Survey on Chemical Constituent, Traditional and Modern Pharmaceutical and Health Benefits of Chinese Star Anise, a Treasure from the East

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ABSTRACT

Introduction: Star anise has traditional usages and multiple applications in botany, chemistry, pharmacology and therapy. Chinese star anise has antioxidant, antibacterial, fungicidal, anti-inflammatory, anesthetic and anti-nociceptive effects. Methods: A literature search was conducted in Medline, PubMed, Science direct and Google scholar databases. Results: The seeds are good source of the minerals calcium, iron, copper, potassium, manganese, zinc and magnesium. The seeds are also a good source of the essential B-complex vitamins pyridoxine, niacin, riboflavin and thiamin. Chinese star anise is also a good source of anti-oxidant vitamins including Vitamin-C and Vitamin-A. The essential oil of Chinese star anise contains anethole which has shown several functional properties including antimicrobial, antioxidant, hypoglycemic, hypolipidemic and oestrogenic properties. Chinese star anise also contains shikimic acid, which has become a major weapon against global influenza. Moreover, it contains bioactive compounds possessing insecticidal properties which can be used as natural grain protectants. The most important compounds of Chinese star anise are α-pinene, β-pinene, myrcene, α-phellandrene, 3-carene, α-terpinene, p-cymene, limonene, trans-ocimene, cis-β-ocimene, γ-terpinene, terpinolene, linalool, γ-terpineol, 4-terpineol, α-terpineol, estragole, cis-anethole, trans-anethole, α-cubebeene, β-clemene, caryophyllene, bergamotene, Δ-cardinene and α-cadinol. Conclusion: The most important properties which have been reported for star anise is carminative, anti-fungal, antibacterial, analgesic, sedative, anticarcinogenic and antioxidant. Usage of Chinese star anise can provide industrial sustainability and could be considered as both organic food and medicine in both East and West.

Key words: Traditional Health Benefits, Modern Pharmaceutical Benefits, Antioxidant, Estragole.

