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Litchi Chinesis: A Medicinal Fruit with Therapeutic Potential

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ABSTRACT

Litchi (Litchi chinensis Sonn.) is a tropical fruit valued worldwide for its flavor, vibrant color, and nutritional richness. Its bioactive compounds, notably polysaccharides and polyphenols, contribute to antioxidant, anti-inflammatory, and anticancer properties, supporting diverse health benefits. Recent studies highlight its potential applications in food, pharmaceutical, and cosmetic industries. However, due to soluble proteins, litchi may trigger adverse reactions in sensitive individuals. This review explores litchi's nutritional profile, therapeutic potential, industrial uses, and safety concerns.

Keywords:- Subtropical crops, *Litchi chinensis* Sonn, fruit development, maturation processes, maturity indicators, and harvesting

INTRODUCTION

Medicinal plants have long been the mainstay of human healthcare, with herbal remedies regarded as safe alternatives to synthetic drugs. Litchi (*Litchi chinensis*), a Sapindaceae member, is widely grown in tropical and subtropical areas for its taste and well-being benefits. Native to southern China and northern Vietnam, it is now grown in over 20 countries. Litchi fruits are red, juicy, aromatic arillate drupes with a single seed and translucent aril. Its flowers are imperfect hermaphrodite, pistillate, and staminate, occurring sequentially on one panicle. Major producers include China, India, Vietnam, and Thailand, with smaller industries in the U.S., Brazil, and Mozambique. Litchi tissues are rich in flavonoids, phenolics, and triterpenoids, with pericarp containing procyanidins B2, B4, epicatechin, and rutin, while seeds contain epicatechin, procyanidins A1/A2, rutin, phlorizin, and litchioside D8.

Though native to China, some reports trace its origin to the Philippines and Cochinchina. Cultivated for ~40,000 years in China [10], it reached India via Burma in

the 17th century and spread across eastern states like Bihar, Jharkhand, and West Bengal. Today, India, China, Australia, South Africa, and Madagascar are top producers. Litchi is an evergreen tree up to 30 m tall, with compound leaves and terminal inflorescences of fragrant yellow-white blooms [13,14]. Fruits mature in 80–112 days, showing variation in size and shape. Small-seeded “chicken tongue” types, with higher flesh-to-seed ratios, are preferred and more expensive.

Litchi requires specific agroclimatic conditions. It thrives in warm subtropical climates with dry winters and humid summers. Optimal flowering and fruiting occur at 21–37.8°C, with seasonal variation and pre-flowering dry spells improving yield. Though adaptable to many soils, the best orchards develop on alluvial sandy loam with good drainage. Soil pH between 6–6.5 is ideal, though calcareous soils also support growth. Mycorrhizal association is essential for high yield and quality, and soil from existing orchards is recommended for new plantations [1].

TAXONOMICAL CLASSIFICATION:

Table 1:- Taxonomic classification of litchi chinensis

Kingdom	Plantae
Order	Sapindales
Family	Sapindaceae
Sub-Family	Sapindaceae
Genes	<i>Litchi</i>
Species	<i>L. Chinensis</i>
Common name	Nephelium litchi

[DATA FROM REF. 1]

SYNONYMS: [1]

- *Corvinia litchi* Stadm. ex-Willem.
- *Euphoria lit-chi* Desf.
- *Litchi chinensis* var. *euspontanea* H. H. Hsue
- *Litchi litchi* Britt.
- *Nephelium chinensis* (Sonnerat) Druce

- *Sapindus edulis* Aiton
- *Scytalia chinensis* (Sonnerat) Gaertn.
- *Scytalia litchi* Roxb

MORPHOLOGICAL DESCRIPTION:

Fruits vary by variety ovoid, spherical, or heart-shaped measuring up to 5 × 4 cm.

Flowers are small, yellowish-white; bark is grey-black. Fruits mature in 80–112 days, weighing ~20 g, with a thin, tough skin turning scarlet or pink-red at ripening.

