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Review Article

Lychee (*Litchi chinensis* Sonn.), the King of Fruits, with Both Traditional and Modern Pharmacological Health Benefits

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ABSTRACT

Introduction: One of the most important tropical and subtropical fruit is lychee (*Litchi chinensis* Sonn). It has been widely cultivated in the Chinese provinces of Guangdong, Guangxi, Fujian and Sichuan. **Methods:** A literature search was conducted in Medline, Scoupus, PubMed and Google scholar databases. The keywords were lychee, traditional Chinese medicine, modern pharmaceutical science, super fruit and health benefits. **Results:** The major chemical constituents of lychee are flavonoids, sterols, triterpenes, phenolic and other bioactive compounds. The most important health benefits of lychee is for skin to prevent signs of aging, help remove blemishes and reduce sunburns. It also has hair benefits by promoting hair growth and providing a distinct shine. Other important health benefits include anticancer effects, promoting cardiovascular health, improving digestion, prevention of cataracts, anti-influenza activity, aiding in weight loss, regulating blood circulation, preventing blood vessel rupture, anti-inflammatory effects, protection from herpes virus infection, strengthening immunity, regulating blood pressure, strengthening bones, preventing anemia and increasing the libido. However, lychee can disturb hormonal balance and may cause allergic reactions in some people. Furthermore, because of high sugar content, it may have negative impacts on people who suffer diabetes. **Conclusion:** The pharmacological and phytochemical characteristics of lychee demonstrate that it is one of the most important super-fruits and medicinal Chinese plants.

Key words: Lychee, Traditional Chinese Medicine, Modern Pharmaceutical Science, Super-fruit, Health Benefits.

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INTRODUCTION

Traditional Chinese medicine (TCM) has been used for thousands of years by different generations in China and other countries to promote good health and treat various diseases.[1-6] On the basis of traditional Chinese medicine (TCM), the fruit and food we eat has specific and significant effects on our bodies and they classify as either warming or cooling.[7-13] In TCM, placesa lot of emphasis on Qi (vital energy) and Yin-Yang balance (negative and positive equilibrium) and therefore these are important to consider when reviewing TCM plants. The aim of this review is survey on some important modern pharmaceutical sciences and traditional benefits of lychee.

LYCHEE OCCURRENCE AND CULTIVATION

Lychee (*Litchi chinensis* Sonn.) is a sub-tropical, juicy and delicious fruit which belongs to family Sapindaceae and its sub family Nepholea.[14] Lychee trees normally have a thick short trunk and brown-grey bark.[15] Lychee has two species, *Litchi philippinensis* and *Litchi chinensis*; the former is a wild plant grown in Philippines. It occupies an important place is being cultivated in many regions, especially China, India, Vietnam, Thailand, Bangladesh, Indonesia, Philippines, Nepal, South Africa and etc, as well as Australia and the USA. The fruit is small, conical, heart-shaped or spherical in shape and bright red in color. The edible portion of lychee fruit is a white to cream-colored, translucent pulp that surrounds a glossy and brown seed. It has been widely cultivated in the Chinese provinces of Guangdong, Guangxi, Fujian and Sichuan for more than 4000 years.[16] It has been reported that cultivars such as Sum Yee Hong, Haak Yip, Kwai May, No Mai Chee, Wai Chee and Seong Sue Wai date back to 500 or 600 years of more, while other cultivars such as Bah Lup, Heong Lai and Tim Naan, or Souey Tung are younger cultivars compared to the former ones.[17] Based on Chinese medicine, lychees belongs to the food groups that have hot nature, which benefits your Yang energy. Lychee was introduced to Burma in the seventeenth century, to India and the West Indies during the eighteenth century and later to other tropical and subtropical parts of the word.[18] In China, the lychee is known as the king of fruit, for its excellent taste and incredible nutritional value. The red, attractive, small fruit is borne in bunches and dried lychee has been erroneously called litchi nut. Apart from its great tatse, its pulp has been found to be rich in nutrients including vitamin C, polysaccharides and many types of minerals.[19-22] The taxonomical position of lychee is shown in Table 1.