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INTRODUCTION

Botany and Plant Description of Chinese Star Anise

Traditional Chinese medicines consider as both medicine and food item, because most of Chinese medicine are used as pigments and flavors in the preparation of Chinese food items.¹,²,³,⁴,⁵,⁶,⁷,⁸ Star anise is a medium-sized evergreen tree which is native to southwest of China. It is widely cultivated in subtropical and tropical areas of Asia.⁹ Its common name has many synonyms in different areas: Chinese star anise or Bajiaohuxiang in China; Anis de la Chine, Anise etoile or Badiane in France; Dai-uikyo or hakkaku-uikyo in Japan; Sternanis in Germany; Illicium anisatum in Italy; Sonf or Anashplato in India; Anis estrellado in Spain; Bunga lawing in Indonesia and Malaysia.¹⁰ Chinese star anise is one of the flavors used in China five spices.¹¹ In traditional Chinese medicine, it is known as warming yang for dispelling cold, as well as regulating the flow of Qi to relieve pain or common cold.¹² The crude fruits and its powders were used in traditional teas to treat nervousness and sleeplessness and also as a sedative.¹³ Dried ripe, star anise fruit and seed are used as important spice in Asian cooking especially in Chinese, Vietnamese and Indian cuisines. Vietnam produces more than 5000 tonne of star anise seeds per annum and it is estimated that the combined production of China and Vietnam is more than 25,000 tonne per annum. Moreover, 200-250 tonne of essential oil is shipped to France and the Czech Republic annually. Wang et al.¹⁴ found that star anise has long been used in traditional Chinese medicine and the food industry with the effects of dispelling cold, regulating the flow of Qi and relieving pain. Chinese star anise, together with the morphological similar Japanese star anise (Illicium anisatum), is also used for decoration purposes.¹⁵,¹⁶ This plant also has been reported to possess anti-bacterial, anti-cancer and of course anti-inflammatory characteristics.²² Kang et al.²³ noted that Chinese anise star can alleviate inflammatory responses and is a common flavor in medicinal tea, cough mixtures and pastilles. Star anise is classified in the division Magnoliophyta, class Magnoliopsida, sub-class Magnoliidae, order Austrobaileyales, family Illiciaceae. Chinese star anise is used as a remedy to treat infant colic. Japanese star anise, Illicium anisatum (Schisandraceae) is an evergreen broad-leaved tree or shrub that exhibits ballochory. The plant is widely distributed in the central and southern parts of the Japanese archipelago.¹⁴ Japanese star anise looks very similar to Chinese star anise in its dried form but that is where the similarity ends. The Japanese star anise is extremely toxic and is not edible in any form. Recently, concern has been raised regarding adulteration of Chinese star anise with Japanese star anise and antioxidant, Estragole.
regions of star anise in China, accounting for more than 85% of the total average of star anise in China. Estragole (4-allyl anisole, 1-methoxy-4-enylbenzene) is a naturally occurring compound which can be extracted from anise and Chinese star anise; flavors and fragrances containing estragole are used in food products, perfumes, soaps and detergents. (E)-anethole, limonene, linalool and α-pinene are major components of the essential oil of *I. verum*. Star anise is socially accepted in occasions and is traditionally being used in high altitude regions of Arunachal Pradesh where dried seedless fruits are used as incense, flavouring tea, preparation of butter salted tea or sugar tea for sweet fragrance and to increase and improve the potency and strength of alcohol. It is also used as a medicine to cure cough, toothache and sinusitis, used as an anti-fungal agent and food preservative. Gholvand et al. reported that the dried star anise fruit contains 49 compounds including trans-anethole (81.40%), limonene (6.50%), chavicol (2.10%) and also anisaldehyde (1.81%). It is primarily located in the woody shell and to a lesser extent in the seed. Anethole is only slightly soluble in water but exhibits high solubility in ethanol. It is 13 times sweeter than sugar. Parsa et al. reported that Chinese star anise is used extensively in both the Indian diet and medicine because it does not have any adverse influence and is also readily absorbed. They have also found that the oil of star anise is a stimulant, stomachic, carminative and is mildly expectorant and diuretic. The fruit of the plant has been used in traditional medicine for treatment of stomach aches, vomiting, rheumatic pain, insomnia and skin inflammation. Its fruit is an important traditional Chinese medicine as well as a commonly used spice. Zhang et al. showed that trans-anethole, p-anisaldehyde, farnesol and estragole are main aroma compounds of Chinese star anise. They have also shown that 47 compounds accounted for more than 90% in total Chinese star anise aroma molecules, including trans-anethole (75.76%), p-anisaldehyde (8.65%), estragole (4.70%), farnesol (3.26%), limonene (1.01%), linalool (1.44%), carophyllene (1.03%) and 4-methoxypropiophenone (0.72%). The crude extract of Chinese star anise can be applied as an optional control of house fly at breeding sites. Classification of Chinese star anise is shown in Table 1. Vernacular and common English names of Chinese star anise are presented in Table 2.

Evidence indicate that anethole is a natural bioactive compound with multiple beneficial effects in human health such as anti-inflammatory, anticancer, chemo preventive, neuroprotective, spasmyloytic, hypotensive, antithrombotic, immunomodulatory and anti-diabetic. Domiciano et al. found that the anethole may be effective in controlling some non-immune acute inflammation-related disease, probably by an inhibitory action on production or release of PGE2 and NO. Wei et al. suggested that *I. verum* fruit extracts and trans-anethole can potentially be developed as a grain protectant to control stored-product insect pests. Zhou et al. suggested that *I. verum* extracts have potential as an eco-friendly biopesticide in integrated pest management against *M. persicae*.

Table 1: Classification of Chinese star anise.

<table>
<thead>
<tr>
<th>Kingdom</th>
<th>Plantae</th>
</tr>
</thead>
<tbody>
<tr>
<td>Division</td>
<td>Magnoliophyta</td>
</tr>
<tr>
<td>Class</td>
<td>Magnoliopsida</td>
</tr>
<tr>
<td>Order</td>
<td>Austrobaileyales</td>
</tr>
<tr>
<td>Family</td>
<td>Illiciaceae</td>
</tr>
<tr>
<td>Genus</td>
<td>Illicium</td>
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<tr>
<td>Species</td>
<td>Verum</td>
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</tbody>
</table>

Table 2: Vernacular and common English names of Chinese star anise.

