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## Review Article

## Phytochemistry, Nutritional Significance, And Therapeutic Prospects of Star Anise (*Illicium Verum*)

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Abstract	Manuscript Information
Star anise ( <i>Illicium verum</i> Hook. f.), a spice widely used in Asian cuisine and traditional medicine, has attracted significant scientific interest due to its unique phytochemical profile and diverse therapeutic properties. Rich in bioactive compounds such as anethole, shikimic acid, flavonoids, and essential oils, star anise offers both nutritional and pharmacological benefits. This review comprehensively explores the nutritional composition and therapeutic potential of star anise, emphasizing its antimicrobial, antioxidant, antiviral, anti-inflammatory, and gastroprotective effects. Furthermore, its role in modern medicine, particularly as a precursor in the synthesis of oseltamivir (Tamiflu®), highlights its global pharmaceutical significance. This article aims to provide a detailed account of star anise's nutritional and therapeutic importance, drawing upon current scientific literature.	<ul style="list-style-type: none"> <li>▪ ISSN No: 2583-7397</li> <li>▪ Received: 12-08-2024</li> <li>▪ Accepted: 27-09-2024</li> <li>▪ Published: 28-10-2024</li> <li>▪ IJCRM:3(5); 2024: 247-249</li> <li>▪ ©2024, All Rights Reserved</li> <li>▪ Plagiarism Checked: Yes</li> <li>▪ Peer Review Process: Yes</li> </ul>
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**KEYWORDS:** Star anise; phytochemistry; shikimic acid; antimicrobial activity; therapeutic potential.

### 1. INTRODUCTION

Spices have been integral to human civilization not only as flavouring agents but also as sources of medicinal compounds. Among them, star anise (*Illicium verum*), belonging to the family Schisandraceae, holds a unique position due to its widespread use in culinary, nutraceutical, and pharmaceutical applications. Indigenous to southern China and Vietnam, star anise is easily recognized by its star-shaped fruit, which contains 6–8 carpels, each holding a single seed (Patra *et al.*, 2020).

Traditionally, star anise has been employed in Chinese and Ayurvedic medicine for its digestive, carminative, and antimicrobial properties (Dhar *et al.*, 2021). More recently, it has

gained international attention as the primary natural source of shikimic acid, a key precursor for the antiviral drug oseltamivir, used in the treatment of influenza (Tian *et al.*, 2019). In addition, its essential oil, characterized by the presence of trans-anethole (70–90%), exhibits potent pharmacological activities including antimicrobial, antioxidant, and insecticidal effects (Krishnan *et al.*, 2020).

This review synthesizes current knowledge on the nutritional and therapeutic aspects of star anise, providing a comprehensive understanding of its significance in both traditional and modern medicine.

## 2. Botanical and Phytochemical Profile

Star anise (*Illicium verum*) is an evergreen tree that grows up to 8–15 meters in height. Its fruits, harvested before ripening, are dried and used in culinary and medicinal applications.

### 2.1 Phytochemical Constituents

Star anise contains a diverse range of phytochemicals:

Essential oils: Trans-anethole, estragole, limonene, and linalool.

Phenolic compounds: Flavonoids (quercetin, kaempferol), tannins, and phenolic acids.

Shikimic acid: A critical compound for antiviral drug synthesis.

Other bioactive compounds: Sesquiterpenes, alkaloids, and lignans.

These compounds account for the spice's broad spectrum of biological activities (Zhou *et al.*, 2018).

## 3. Nutritional Composition

Though primarily used as a spice, star anise contains notable nutritional components that contribute to health and wellness.

### 3.1 Macronutrients

Star anise is low in calories but rich in carbohydrates and dietary fiber. Per 100 g, it provides approximately 337 kcal, 50 g carbohydrates, 15 g dietary fiber, 18 g protein, and 16 g fat (USDA, 2021).

### 3.2 Micronutrients

Star anise is a source of essential vitamins and minerals, including:

Vitamins: Vitamin A, vitamin C, and B-complex vitamins such as niacin and riboflavin.

Minerals: Calcium, magnesium, potassium, iron, zinc, and manganese.

### 3.3 Phytochemicals and Antioxidants

Polyphenolic compounds such as flavonoids and phenolic acids contribute to its antioxidant potential, helping neutralize free radicals and reduce oxidative stress (Yang *et al.*, 2020).