LYCHEE NUTRITIONAL COMPOSITION AND CHEMICAL CONSTITUENTS

Lychee fruits contain Oligonol, a low molecular weight polyphenol which is thought to have antioxidant and anti-influenza virus actions.[23] Sakurai *et al.*[23] suggested that oligonol has antioxidative effects and it attenuates high fat diet (HFD)-induced dysregulated expression of genes for adipokines in adipocytes. Choi *et al.*[24] also indicated that oligonol has strong preventative potential in diabetes mellitus and in Alzheimer, s disease. Lychee is also a good source of vitamin-C, B-complex vitamins such as thiamin, niacin and folates. Green fruits contained only malvinidin-3-acetylglucoside and polymeric pigment, while the ripe fruit contained cyanidin-3-rutinoside (>75%), cyanidin-3-glucoside (< 17%) and malvinidin-3-acetylglucoside (<9%).[25] Brat *et al.*[26] reported that lychee has one of the highest reported polyphenol concentrations of any fruit, with 222.3 mg of gallic acid equivalents. Lychee pericarp is rich in phenolic substances including epicateching, procyanidins, cyaniding-3-glucoside and quercetin-3-rtinoside.[27] Lychee pericarp accounts for about 15% of the total weight of fresh lychee.[28,29] Liu *et al.*[30] showed that

Table 1: Taxonomical position of lychee.

Kingdom	Plantae
Order	Sapindales
Family	Sapindaceae
Subfamily	Sapindoideae
Genus	*Litchi*
Species	*chinensis*

Table 2: The main volatile compounds in both lychee juice and lychee wines.[31]

Hexanoic acid
Octanoic acid
Decanoic acid
Isobutyric acid
Isobutyl alcohol
Active amyl alcohol
Isoamyl alcohol
2-Phenylethyl alcohol
1-Butanol
1-Octanol
Ethyl acetate
Ethyl hexanoate
Ethyl octanoate
Ethyl decanoate
Ethyl dodecanoate
Isobutyl octanoate
Isobutyl decanoate
Isoamyl acetate
Isoamyl hexanoate
Isoamyl octanoate
Isoamyl decanoate
2-Phenylethyl acetate
Citronellyl acetate
Citronellol
Linalool
Geraniol
cis-Rose oxide

the highest and lowest contents phytochemical contents in litchi flowers are phenols, flavonoids and condensed tannins and the antioxidant activities of the lychee flower extracts were the order: acetone extract> methanol extract> water extract. Concentrations of main volatile compounds in both lychee juice and lychee wines are shown in Table 2.

MEDICIAL USES AND POTENTIAL HEALTH BENEFITS OF LYCHEE IN BOTH TRADITIONAL AND MODERN PHARMACEUTICAL SCIENCES

Guo *et al*.[32] stated that peel and seed fractions of some fruits such as longan and lychee seeds possessed high antioxidant activity and rich sources of natural antioxidants. Qi *et al*.[33] concluded that lychee seed water extract

Table 3: The most important facts about pharmacology, phytochemistry and traditional uses of Lychee (*Litchi chinensis*).[43]

Phytochemistry	Phenolics
Pharmacology	Coumarin
	Lignans
	Sesquiterpenes
	Fatty acids
	Sterols
	Triterpenes
	Anticancer
	Hepatoprotective
	Antioxidant
	Antiplatelet
	Antiviral
	Antimutagenic
	Antihyperlipidemic
	Antipyretic
	Antiinflammatory
Traditional Uses	Cough
	Flatulence
	Stomach ulcers
	Diabetes
	Obesity
	Testicular swelling

(LSWE) was determined to be effective in inhibiting adipogenesis and retarding lipid oxidation, which can improve the safety and quality of meat products. According to Ben Cao Gang Mu, an ancient monograph of herbal medicines written by Li Shizheng in Ming Dynasty, litchi flesh promotes body fluid production and improves sense, intelligence and Qi. Litchi skin can be used to cure dysentery, metrorhagia and eczema; and litchi seed. Xu *et al*.[34] stated that as an inedible part of the fruits, lychee seeds are mainly discarded as waste although they have been used as a traditional Chinese medicine for the alleviation of epigastric pain and testicular swelling and pain. The seeds are mainly discarded as waste except a small amount which is applied as traditional Chinese medicine to treat epigastric pain, testicular swelling and pain.[35] Dong *et al*.[36] disclosed that the methyl jasmonates in lychee seeds maybe partially responsible for anti-inflammatory activity of lychee and could be served as anti-inflammatory agents in functional food. Other studies have shown that lychee seeds also exhibited anti-influenza virus and reducing visceral obesity properties.[37] Bahijri *et al*.[38] reported that oligonol could be useful as future hypolipidemic and weight controlling agent for overweight and obese females. Some researchers have shown the lychee fruit pulp extract (alcoholic and aqueous) has hepatoprotective activity against toxins such as carbon tetrachloride (CCl_4) in addition to its proven anti-apoptosis and anti-lipid peroxidation affects.[39] Zeng *et al*.[40] reported that lychee pericarp could be used as an inexpensive functional food ingredient. Bhoopat *et al*.[39] noted that antioxidant properties of the lychees as evidenced by the vitamin C and phenolic compounds, anti-lipid peroxidation and anti-apoptosis could explain the hepatoprotective effects in CCl_4-induced hepatotoxicity. Lychee seed is the dry mature seed of a lychee and used as a traditional Chinese medicine named Li-zhi-he in Chinese and was recorded by the Benaco Yanyi and Benaco Gangmu for regulating Qi, dispelling cold, alleviating pain and relieving