<table>
<thead>
<tr>
<th>Common English names</th>
<th>Badian Star Anise, Chinese Aniseed, Chinese Anise, Chinese Star Anise, Indian Anise, Star Anise, Star Aniseed, True Star Anise</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chinese</td>
<td>Ba Jiao, Ba Jiao Hui Xiang, Da Hui Xiang (Mandarin); Bat Gok, Bart Gok, Pa-Chiao, Pak Kok (Cantonese), PehKah (Hokien)</td>
</tr>
<tr>
<td>Hindi</td>
<td>Anasphal, BadiyanKhatala</td>
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<tr>
<td>Kannada</td>
<td>Kankola</td>
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<tr>
<td>Malayalam</td>
<td>Takkolappulli, Takkolappottil</td>
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<tr>
<td>Sanskrit</td>
<td>Takkolakum</td>
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<tr>
<td>Tamil</td>
<td>Anusappu, Anusappu</td>
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<tr>
<td>Telugu</td>
<td>Kuppi, Anasapveru</td>
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<tr>
<td>Danish</td>
<td>Stjerne anis</td>
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<tr>
<td>Dutch</td>
<td>Adas China, Sternijs</td>
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<td>French</td>
<td>Anis delachine</td>
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<tr>
<td>German</td>
<td>Sternanis</td>
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<tr>
<td>Italian</td>
<td>Anicestellato</td>
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<tr>
<td>Spanish</td>
<td>Anis estrarlado</td>
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<tr>
<td>Indonesian</td>
<td>Bunga lawang</td>
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<tr>
<td>Malaysia</td>
<td>Bunga Lawang</td>
</tr>
<tr>
<td>Arab</td>
<td>Raziyanjekhatai</td>
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<tr>
<td>Persian</td>
<td>Badian-i-khatai</td>
</tr>
</tbody>
</table>

Table 3: Economic and medicinal importance of Chinese star anise.

1. The anti-bacterial and anti-fungal properties of Chinese star anise are useful in the treatment of diseases like asthma, bronchitis and dry cough.
2. Chinese star anise can also be used as for its sedating properties to secure a good sleep.
3. Its oils are appropriate in providing relief from rheumatism and lower back pain.
4. It can also be used as a natural breath freshener.
5. There is a compound present in Chinese star anise which is called Shikimic acid and it is used for preparing drug for curing influenza or the flu virus.
6. Another important compound present in Chinese star anise which contains anti-oxidants properties is Linalool and it is good for overall health.
7. The chemical compounds which derived from this important herb also have anti-oxidant, disease preventing and health promoting properties.
8. Anethole is the most important compounds in this herb, but other important compounds found in the seeds include extragol, p-anisaldehyde, anise alcohol, acetophenone, pinene and limonene.
9. In traditional Chinese and Asian medicine, it mainly uses as stomachic, anti-septic, anti-spasmodic, carminative, digestive, expectorant, stimulant and tonic.
10. The seeds are excellent source of many essential B-complex vitamins such as pyridoxine, niacin, riboflavin and thiamin.
11. Seeds are also great source of minerals like calcium, iron, copper, potassium, manganese, zinc and magnesium.
12. This important spice is also contain good amounts of anti-oxidant vitamins such as vitamin-C and Vitamin-A.
Modern Medicinal Usage of Star Anise