The aril is juicy and sweet, enclosing a single dark brown seed (0.6–1.2 cm × 1–3 cm). Litchi requires tropical climates above –4°C. It is cultivated in Asia, Africa, South America, Australia, and South Africa, with China the leading producer and India second [2].

NUTRITIONAL CONSTITUENTS:

1. **Macronutrients:** Fresh litchi pulp provides ~66 kcal/100 g, mainly from carbohydrates, and contains dietary fibre.
2. **Micronutrients:** Rich in vitamin C (71.5 mg/100 g), it also provides niacin, thiamine, riboflavin, and minerals like phosphorus, magnesium, and potassium.
3. **Bioactive Components:** Polyphenols and polysaccharides, influenced by maturity and environment, contribute antioxidant and health-promoting properties [3].

Table 2:-Nutritional composition of litchi fruit (per 100g fresh weight)

component	Content	component	content
Energy	66 kcal	Vitamin C	71.5 mg
Carbohydrates	16.5 g	Potassium	171 mg
Protein	0.8-1.1 g	Magnesium	10 mg
Fat	0.4-0.6 g	Phosphorus	31 mg
Dietary Fiber	1.3 g	Calcium	5 mg
Moisture	80-82%	Iron	0.31 mg

[DATA FROM REF.3]

LITCHI FUNCTIONAL PROPERTIES

According to FAO, a functional diet provides essential nutrients, while EFSA defines functional foods as those offering health benefits beyond basic nutrition, including disease prevention. Growing interest in such foods highlights their role in health promotion. Litchi, due to its bioactive compounds, shows antioxidant, anti-inflammatory, antibacterial, and anticancer properties. Besides the pulp, its pericarp and seed also contain beneficial components.

Traditionally, pericarps were used for haemostatic and analgesic effects. Seeds, rich in starch with high amylopectin and low amylose, have unique functional qualities, including suitability for controlled drug release [4].

VALUE- ADDED PRODUCTS OF LITCHI

Various value-added products are made from litchi, a fruit that spoils easily. Litchi pulp is used to make the flavourful concentrated beverage known as litchi squash. In China, litchi nuts dried litchi fruit are a highly sought-after commodity. The litchi fruit is also used to make other products like wine, juice, pickles, jelly, ice cream, preserves, canned litchi, dehydrated litchi pulp, and more[4].

ANTINUTRITENT

It is commonly known that nutrients are good for human health. Conversely, antinutrients are less well known, extremely bioactive, and have negative effects on the body, but they also have positive ones. These substances can be found in many plant-based diets.

Antinutrients have significant biological activity even though they may have detrimental effects on the body's ability to absorb nutrients (Table 3). They also contribute significantly to several biological or ecological processes in plants, serving as defence mechanisms against insects, herbivorous animals, microbes, and allelopathy in addition to drawing pollinators and seed dispersers. Furthermore, plant competition and the control of plant growth and development

may benefit from antinutrients. Whether synthetic or naturally occurring, compounds known as antinutrients can obstruct the absorption of vital nutrients and may be the cause of detrimental effects associated with nutrient absorption.

The quantity of antinutrients consumed determines this. High dosages can cause a number of symptoms, including headaches, nausea, skin rashes, oedema, and nutritional deficiencies[5].

Table 3:- Antinutrient content in fresh and dried *L. chinensis* per 100 g

Part of the fruit	Phenolic compounds (mg of tannic acid equivalent / 100 gr fruit)	Nitrate (mg)	Oxalic acid
Fresh pericarp	22.0	339	-
Fresh seed	11.45	148	-
Fresh pulp	21	51	-
Dry pericarp	71	351	-
Dry seed	34	154	-
Inhibitory activity			
Part of the fruit	Trypsin (TIU g) ^a	α -amylase (AIU 100 g) ^a	Lipase (LIUg) ^a
Fresh pericarp	14.61	-	0.19
Fresh seed	3.17	-	0.22
Fresh pulp	-	7.23	0.75
Dry pericarp	24.75	1.13	0.06
Dry seed	13.83	1.08	0.07