polydipsia.[40] Queiroz *et al*.[42] Reported that the antioxidant activity found in the peel and seeds of the lychee is high and is mainly due to ascorbic acid and beta-carotene. The most important facts about pharmacology, photochemistry and traditional uses of lychee is shown in Table 3.

CONCLUSION

Lychee or litchi (*Litchi chinensis* Sonn.) is a delicious subtropical fruit tree of commercial important of the Sapindaceae family, indigenous to parts of Southern China. Seeds of lychee also may hold several beneficial roles in the field of pharmacy and food technology and further researches are required in this field of study. The most important pharmacological activities of lychees leaves are anti-oxidant activity, analgesic and anti-inflammatory activity as well as hepatoprotective activity. The most notable pharmacological characteristics of flower of lychee are anti-oxidant activity, cardiovascular activity, cytotoxicity, anti-lipase activity. The most important pharmacological activities of pericarp are antioxidant activity, anti-cancer activity. Seeds of lychee have antioxidant activity, anti-cancer activity, reduce blood sugar and lipid levels, as well as having anti-virus activity. The fruits activities are anti-inflammatory activity, aldose reductase inhibition activity, anti-viral activity, hepato-protective activity and many other benefits. This review highlighted lychee as an important source of bioactive properties and valuable nutritional constituents. It can also provide sustainability and could be considered as organic super-fruit in both Asian and non-Asian countries.

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CONFLICT OF INTEREST

No potential conflict of interest was reported by the authors.

ABBREVIATIONS

TCMs: Traditional Chinese medicine; **HFD:** High fat diet; **LSWE:** Lychee seed water extract.

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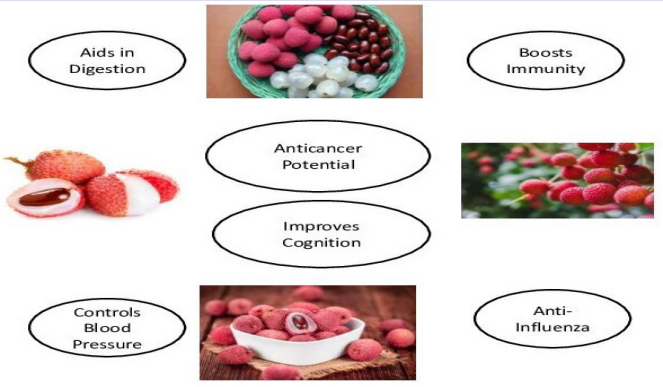
PICTORIAL ABSTRACT



SUMMARY

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- Seeds of lychee also may hold several beneficial roles in the field of pharmacy and food technology and further researches are required in this field of study.
- The most important pharmacological activities of lychee,s leaves are anti-oxidant activity, analgesic and anti-inflammatory activity as well as hepatoprotective activity.
- The most notable pharmacological characteristics of flower of lychee are anti-oxidant activity, cardiovascular activity, cytotoxicity, anti-lipase activity.
- The most important pharmacological activities of pericarp are anti-oxidant activity, anti-cancer activity. Seeds of lychee have anti-oxidant activity, anti-cancer activity, reduce blood sugar and lipid levels, as well as having anti-virus activity.
- The fruits activities are anti-inflammatory activity, aldose reductase inhibition activity, anti-viral activity, hepato-protective activity and many other benefits. This review highlighted lychee as an important source of bioactive properties and valuable nutritional constituents.

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