## 4. Therapeutic Aspects of Star Anise

### 4.1 Antimicrobial Activity

The essential oils of star anise demonstrate potent antimicrobial properties. Trans-anethole and linalool exhibit inhibitory effects against *Escherichia coli*, *Staphylococcus aureus*, and *Candida albicans* (Patra *et al.*, 2020). These properties validate its use in traditional medicine for treating infections and digestive disorders.

### 4.2 Antiviral Properties

Star anise is the primary commercial source of shikimic acid, the precursor for oseltamivir (Tamiflu®), widely used in managing influenza A and B (Tian *et al.*, 2019). Additionally, extracts have shown activity against the herpes simplex virus and hepatitis B virus in experimental studies.

### 4.3 Antioxidant Activity

Flavonoids and phenolic compounds in star anise act as free radical scavengers, reducing lipid peroxidation and oxidative stress. Studies demonstrate that its extracts exhibit high ferric-reducing antioxidant power (FRAP) and DPPH radical scavenging activity (Krishnan *et al.*, 2020).

### 4.4 Anti-inflammatory Effects

Star anise essential oil modulates inflammatory mediators by suppressing the production of nitric oxide, tumor necrosis factor- $\alpha$  (TNF- $\alpha$ ), and interleukin-6 (IL-6). Animal studies have shown its efficacy in reducing inflammation in arthritis and colitis models (Dhar *et al.*, 2021).

### 4.5 Gastroprotective Effects

Traditionally used to relieve indigestion, bloating, and nausea, star anise stimulates digestive enzymes and improves gut motility. Its carminative properties help reduce flatulence and gastric discomfort (Zhou *et al.*, 2018).

### 4.6 Antifungal Activity

The spice shows strong antifungal potential, particularly against *Candida* species, attributed to trans-anethole and linalool (Patra *et al.*, 2020).

### 4.7 Analgesic and Sedative Properties

Experimental models reveal that star anise extract exerts mild analgesic and sedative effects, possibly due to its modulation of GABAergic neurotransmission (Yang *et al.*, 2020).

### 4.8 Anticancer Potential

Preliminary studies suggest that star anise extract exhibits cytotoxicity against certain cancer cell lines, mediated by apoptosis induction and oxidative stress modulation (Dhar *et al.*, 2021). However, clinical validation is lacking.

### 4.9 Antiparasitic and Insecticidal Effects

Star anise essential oil has insecticidal activity against mosquitoes and stored grain pests, making it valuable in agriculture and vector control (Krishnan *et al.*, 2020).

## 5. Star Anise in Traditional Medicine

In Traditional Chinese Medicine (TCM), star anise is classified as a warm spice used to treat colds, flu, and digestive disorders. In Ayurveda, it is valued for its *deepana* (appetizer) and *pachana* (digestive) properties. Folk medicine also prescribes star anise tea for cough, bronchitis, and insomnia (Patra *et al.*, 2020).

## 6. Modern Pharmaceutical Applications

The pharmaceutical importance of star anise is underscored by its role in oseltamivir production. With influenza pandemics posing global threats, demand for shikimic acid from star anise has increased substantially (Tian *et al.*, 2019). Biotechnological approaches, including microbial fermentation, are being

explored as alternatives, but star anise remains the primary commercial source.

### 7. Safety and Toxicological Aspects

While *Illicium verum* is generally recognized as safe (GRAS), adulteration with Japanese star anise (*Illicium anisatum*), which contains toxic sesquiterpene lactones, can cause neurotoxicity, seizures, and gastrointestinal distress (Zhou *et al.*, 2018). Quality control measures are therefore critical to ensure safety.

### 8. Future Perspectives

Star anise presents opportunities for further exploration in nutraceuticals and functional foods. Research gaps include:

Clinical trials validating therapeutic efficacy.

Development of standardized extracts with defined phytochemical content.

Exploration of synergistic effects with other spices and herbs.

Sustainable cultivation and alternative sources of shikimic acid.

### 9. CONCLUSION

Star anise (*Illicium verum*) is more than a culinary spice; it is a nutritionally significant and therapeutically valuable plant. Rich in bioactive compounds, it exhibits antimicrobial, antiviral, antioxidant, anti-inflammatory, and gastroprotective properties. Its role as the natural source of shikimic acid for oseltamivir underscores its global pharmaceutical relevance. Ensuring authenticity and safety, alongside further clinical research, will enhance its role in modern medicine and functional nutrition.

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