diabetes action through in vitro dose-dependent inhibition of α-amylase²⁷.

Antibacterial effect

The antibacterial activity of star anise is due to its components like anisyl aldehyde, alcohol, and acetone, which inhibit the growth of *Pseudomonas aeruginosa*, *Staphylococcus aureus*, and *Acinetobacter baumannii*²⁸. The aqueous methanol extract of star anise also showed significant inhibition of bacterial growth with a zone diameter of 13mm in both *Acinetobacter baumannii* (AB5057) and *Methicillin-resistant Staphylococcus aureus* (MRSA USA 300).²⁹

Anti-inflammatory effect

The essential oil of *I.verum* produces an anti-inflammatory effect similar to an antioxidant effect through the production of free radicals, inhibition of lipid peroxidation, and protein breakdown³⁰. Furthermore, different concentrations of star anise extract prevent heat-induced albumin breakdown³¹. Star anise component trans-anethole also possesses anti-inflammatory activity by making fewer IL1b, IL6, MDC (macrophage-derived chemokine), and TARC (thymus activation regulated chemokine)³².

Antiemetic effect

Flavonoids, phenolic acid, and alkaloid components of star anise have been reported to produce effects against emesis³³.

Anti-flu effect

In plants, bacteria, and fungi, shikimic acid is produced as an intermediate product of amino acid synthesis, while in mammals, this mechanism is absent. Shikimic acid is present in the star anise fruit and is a primary production source. It is the precursor for forming oseltamivir against avian and swine influenza, both A and B (H1N1 and H5N1)^{34,35}. It also relieves blockage of the respiratory tract, inflammation of the bronchi, and whooping cough³⁶.

Neuroprotective effect

According to the cholinergic hypothesis, the abnormal cholinergic transmission of acetylcholine in the central nervous system is the cause of memory loss in Alzheimer's disease. Cholinesterase inhibitors are the first option for treating Alzheimer's disease. A significant proportion of trans-anethole in star anise gives it its anti-cholinesterase properties³⁷.

Sedative and anxiolytic effects

It has been reported that the sedative and anxiolytic activity of star anise is due to the presence of trans-anethole and water extract, which cause the initiation of the GABA-nergic inhibitory system³⁸.

Antispasmodic

Star anise is well known for its anti-flatulence and eupeptic effects³⁹. It is also a famous herbal medicine for treating infant colic. Its antispasmodic action is due to anethole and terpenes hydrocarbons (limonene, phellandrene, and dipentene)⁴⁰.

Antidiarrheal effect

The presence of anethole and dicycloether in star anise has the potential for antidiarrheal effects. Also, flavonoids and glycosides of star anise may have protective action against the damaging impact of ricinoleic acid on the mucosa, so severe diarrhea does not happen⁴⁰.

Anti-thrombotic effect

The rise in prothrombin time and activated partial thromboplastin time occurs due to the methanol extract of star anise. The foremost mechanism of warfarin is that it inhibits the vitamin K epoxide reductase enzyme, which is essential for clotting factors 2, 7, 9, and 10. It is probably true that star anise also has a similar mechanism of action as warfarin⁴¹.

Anticancer effect

It has been reported that essential oils from *I. verum* fruit possess anti-proliferative activity against a human colon cancer cell line with an IC₅₀ value of 50.34µg/ml by inducing apoptosis and controlling cell metastasis. Another study showed the trans-Anethole component of *I. verum* has an anti-proliferative effect in human osteosarcoma cell lines with an IG₅₀ value of 60.25µM. It also restricted the cell cycle in the G1 and G0 phases by producing reactive oxygen species and reducing mitochondrial membrane potential^{25,42}.

CONCLUSION

Even though it is frequently utilized, the precise mechanisms underlying some of its therapeutic qualities and any possible adverse effects are still not completely understood. Therefore, further clinical research must be done to understand better the potential of this natural medicine to replace synthetic drugs. These studies may provide fresh insights into the efficacy and safety of *I. verum*, which may assist in advancing medical practices and better meeting patient demands.

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AUTHOR CONTRIBUTIONS

Pahore Ak: Designed and wrote the original draft of the manuscript

Khan S: Review of manuscript, editing, approval of final draft

Karim N: Review of manuscript, editing, approval of final draft

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