Table 4:-Antioxidant activity of diferent compounds bioactive of *Litchi chinensis*

Part of the fruit	Identified bioactive compounds	Extraction conditions	Study models	Concentration
Pericarp	A-type procyanidin	Ethanol 70% at 50 °C for 2 h Purification by AB-8 macroporous resin column	In vivo Male Sprague-Dawley rats	IC ₅₀ 9.34 µg/mL DPPH IC ₅₀ 143 µg/mL Hydroxyl radical (·OH)
	(-)-epicatechin Procyanidin	Ethanol 70% in a water bath at 70 °C and Purification AB-8 resin column	In vitro	IC ₅₀ 0.148–0.364 µg/mL Hydrogen peroxide (H ₂ O ₂) IC ₅₀ 23.03–56.01 µg/mL Superoxide radical (O ₂ ·) IC ₅₀ 7.3–14.8 µg/mL DPPH IC ₅₀ 162.6–350.6 µg/mL Hydroxyl radical (·OH)
	4-hydroxycinnamic acid, 3,4-dihydroxy-cinnamic acid, and proanthocyanidin A2	Ultrasonic-microwave, power 307 W, time 17 min, temperature 46 °C, and material liquid and biotransformation by <i>Lactobacillus plantarum</i>	In vitro	IC ₅₀ 2.86 µg/mL DPPH IC ₅₀ 4.16 µg/mL ABTS 40.88 µmol TE/mg DW ORAC
	Procyanidin A2, B2, epicatechin, rutin, quercetin, (+)-catechin, (-)-epigallocatechin, epigallocatechin gallate	The freeze drying, continued in a saturated aqueous Na ₂ CO ₃ solution at pH 10 at 60 °C	In vitro	IC ₅₀ 0.68 µg/mL DPPH IC ₅₀ 0.83 µg/mL ABTS
Pulp	Uronic acid Galactose Mannose	Ethanol 80% at 4 °C for 24 h	In vitro	22.08 – 28.14 µmol TE/g DW ORAC 4.72 – 10.79 µmol QE/ g DW Cellular antioxidant activity
Seed	Epicatechin, procyanidin B2, procyanidin C1, and A-type procyanidin trimer	Lyophilized, 70% aqueous methanol by sonication for 30 min	In vitro	IC ₅₀ 1.88 – 2.82 µg/mL DPPH IC ₅₀ 1.52 – 2.71 µg/mL ABTS
	Flavonoids, terpenoids, tannins, saponins, and alkaloids	Ethanol 30% at 4 °C for 72 h with occasional shaking	In vitro	IC ₅₀ 274 µg/mL DPPH IC ₅₀ 31 µg/mL ABTS
	Polymeric proanthocyanidins	Acetone 70% with 0.1% ascorbic acid	In vitro	IC ₅₀ 87.52 µg/mL DPPH IC ₅₀ 73.56 µg/mL ABTS 5.51 mmol AAEE/g FRAP

PHYTOCHEMICAL CONSTITUENTS

Primary and Secondary Metabolites:

High levels of carbohydrates (glucose, fructose, and sucrose), modest levels of lipids (0.4–0.6%), proteins (0.8–1.1%), and 80–82% moisture are all present in *L. chinensis* pulp. Plant parts have different secondary metabolites. Flavonoids and proanthocyanidins, such as epicatechin, quercetin, and procyanidin A2, which are associated with biological activity, are abundant in pericarp.

1. **Leaf:** Contains procyanidins, epicatechin, and flavonoid glycosides (kaempferol, quercetin), supporting antioxidant activity.
2. **Fruit:** Rich in citric/malic acids and aroma compounds (geraniol, cis-rose oxide, linalool), plus benzyl alcohol and 5-hydroxymethyl-2-furfural.
3. **Seed:** Contains leucocyanidin, cyanidin/malvidin glycosides, saponins, proteins, and carbohydrates, showing notable bioactivity.
4. **Pericarp:** Includes phenolics like butylated hydroxytoluene, bis-(8-epicatecharyl) methane, and flavonoids, contributing to strong antioxidant potential [6].