One of the most important character of *I. verum* is a digestive aid which may make the nursing mothers promote breast milk production, has the anti-bacterial and anti-fungal affection of asthma, bronchitis and dry cough, refreshed the breath and ensure good sleep.48-51 Illicium verum is the most important compound in traditional Chinese medicine, modern medicine as well as traditional Asian medicine. Its fruit is also commonly used as a spice. The fruit is aromatic and has a strong, pungent and mildly sweet taste. Chinese star anise together with the morphological similar Japanese star anise together with the morphologically similar Japanese star anise (*Illicium anisatum*), is also used for decoration purposes. The Japanese star anise is extremely toxic and is not edible in any form. It has been reported that (E)-Anethole, limonene, linalool and α-pinene are major components of the essential oil of *I. verum*. The most important compounds of Chinese star anise are α-Pinene, β-Pinene, Myrcene, α-Phellandrene, 3-Carene, α-Terpinene, p-Cymene, Limonene, Trans-Ocimene, Cis-β-Ocimene, γ-Terpineol, Terpinolene, Linalool, γ-Terpineol, 4-Terpineol, α-Terpineol, Estragole, Cis-Anethole, Trans-Anethole, α-Cubebene, β-Clemene, Caryophyllene, Bergamote, Δ-Cadinene and α-Cadinol. Star anise is one of the many species that contain bioactive compounds as well as a number of phenolic and flavonoid compounds, having antioxidant, preservative and antimicrobial properties. Star anise considered as the main source of shikimic acid, which is the most important ingredient of Tamiflu drug. Chinese star anise has anti-bacterial and anti-fungal characters and it is useful in treatment of diseases like asthma, bronchitis and dry cough, it is also good to having a good sleep; it is a natural breath fresher, one of its most compounds is Shikimic which is used as a drug in curing influenza and flu virus; it consists of Linalool which is good for overall health because of its antioxidants characters. Its seeds are good source of minerals like calcium, iron, copper, potassium, manganese, zinc and magnesium. The essential oil of Chinese star anise contains anethole which has shown several functional properties including antimicrobial, antioxidant, hypoglycemic, hypolipidemic and oestrogenic properties. Star anise primarily contains anethole and fatty oil; its essential oil has a sweetish, burning flavor and a highly aromatic odor.

CONCLUSION

Aromatic and medicinal plants are gifts of nature which have been used against different diseases since the beginning of the history. Star anise (*Illicium verum* Hook. f.) is one of the most famous evergreen trees, which was originally distributed in tropic and subtropic areas of Asia, especially China and it is famous for its use in traditional Chinese medicine as well as traditional Asian medicine. Its fruit is also commonly used against different diseases since the beginning of the history.

ACKNOWLEDGEMENT

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

ABBREVIATIONS

TCM: Traditional Chinese medicine.

REFERENCES


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Star anise (Illicium verum Hook. f.) is one of the most famous evergreen tree which has originally distributed in tropic and sub-tropic areas of Asia, especially China.

The fruit is aromatic and has a strong, pungent and mildly sweet taste. In traditional Chinese medicine and the food industry with the effects of dispelling cold, regulating the flow of Qi, and relieving pain.

The most important compounds of Chinese star anise are α-Pinene, β-Pinene, Myrcene, α-Phellandrene, 3-Carene, α-Terpine, p-Cymene, Limonene, Trans-Ocimene, Cis-β-Ocimene, γ-Terpine, Terpinolene, Linalool, γ-Terpineol, 4-Terpineol, α-Terpineol, Estragole, Cis-Anethole, Trans-Anethole, α-Cubebe, β-Clemene, Caryophyllene, Bergamotene, Δ-Cardinene, and α-Cadinol.

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Star anise considered as the main source of shikimic acid, which is the most important ingredient of Tamiflu drug.

Chinese star anise has anti-bacterial and anti-fungal characters, and it is useful in treatment of diseases like asthma, bronchitis and dry cough, it is also good to having a good sleep.

Its seeds are good source of minerals like calcium, iron, copper, potassium, manganese, zinc, and magnesium.

The seeds are a great source of essential B-complex vitamins such as pyridoxine, niacin, riboflavin and thiamin.

Chinese star anise is also a good source of anti-oxidant vitamins such as Vitamin-C and Vitamin-A. The essential oil of Chinese star anise contains anethole which has shown several functional properties including antimicrobial, antioxidant, hypoglycemic, hypolipidemic and oestrogenic properties.