TRADITIONAL USES OF LITCHI

Traditional medical practices provide the historical basis for the therapeutic properties of *Litchi chinensis* Sonn. in treating a variety of illnesses. The Litchi tree is used in Ayurvedic and Unani medicine for its fruits, leaves, and blossoms. With two to four paired leaves, the foliage has a verdant colour and is useful for reducing inflammation and displaying antioxidant qualities]. The litchi fruit has been used in traditional Chinese medicine to treat a wide range of conditions, including wounds, neuralgic discomfort, testicular inflammation, nerve inflammation, gastralgia, orchitis, hernia,

intestinal problems, digestive ulcers, and excretory and reproductive complications. A wide range of biological activities, such as antioxidant, anti-inflammatory, antimicrobial, anti-obesity, hepatoprotective, anticancer, antidiabetic, and antiviral qualities, have been found in recent studies of both crude and purified extracts of *Litchi chinensis* Sonn [4] .

PHARMACOLOGICAL ACTIVITIES

1. **Hepatoprotective Activity:** Litchi pulp extract (500 mg/kg) showed hepatoprotective effects in CCl₄-induced toxicity in rats, reducing enzyme markers and apoptosis due to vitamin C and phenolic antioxidants.
2. **Anti-inflammatory & Analgesic Activity:** Hydroalcoholic leaf extract (HLCL) rich in flavonoids and saponins reduced carrageenan-induced inflammation and showed significant analgesic effects in mice.
3. **Cardiovascular Activity:** In hamsters, Litchi fruit water extract (LFWE) improved lipid metabolism by regulating PPAR- α , LDL receptor genes, lowering MDA, and enhancing antioxidant capacity.
4. **Antilipase Activity:** Litchi flower extract reduced liver fat, adipose tissue, and cholesterol in hypercaloric diet-fed rats, inhibited lipase, and showed anti-obesity potential.
5. **Aldose Reductase Activity:** Fruit extracts inhibited rat lens aldose reductase; delphinidin glycosides showed strongest effect, indicating antidiabetic potential.
6. **Antioxidant Polysaccharides:** Polysaccharide fractions displayed strong radical scavenging, chelating,

and reducing activity, with LFP-III most effective.

7. **Anticancer Activity:** Pericarp extract suppressed ER+ and ER– breast cancer cell growth by modulating apoptosis and proliferation-related genes.
8. **Antioxidant Activity:** Flower extracts rich in phenolics (proanthocyanidin A2, epicatechin) showed strong DPPH and LDL oxidation inhibition.
9. **Diabetic Activity:** Seed extracts inhibited protein tyrosine phosphatase 1B, reduced hyperglycemia, and acted as anti-diabetic and antiglycation agents in T2D models[7].

CONCLUSION

Since ancient times, litchi (*Litchi chinensis* Sonn.), an evergreen fruit tree with substantial economic and therapeutic significance, has been grown and is still an essential crop in tropical and subtropical areas. Litchi is a promising functional food with nutraceutical potential since it is high in vital nutrients, bioactive compounds, and phytochemicals and has substantial anti-inflammatory, anti-cancer, antibacterial, antioxidant, and antidiabetic effects.

Compounds found in its edible pulp, seeds, pericarp, leaves, and flowers support a variety of pharmacological activities, from anti-obesity and antidiabetic advantages to hepatoprotective and cardioprotective effects.

Beyond its nutritional and therapeutic significance, litchi provides opportunities for value-added goods including wines, juices, jams, and nutraceutical formulations, supporting both economic sustainability and food security. The fruit's safety and industrial usefulness are further improved by the fact that, despite their

presence, antinutritional substances are generally non-toxic and can be minimised through processing. All things considered, litchi is a versatile plant with numerous uses in business, medicine, and food.

In addition to broadening its usage as a functional food, further investigation into its phytoconstituents, therapeutic mechanisms, and processing techniques will pave the way for novel applications in contemporary pharmacology and value-added product development.

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